Project:	**Battery Park City Ballfield and Community Center Resiliency Project – General Contractor Services**	**Date:**	**November 18, 2019**
		RE:	**Addendum # 1**
		# of Pages:	**443**

The following revisions are hereby made to the RFP for the Battery Park City Ballfield and Community Center Resiliency Project – General Contractor Services:

The attached one hundred percent (100%) Drawings and Specifications will replace and supersede the 95% Drawings and Specifications attached to the RFP as Exhibit H (the "Construction Documents"). All references to the Construction Documents throughout the RFP, and all obligations related thereto, refer to the attached 100% Drawings and Specifications. Revisions or additions to specific pages within the Construction Documents have been bubbled to reflect the specific differences between the 95% Drawings and Specifications, and the 100% Drawings and Specifications.

By signing the line below, I am acknowledging that all pages of this Addendum #1 have been received, reviewed and understood, and will be incorporated into the Proposal submitted. This document must be attached to the Proposal for consideration.

_____	_____	_____
Print Name	Signature	Date

Number of pages received: _____<fill in>

Distributed to: All prospective Proposers

THE CITY OF NEW YORK
BATTERY PARK CITY AUTHORITY

BATTERY PARK CITY BALLFIELD AND COMMUNITY CENTER RESILIENCY DESIGN

BALLFIELD AND COMMUNITY CENTER FLOOD PROTECTION
CONTRACT NO. 18-2624





100% DESIGN SUBMITTAL
NOVEMBER 15th, 2019

GENERAL

SHEET NO.	DWG NO.	TITLE
	G-000	COVER SHEET
1	G-001	DRAWING LIST
2	G-002	FLOOD COMPLIANCE MAP
3	G-003	TREE PROTECTION PLAN
4	G-004	TREE PROTECTION DETAILS

CIVIL

SHEET NO.	DWG NO.	TITLE
5	C-001	CIVIL GENERAL NOTES
6	C-002	CIVIL LEGEND AND ABBREVIATIONS
7	C-101	EXISTING CONDITIONS - STREET LEVEL PLAN
8	C-102	EXISTING CONDITIONS - UTILITY PLAN
9	C-103	SITE DEMOLITION PLAN - SHEET 1 OF 2
10	C-104	SITE DEMOLITION PLAN - SHEET 2 OF 2
11	C-111	SITE LAYOUT PLAN - SHEET 1 OF 2
12	C-112	SITE LAYOUT PLAN - SHEET 2 OF 2
13	C-121	SITE GRADING, DRAINAGE, AND UTILITY PLAN - SHEET 1 OF 2
14	C-122	SITE GRADING, DRAINAGE, AND UTILITY PLAN - SHEET 2 OF 2
15	C-131	SOIL EROSION AND SEDIMENT CONTROL PLAN - SHEET 1 OF 2
16	C-132	SOIL EROSION AND SEDIMENT CONTROL PLAN - SHEET 1 OF 2
17	C-501	SITE DETAILS
18	C-502	SOIL EROSION AND SEDIMENT CONTROL DETAILS

LANDSCAPE ARCHITECTURE

SHEET NO.	DWG NO.	TITLE
19	LA-100	SITE PLAN
20	LA-101	FENCE PANEL ELEVATION
21	LA-102	FENCE PANEL ELEVATION
22	LA-103	FENCE PANEL ELEVATION
23	LA-104	FENCE PANEL ELEVATION
24	LA-105	FENCE PANEL ELEVATION
25	LA-106	FENCE PANEL ELEVATION
26	LA-107	FENCE PANEL ELEVATION
27	LA-108	FENCE PANEL ELEVATION
28	LA-109	PLANTING PLAN
29	LA-110	PLANTING PLAN
30	LA-501	ARCHITECTURAL PANEL DETAILS- A
31	LA-502	ARCHITECTURAL PANEL DETAILS- B
32	LA-503	ARCHITECTURAL PANEL ENLARGEMENTS
33	LA-504	TREE PROTECTION DETAILS
34	LA-505	PLANTING DETAILS

STRUCTURAL

SHEET NO.	DWG NO.	TITLE
35	S-001	STRUCTURAL NOTES SHEET 1 OF 3
36	S-002	STRUCTURAL NOTES SHEET 2 OF 3
37	S-003	STRUCTURAL NOTES SHEET 3 OF 3
38	S-101	PERIMETER PLAN SHEET 1 OF 4
39	S-102	PERIMETER PLAN SHEET 2 OF 4
40	S-103	PERIMETER PLAN SHEET 3 OF 4
41	S-104	PERIMETER PLAN SHEET 4 OF 4
42	S-501	STEEL PLATE WALL SECTIONS AND DETAILS
43	S-502	RETAINING WALL SECTIONS AND DETAILS
44	S-503	CONCRETE WALL SECTIONS AND DETAILS
45	S-504	CONCRETE DETAILS
46	S-505	TYPICAL UTILITY CROSSING DETAILS
47	S-506	WALL SECTIONS AT GATES
48	S-507	PLAN DETAILS AT GATES
49	S-508	BASE PLATE ENCASEMENT DETAILS
50	S-509	STEEL PLATE FLOOD WALL CORNER DETAIL
51	S-510	STACKABLE FLOOD BARRIER SHEET 1 OF 4
52	S-511	STACKABLE FLOOD BARRIER SHEET 2 OF 4
53	S-512	STACKABLE FLOOD BARRIER SHEET 3 OF 4
54	S-513	STACKABLE FLOOD BARRIER SHEET 4 OF 4

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PROJECT IDENTIFICATION

NEW YORK STATE OF OPPORTUNITY. Battery Park City Authority

BATTERY PARK CITY
BALLFIELD AND COMMUNITY
CENTER

MARK	DATE	DESCRIPTION	BY
D	11/15/19	100% DESIGN SUBMITTAL	AC
C	11/01/19	ISSUE FOR BID - 95%	AC
B	10/18/19	75% DESIGN SUBMITTAL	AC
A	09/06/19	50% DEISGN SUBMITTAL	AC

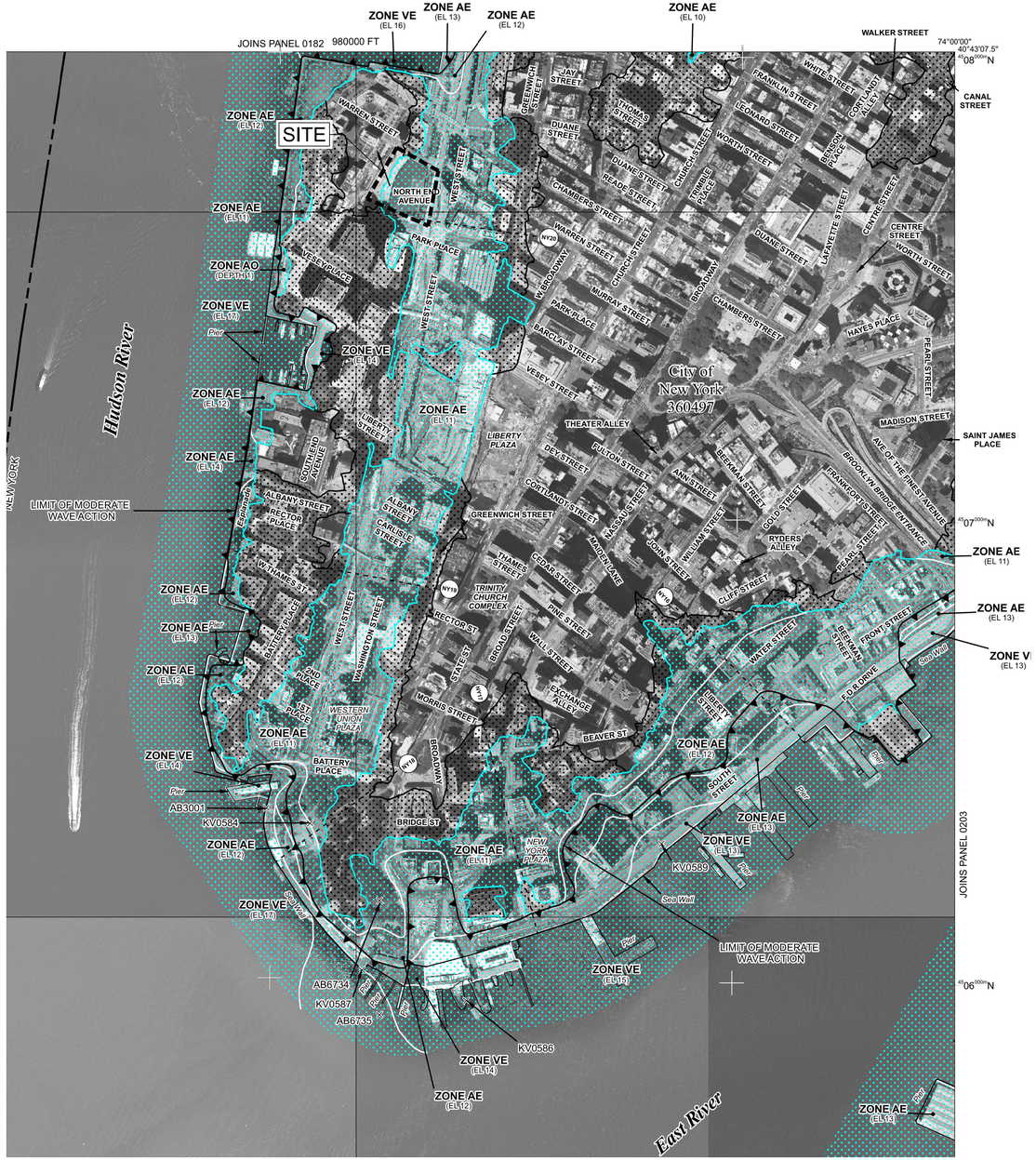
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SHEET TITLE

DRAWING LIST

G-001



NFIP NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0184G

FIRM

FLOOD INSURANCE RATE MAP

CITY OF,
NEW YORK
NEW YORK
BRONX, RICHMOND, NEW YORK, QUEENS, AND KINGS COUNTIES

PANEL 184 OF 457

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
NEW YORK, CITY OF	360497	0184	G

PRELIMINARY
DECEMBER 5, 2013

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
3604970184G

MAP REVISED

Federal Emergency Management Agency

LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X — Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X — Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D — Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS
OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- Limit of Moderate Wave Action
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

- (A) — (A) — Cross section line
- (23) — (23) — Transect line
- Culvert, Flume, Penstock or Aqueduct
- Road or Railroad Bridge
- Footbridge
- 87°07'45", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
- 24°76'000"N — 1000-meter Universal Transverse Mercator grid values, zone 18
- 600000 FT — 5000-foot grid values: New York State Plane coordinate system, Long Island zone (FIPSZONE 3104), Lambert Conformal Conic projection
- DX5510 × — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- ● M1.5 — River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

INITIAL NFIP MAP DATE
June 28, 1974

FLOOD HAZARD BOUNDARY MAP REVISIONS
June 11, 1976

FLOOD INSURANCE RATE MAP EFFECTIVE
November 16, 1983

FLOOD INSURANCE RATE MAP REVISIONS

For descriptions of revisions see Notice to Users page in the Flood Insurance Study report.

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'
250 0 500 1000 FEET
150 0 150 300 METERS

STV 100 Years
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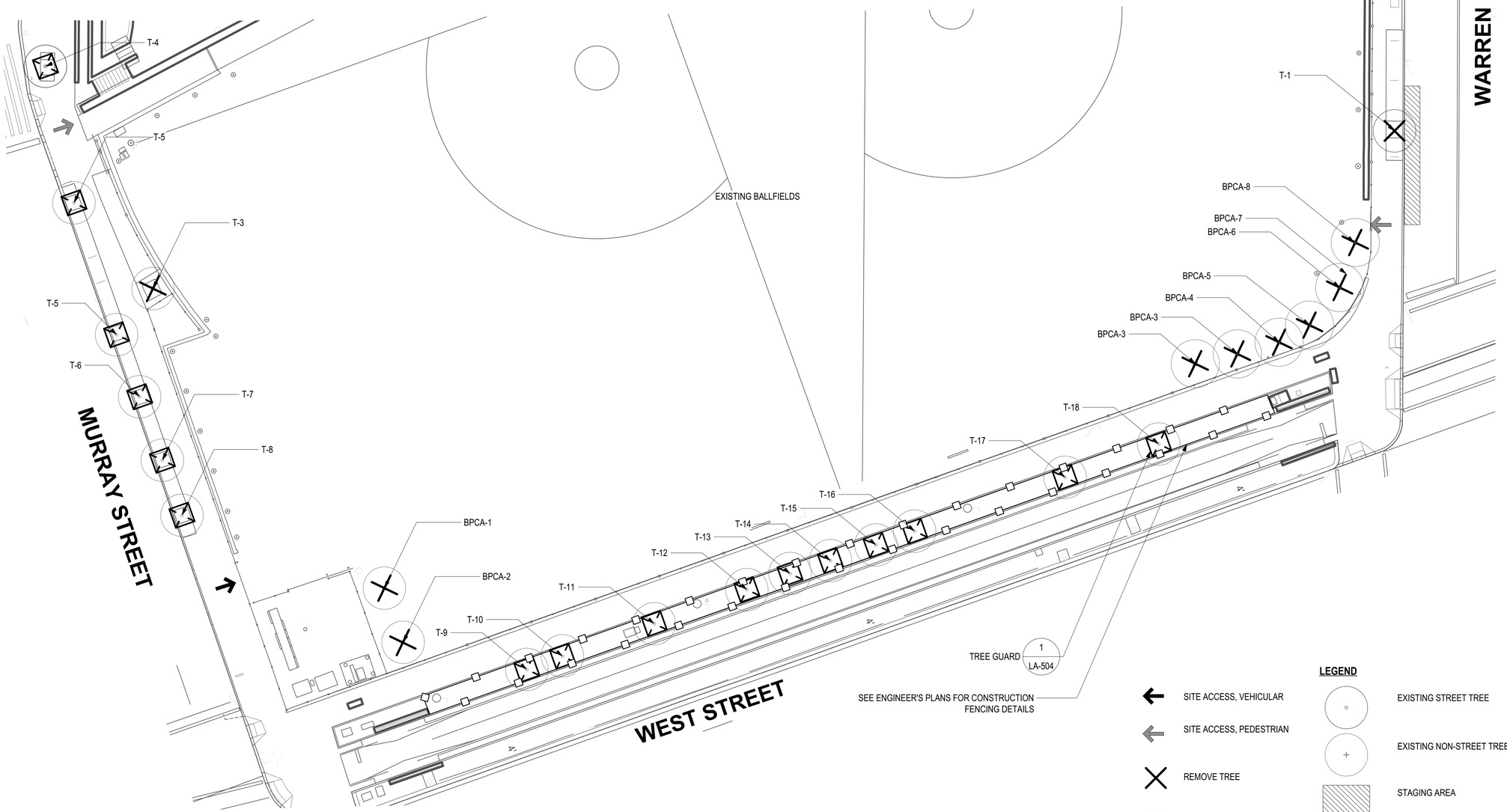
SHEET TITLE

FLOOD COMPLIANCE MAP

G-002

TREE PROTECTION NOTES

1. IT IS THE CONTRACTOR'S RESPONSIBILITY TO CHECK AND VERIFY ALL SITE CONDITIONS, BOTH ABOVE AND BELOW THE SURFACE, PRIOR TO COMMENCING WORK. ANY DISCREPANCIES BETWEEN INFORMATION SHOWN ON THE DRAWINGS AND ACTUAL FIELD CONDITIONS SHOULD BE BROUGHT TO THE ATTENTION OF THE ENGINEER IN WRITING, PRIOR TO THE COMMENCEMENT OF WORK.
2. CONSTRUCTION ACCESS ROUTE IS DIAGRAMMATIC. FINAL ROUTE SHALL BE ESTABLISHED ON SITE AND APPROVED BY THE RESIDENT ENGINEER. THE CONSTRUCTION ROUTE PROPOSED BY THE CONTRACTOR SHALL BE REVIEWED BY THE ENGINEER AT LEAST SEVEN DAYS PRIOR TO SITE WORK. ROUTE SHALL BE CONFIRMED ONSITE AND FINAL APPROVED BY THE ENGINEER
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COMPLIANCE BY ALL WORKERS AND SUBCONTRACTORS WITH THESE NOTES AND GENERAL CONDITIONS, SPECIAL PROVISIONS, SECTION C,
ARTICLE 14 "TREE WORK."
4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION AND PRESERVATION OF ALL EXISTING TREES NOT LISTED FOR REMOVAL THAT ARE LOCATED COMPLETELY OR PARTIALLY WITHIN THE CONTRACT LIMIT LINE.
5. THE CONTRACTOR SHALL NOTIFY THE ENGINEER A MINIMUM OF 48 HOURS IN ADVANCE OF ANY WORK ON OR IMPACTING EXISTING TREES, INCLUDING BUT NOT LIMITED TO TREE PROTECTION, PRUNING, TREE REMOVAL, EXCAVATION WITHIN TREE PROTECTION ZONES, DECOMPACTION, TOPSOIL, AND PLANTING WORK. THE ENGINEER SHALL NOTIFY THE APPROPRIATE BOROUGH FORESTER.
6. THE TREE PROTECTION ZONE (TPZ) ALSO CALLED THE CRITICAL ROOT ZONE (CRZ) SHALL BE DEFINED AS THE AREA WITHIN THE DRIP LINE OF EXISTING TREES, UNLESS OTHERWISE SHOWN ON THE TREE PROTECTION PLAN.
7. THE CONTRACTOR SHALL TAKE EXTREME CARE TO PROTECT THE ROOT SYSTEMS OF EXISTING TREES. MATERIAL, EQUIPMENT, OR VEHICLES SHALL NOT BE STOCKPILED OR PARKED WITHIN THE TPZ OF ANY TREE COMPLETELY OR PARTIALLY WITHIN THE CONTRACT LIMIT LINE TO MINIMIZE SURFACE AND SUBSURFACE ROOT AND SOIL COMPACTION.
8. IF STOCKPILING OCCURS WITHIN THE TPZ, A STOP WORK ORDER SHALL BE ISSUED IMMEDIATELY, AND WORK SHALL NOT RE-COMMENCE UNTIL ALL STOCKPILED MATERIAL IS REMOVED FROM THE TPZ AND MITIGATION MEASURES ARE PERFORMED TO THE SATISFACTION OF THE RESIDENT ENGINEER.
9. TEMPORARY WOODEN TREE GUARDS WITH WRAP FOR INDIVIDUAL TREES, TEMPORARY WOODEN TREE GUARD FOR GROVES, AND TEMPORARY SNOW FENCE BOUNDARY SHALL BE MAINTAINED FOR THE DURATION OF THE CONTRACT AND ARE NOT TO BE REMOVED UNTIL DIRECTED BY THE ENGINEER.
10. ALL TREES WITHIN THE CONTRACT LIMIT LINE ARE TO RECEIVE AT LEAST ONE (1) INCH (THE EQUIVALENT OF 750 GALLONS OF WATER PER 1,000 SQUARE FEET OF TREE PROTECTION ZONE) OF WATER PER WEEK BETWEEN THE MONTHS OF MARCH AND OCTOBER. IF RAINWATER IN ANY GIVEN WEEK IS BELOW THIS QUANTITY, THE CONTRACTOR MUST SUPPLEMENT THE AMOUNT RECEIVED BY UTILIZING SOAKER HOSES OR AS DIRECTED BY THE ENGINEER. IF A WATER SOURCE IS UNAVAILABLE AT THE SITE THE CONTRACTOR IS TO PROVIDE IRRIGATION BAGS AND WATER TO APPLY THE REQUISITE WATER AMOUNT.



1 / G-003 TREE PROTECTION PLAN
SCALE: 1" = 20'-0"

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A	11/01/19	ISSUED FOR BID - 95%	AW

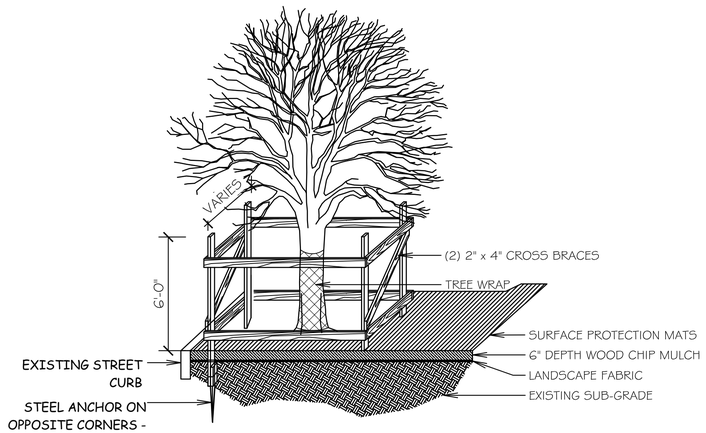
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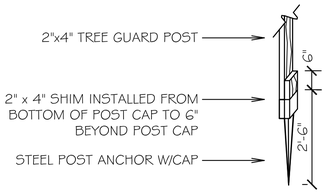
SHEET TITLE

TREE PROTECTION PLAN

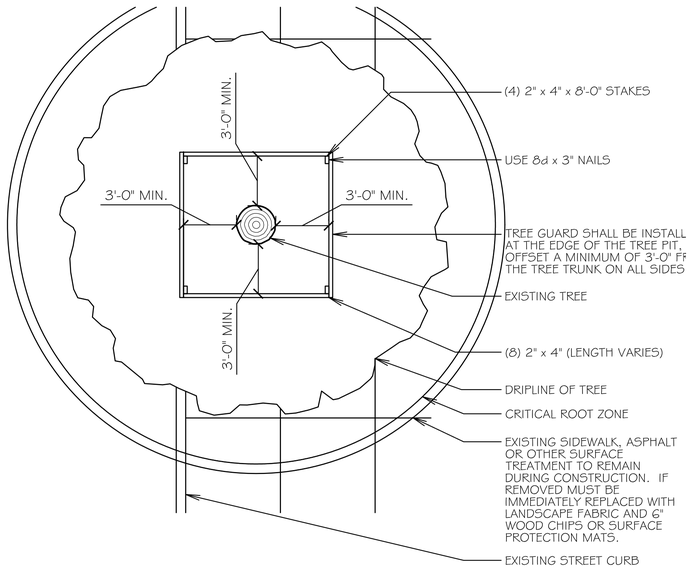
G-003



SECTION VIEW
SCALE: 1/4" = 1'-0"



ENLARGEMENT SECTION VIEW
SCALE: 1/2" = 1'-0"



PLAN VIEW

1 / G-004 TREE GUARD WITH CRITICAL ROOT ZONE GROUND PROTECTION
AS SHOWN

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SHEET TITLE

TREE PROTECTION DETAILS

G-004
1

GENERAL CIVIL NOTES

1. THIS PLAN IS BASED ON A FIELD SURVEY BY NAIK SURVEYING PERFORMED IN NOVEMBER 2018 AND UPDATED ON APRIL 12, 2019.
2. PORTIONS OF THE SURVEY HAVE BEEN REVISED TO REFLECT FIELD CONDITIONS AND/OR RECORD DRAWINGS OBTAINED AFTER THE ISSUANCE OF THE SURVEY INCLUDING: CORRECTION TO THE ROUTE OF THE EXISTING STORM LINES ON THE CORNER OF MURRAY ST AND WEST ST AND CORRECTIONS TO THE SIZES OF EXISTING FENCE POSTS SURROUNDING THE BPCA PROPERTY. THESE CHANGES SHOULD BE VERIFIED IN FIELD BY THE CONTRACTOR.
3. THE SITE IS LOCATED WITHIN FLOOD ZONE AE BASED ON THE 2013 FEMA FIRM MAP NO. 3604970184G. THE BASE FLOOD ELEVATION IS 11.0' (NAVD88). SEE G-002 FOR FLOOD MAP.
4. THE CONTRACTOR SHALL CONTACT THE VARIOUS UTILITY COMPANIES WITH SERVICE IN THE AREA PRIOR TO EXCAVATING PIPES OR RELATED STRUCTURES UNDER THE PUBLIC SIDEWALK.
5. TEMPORARY FENCING OR BARRICADES SHALL BE INSTALLED TO ISOLATE WORK AREAS FROM THE PUBLIC AND ADJACENT BUILDING OCCUPANTS DURING THE WORK OF THIS CONTRACT. EXTREME CAUTION SHALL BE TAKEN NOT TO TOUCH OR DAMAGE EXISTING SYNTHETIC TURF WITHIN THE BALLFIELDS DURING CONSTRUCTION OPERATIONS.
6. THE CONTRACTOR SHALL EXAMINE AND VERIFY IN THE FIELD ALL EXISTING AND GIVEN DIMENSIONS WITH THOSE SHOWN ON THE PLANS. ALL EXISTING GRADES SHALL BE VERIFIED PRIOR TO CONSTRUCTION IN THE EVENT THERE ARE DISCREPANCIES BETWEEN FIELD CONDITIONS AND THE SURVEY. IN THE CASE OF DISCREPANCIES, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE PROJECT ENGINEER.
7. WHERE CONSTRUCTION IS ADJACENT TO EXISTING LINES (FUEL, WATER, TELEPHONE, GAS, ELECTRIC, COMMUNICATION, STORM SEWER, SANITARY SEWER, AND THERMALS) THE CONTRACTOR SHALL HAND EXCAVATE TEST PITS AND LOCATE, MARK AND PROTECT UTILITY LINES AGAINST DISTURBANCE OR DAMAGE.
8. ALL ITEMS NOTED FOR DEMOLITION SHALL BE COMPLETELY REMOVED AND LEGALLY DISPOSED.
9. IT IS THE SOLE RESPONSIBILITY OF THE CONTRACTOR TO OBTAIN ALL REQUIRED SIDEWALK PERMITS INCLUDING SIDEWALK CLOSURE PERMIT FOR COMPLETING WORK ON MURRAY STREET, WARREN STREET, AND WEST STREET.
10. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL MAINTENANCE OF TRAFFIC. MAINTENANCE AND PROTECTION OF TRAFFIC SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF THE CITY OF NEW YORK DEPARTMENT OF TRANSPORTATION AND THE D.O.T. MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (M.U.T.C.D.) AND NEW YORK STATE D.O.T. STANDARDS.
11. ALL SHEETING PLACED UNDER THIS CONTRACT SHALL BE REMOVED UPON COMPLETION OF THE CONTRACT WORK, AND THE COST SHALL BE DEEMED INCLUDED IN THE PRICES BID FOR ALL SCHEDULED ITEMS. THE SHEETING SHALL CONFORM TO THE REQUIREMENTS OF TITLE 29 CODE OF FEDERAL REGULATIONS, PART 1926, SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION (OSHA).
12. THE CONTRACTOR SHALL MAINTAIN SAFE AND ADEQUATE VEHICULAR AND PEDESTRIAN ACCESS TO ADJACENT PROPERTIES. ACCESSIBILITY TO FIRE HYDRANTS AND PROVISION FOR THE INGRESS AND EGRESS OF EMERGENCY VEHICLES INCLUDING POLICE, FIRE AND AMBULANCE VEHICLES SHALL BE REQUIRED AT ALL TIMES.
13. AREAS DISTURBED BY THE INSTALLATION OF THE NEW WORK SHALL BE RESTORED TO IN KIND UPON COMPLETION OF WORK.
14. ALL WORK SHALL BE INSTALLED WITHIN THE SPACE PROVIDED AS SHOWN ON THE DRAWINGS. ANY ITEMS WHICH CANNOT BE INSTALLED WITHIN THE SPACE PROVIDED SHALL BE BROUGHT TO THE ATTENTION OF THE BPCA'S REPRESENTATIVE PRIOR TO INSTALLATION OF ANY WORK IN THAT AREA.
15. ALL GRADING AND FILL MUST COMPLY WITH NYC BUILDING CODE APPENDIX G303.7.
16. ALL UTILITIES SHALL BE ADEQUATELY PROTECTED AGAINST FLOOD DAMAGE. UNDERGROUND TANKS SHALL COMPLY WITH NYC BUILDING CODE APPENDIX G307.1 AND STORMWATER INLETS AND PIPING SHALL COMPLY WITH NYC BUILDING CODE APPENDIX G307.2.
17. AN EMERGENCY FLOOD MANUAL WILL BE PROVIDED WITH INSTRUCTIONS FOR BEFORE, DURING, AND AFTER A FLOOD EVENT AT THE SITE IN ACCORDANCE WITH APPENDIX G 6.2.3 AND ASCE 24.

FIRE PREVENTION NOTES

1. THERE SHALL BE NO OPEN FLAME OR SPARK PRODUCING DEVICE, EXCEPT AS PERMITTED BY 313 AND 2604.1.5 OF THE ADMINISTRATIVE CODE. THE APPLICABLE PROVISIONS OF CHAPTER 27 OF THE ADMINISTRATIVE CODE WILL BE COMPLIED WITHIN ALL RESPECTS. MAINTAIN FIRE FIGHTING EQUIPMENT AS DIRECTED BY THE FIRE COMMISSIONER AND SECTION 2205.5 OF THE CODE. THE PROVISIONS OF THE NYC FIRE AND ADMINISTRATIVE CODE TO BE COMPLIED WITHIN ALL RESPECTS. INSTALLATION OF TANKS TO BE MADE BY A LICENSED INSTALLER OF PETROLEUM PRODUCT STORAGE TANKS.
2. THE CONTRACTOR SHALL SUPPLY AND INSTALL A 20-POUND ABC RATED FIRE EXTINGUISHER AT THE PROJECT SITE. THE FIRE EXTINGUISHERS SHALL BE MODEL TGP20G AS MANUFACTURED BY GENERAL FIRE EXTINGUISHERS CO. OR AN APPROVED EQUAL.

UTILITY SERVICE NOTES

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PREPARING AND FILING ANY UTILITY DISCONNECT ORDERS OR NEW CONNECTION REQUESTS FOR WATER, TELECOMMUNICATIONS, ELECTRIC, SEWER AND GAS LINES FOR AFFECTED FACILITIES WITHIN THE PROJECT WORK AREA.
2. ALL ABANDONED UNDERGROUND UTILITIES, SEWER AND/OR WATER STRUCTURES ENCOUNTERED DURING CONSTRUCTION SHALL BE REMOVED TO A POINT 2 FEET BEYOND THE LIMIT OF THE NEW WORK. ENDS OF ABANDONED PIPES SHALL BE CAPPED OR PLUGGED WITH CONCRETE TO 6 INCHES MINIMUM THICKNESS. TOPS OF ABANDONED UNDERGROUND STRUCTURES SHALL BE REMOVED TO A POINT 2 FEET BELOW THE LIMIT OF NEW WORK AND THEIR BASE FILLED WITH COMPACTED CLEAN SAND.
3. THE CONTRACTOR SHALL EXERCISE CAUTION WHEN REGRADING AND/OR REPAVING OVER EXISTING/NEW UTILITIES INCLUDING, BUT NOT LIMITED TO STORM AND SANITARY SEWERS, WATER MAINS, GAS AND ELECTRIC LINES.

DRAINAGE NOTES

1. ALL PROPOSED DRAINAGE WORK SHALL BE DONE IN CONFORMANCE WITH THE LATEST STANDARDS OF THE NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION UNLESS OTHERWISE NOTED.
2. ALL EXISTING SEWER MANHOLES WITHIN THE CONTRACT LIMITS SHALL BE ADJUSTED TO MATCH FINAL GRADE ELEVATIONS. ANY MANHOLES THAT HAVE BEEN DAMAGED, WORN OR HAVE NONSTANDARD FRAMES AND COVERS SHALL BE PROVIDED WITH NEW 27-INCH CASTINGS IN ACCORDANCE WITH THE LATEST STANDARDS OF NYCDEP INCLUDING ANY NECESSARY MODIFICATIONS OF THE MANHOLE MASONRY.
3. ANY DAMAGE TO MANHOLES OR SEWERS CAUSED BY THE CONTRACTOR'S WORK SHALL BE REPAIRED OR REPLACED BY THE CONTRACTOR, AS DIRECTED BY THE ENGINEER, AT NO COST TO THE AUTHORITY OR BPCA.
4. ALL STORM DRAINAGE STRUCTURES AND PIPING SHALL BE CLEANED AND FLUSHED UPON COMPLETION OF CONSTRUCTION, STARTING FROM ROOF DRAINS ON TO THE FINAL CONNECTION(S) AT THE MUNICIPAL SEWER.
5. POSITIVE DRAINAGE SHALL BE MAINTAINED AWAY FROM THE BUILDING, AT ALL TIMES.

PAVING NOTES (NYC/NYS DOT RIGHT-OF-WAY)

1. ALL MATERIALS, CONSTRUCTION METHODS AND WORKMANSHIP SHALL CONFORM WITH THE LATEST STANDARD DETAILS AND SPECIFICATIONS OF THE NYC AND NYS DOT BUREAU OF HIGHWAY OPERATIONS.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING A SAFE CONSTRUCTION AREA, AND PROVIDING FOR PEDESTRIAN AND VEHICULAR TRAFFIC FLOW AROUND THE CONSTRUCTION SITE IN ACCORDANCE WITH NYCDOT AND NYSDOT, OFFICE OF CONSTRUCTION MITIGATION AND CONTROL (OCMC).
3. THE CONTRACTOR SHALL PROVIDE A MAINTENANCE AND PROTECTION OF TRAFFIC PLAN (MPT) IN ACCORDANCE WITH NYS DOT REQUIREMENTS FOR THE WORK ALONG WEST STREET.
4. WHERE A NEW PAVEMENT OR SIDEWALK IS INSTALLED THE CONTRACTOR IS RESPONSIBLE FOR THE ADJUSTMENT OF ALL EXISTING HANDHOLES, MANHOLE COVERS, CATCH BASINS, AND VALVE BOXES AS REQUIRED TO MEET THE NEW GRADES. ALL UTILITY STRUCTURES WITHIN THE CONSTRUCTION AREA SHALL REMAIN AND BE MAINTAINED THROUGHOUT CONSTRUCTION.
5. ALL EXISTING AND/OR PROPOSED GUTTER FLOW WITHIN THE PROJECT AREA SHALL BE MAINTAINED SO AS NOT TO CAUSE ANY PONDING CONDITIONS.
6. ALL EXISTING NYCDEP DRAINAGE STRUCTURES ARE TO BE CLEANED AND MADE OPERABLE AROUND THE SITE AT THE COMPLETION OF CONSTRUCTION.
7. ALL PAVEMENT MARKINGS, INCLUDING THERMOPLASTIC LANE DIVIDERS, REMOVED DURING CONSTRUCTION, SHALL BE REPLACED IN-KIND, AND IN ACCORDANCE WITH THE BUREAU OF TRAFFIC OPERATIONS STANDARDS.
8. THE CONTRACTOR WILL REPLACE ANY MISSING, BROKEN, OR EXISTING CURB, SIDEWALK OR ROADWAY DAMAGED PRIOR TO OR DURING CONSTRUCTION AND REPAIR AS DIRECTED BY THE BOROUGH, NYC DOT, OR NYS DOT MAINTENANCE ENGINEER.
9. NEW SIDEWALKS AND CURB INSTALLATIONS ARE TO MATCH EXISTING GRADES AND CONDITIONS AT ABUTTING PROPERTY BOUNDARIES WITH NO TRIP HAZARDS.
10. WHERE EXISTING CONCRETE PAVEMENT OR ASPHALT CONCRETE PAVEMENT ARE REMOVED, THE CONTRACTOR SHALL SAWCUT AND CLEANLY TRIM EDGE OF REMAINING PAVEMENT BEFORE INSTALLING NEW CONSTRUCTION.
11. EXISTING PAVEMENT IN THE AREAS OF NEW PAVEMENT SHALL BE ENTIRELY REMOVED AND DISPOSED OF BY THE CONTRACTOR. THE SUBGRADE SHALL BE PREPARED AS PER THE CONTRACT SPECIFICATIONS AND DETAILS AND BROUGHT TO THE REQUIRED ELEVATION.
12. THE CONTRACTOR SHALL ENSURE THAT PAVEMENT SLOPES FROM REPAVING ACTIVITIES WILL PROVIDE POSITIVE DRAINAGE TOWARD EXISTING CATCH BASINS.
13. THE CONTRACTOR SHALL ENSURE THAT EDGES OF NEW PAVEMENT MATCH THE EDGES OF ABUTTING EXISTING PAVEMENT AS TO NOT CREATE ANY TRIP HAZARDS.

EROSION AND SEDIMENT CONTROL NOTES

1. ALL EROSION AND SEDIMENT CONTROL (ESC) MEASURES SHALL CONFORM TO THE STANDARDS SET FORTH IN THE LATEST EDITION OF THE "NEW YORK STATE STANDARDS AND SPECIFICATIONS FOR EROSION AND SEDIMENT CONTROL".
2. ALL ESC MEASURES SHALL BE INSTALLED PRIOR TO ANY MAJOR PAVEMENT REMOVAL OR EARTHWORK, OR IN THEIR PROPER SEQUENCE, AND MAINTAINED UNTIL PERMANENT PROTECTION IS ESTABLISHED.
3. ALL STORM DRAIN INLETS SHALL BE PROTECTED WITH FILTER FABRIC OR HAY BALES UNTIL PAVING HAS BEEN ESTABLISHED.
4. ANY DAMAGE INCURRED BY EROSION SHALL BE INSPECTED AND MAINTAINED PERIODICALLY AFTER ALL STORM EVENTS.
5. THE CONTRACTOR SHALL PROVIDE AN EROSION AND SEDIMENT CONTROL PLAN IN CONJUNCTION WITH THE PHASING AND LOGISTICS PLAN FOR APPROVAL PRIOR TO CONSTRUCTION START.
6. EXISTING TREES TO REMAIN SHALL BE PROTECTED PER NYC DOT AND DPR STANDARDS. SEE LANDSCAPING DRAWINGS FOR ADDITIONAL INFORMATION.

EXCAVATION NOTES

1. THE FOLLOWING INFORMATION IS TO BE USED AS A GUIDE ONLY. IN THE EVENT OF A CONFLICT BETWEEN THIS INFORMATION AND OSHA OR OTHER LOCAL REGULATIONS, THE MOST RESTRICTIVE REGULATIONS AND REQUIREMENTS SHALL GOVERN ALL EXCAVATION WORK.
2. TRENCHING, SHORING - SECTIONS 1962.50 THROUGH 1926.653 AND ARTICLE 4, SECTION 27-1032 THE CONTRACTOR SHALL COMPLY WITH ALL REQUIREMENTS OF OSHA SUBSECTION P. EXCAVATIONS, OF THE NEW YORK CITY BUILDING CODE.
3. THE CONTRACTOR SHALL NOTIFY THE PROJECT ENGINEER WHEN EXCAVATIONS ARE ADJACENT TO PROPERTY LINES, ROADS, AND SIDEWALKS. PARTICULARLY WHERE BUILDINGS ON ABUTTING PROPERTY ARE NEAR THE PROPERTY LINE.
4. THE CONTRACTOR SHALL CUT BACK AND SHEET AS NECESSARY FOR STABILITY, SAFETY, AND PROTECTION OF UTILITIES, STRUCTURES, STOCKPILED MATERIAL AND EQUIPMENT. IN THE EVENT THAT SHEETING AND/OR SHORING ARE NECESSARY, THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING ALL NECESSARY SHORING DESIGN COMPUTATIONS AND DETAILS SIGNED BY AN ENGINEER LICENSED TO PRACTICE IN NEW YORK STATE, TO THE BPCA'S REPRESENTATIVE FOR APPROVAL.
5. THE CONTRACTOR MUST TAKE ALL NECESSARY PRECAUTIONS TO LOCATE ALL EXISTING UTILITIES AND APPURTENANCES TO REMAIN IN PLACE PRIOR TO THE START OF EXCAVATION. ANY BURIED UTILITIES ENCOUNTERED WHICH WERE NOT IDENTIFIED BEFORE THE START OF EXCAVATION SHALL BE REPORTED TO THE BPCA'S REPRESENTATIVE.
6. ALL EXCAVATED SOIL MUST BE REPLACED WITH APPROVED BACKFILL. BACKFILL MATERIALS SHALL NOT BE PLACED WITHOUT WRITTEN APPROVAL FROM THE BPCA'S REPRESENTATIVE.
7. ALL EXCAVATIONS GREATER THAN 5'-0" IN DEPTH MUST BE SHORED OR SLOPED AS PER OSHA, UNLESS IN ROCK, SHALE OR CEMENTED SANDS AND GRAVELS.

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SEALS

PROJECT IDENTIFICATION

NEW YORK STATE OF OPPORTUNITY. Battery Park City Authority

BATTERY PARK CITY BALLFIELD AND COMMUNITY CENTER

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CIVIL GENERAL NOTES

C-001

LEGEND

EXISTING	EXISTING TO BE REMOVED	NEW	DESCRIPTION
			BUILDING
			PROPERTY LINE
			BITUMINOUS PAVING
			CONCRETE PAVEMENT
			GRASS/LANDSCAPED AREA/TURF
			PAVERS
			SAW CUT PAVEMENT
			CONCRETE CURB
			CONCRETE WALL
10		8.0	CONTOUR ELEVATION (MAJOR)
11		8.5	CONTOUR ELEVATION (MINOR)
x 11.96		+11.50 OR 11.50	SPOT ELEVATION
BC8.50 TC9.00			BOTTOM/TOP OF WALL/CURB ELEVATION
			24' WELDED WIRE MESH FENCE
			GUIDE RAIL
			HAND RAIL
SN			SIGN
LT			LIGHT POLE
MLP			METAL LIGHT POLE
			METAL MULTI-LIGHT TOWER
MPED			METAL PEDESTRIAN SIGNAL
MTL			METAL TRAFFIC LIGHT
			GUY WIRE
WLP			WOODEN LIGHT POLE
WP2L			WOODEN POLE WITH 2 LIGHTS
			AREA DRAIN
D			STORM PIPE
			CATCH BASIN
D			STORM MANHOLE
S			SANITARY SEWER
S			SANITARY MANHOLE
G			GAS VALVE
G			GAS LINE
W			WATER MANHOLE
W			WATER LINE
WV			WATER VALVE
W			WATER FOUNTAIN
HYD			HYDRANT
			INLINE CHECK VALVE

LEGEND

EXISTING	EXISTING TO BE REMOVED	NEW	DESCRIPTION
			FIRE LINE
E			ELECTRIC LINE
E			ELECTRIC MANHOLE
E BXE			ELECTRIC BOX
MH			UNKNOWN MANHOLE
UV			UNKNOWN VALVE
			TREE
BOL			BOLLARD
VER			VERIZON LINE
C			COMMUNICATIONS LINE
F			FIRE CALL BOX
			FLOW ARROW
			TREE PROTECTION
			INLET PROTECTION
			SEDIMENT FILTER LOG
			STOCKPILE
CF			CONSTRUCTION FENCE
		F-100	STABILIZED CONSTRUCTION ENTRANCE WALL ALIGNMENT STATION

ABBREVIATIONS

ASPH - ASPHALT
BC - BOTTOM OF CURB
BFE - BASE FLOOD ELEVATION
BOL - BOLLARD
BUR - BURIED
BW - BOTTOM OF WALL
BXE - ELECTRIC BOX
CB - CATCH BASIN
CC - CONCRETE CURB
CLF - CHAIN LINK FENCE
COMM - COMMUNICATION
CONC - CONCRETE
COND - CONDUIT
CSW - CONCRETE SIDEWALK
SSW - STONE SIDEWALK
ECS - EMPIRE CITY SUBWAY (VERIZON)
ESC - EROSION AND SEDIMENT CONTROL
ESVP - EXTRA STRENGTH VITRIFIED PIPE
DC - DEPRESSED CURB
DE - DEAD END
DFE - DESIGN FLOOD ELEVATION
D.I. - DUCTILE IRON
DIP - DUCTILE IRON PIPE
DN - DOWN
D.P. - DUCTILE PRECAST
EB - ELECTRIC BOX
EL - ELEVATION
ELEC - ELECTRIC
EOP - END OF PAVEMENT
GR - GRATE
GV - GAS VALVE
HDPE - HIGH DENSITY POLYETHYLENE PIPE
HYD - HYDRANT
LT - LIGHT POLE
M - # - MANHOLE NUMBER
MGR - METAL GUIDE RAIL
MH - MANHOLE
MC - METAL COVER
MHE - ELECTRIC MANHOLE
MHS - SEWER MANHOLE
MHU - UNKNOWN MANHOLE
MLP - METAL LIGHT POLE
MPED - METAL PEDESTRIAN SIGNAL
MTL - METAL TRAFFIC LIGHT
MUT - METAL UTILITY POLE
PE - POLYETHYLENE
PL - PLASTIC
R - RECORD
RCP - REINFORCED CONCRETE PIPE
RET - RETIRED
RGS - RIGID GALVANIZED STEEL
SFC - STEEL FACE CURB
SN - SIGN
ST - STEEL PIPE
STP - STANDPIPE
TC - TOP OF CURB
TW - TOP OF WALL
TYP - TYPICAL
UV - UNKNOWN VALVE
VER - VERIZON
VP - VENT PIPE
VS - # - VAULT NUMBER
WV - WATER VALVE
WLP - WOODEN LIGHT POLE

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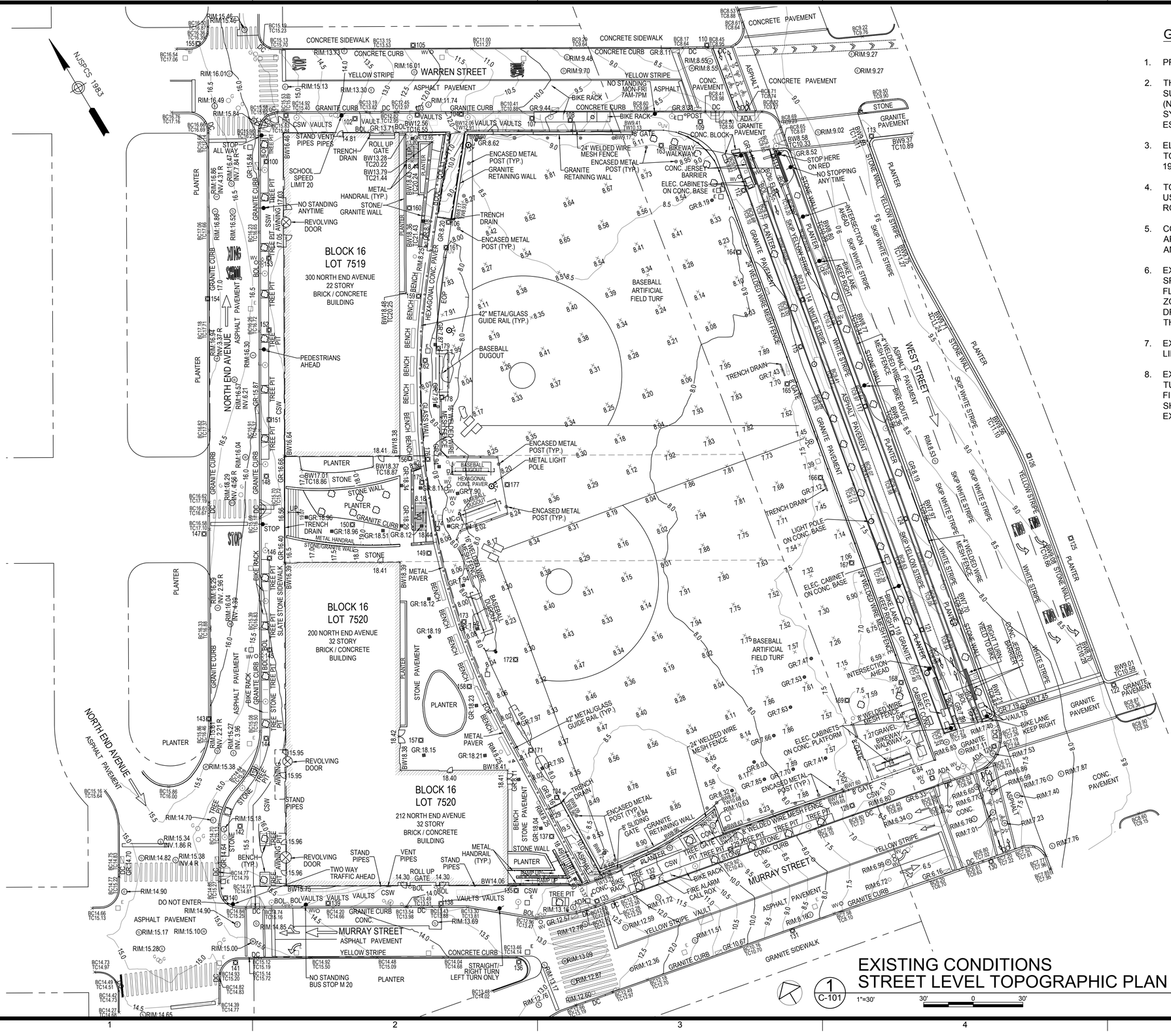
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CIVIL LEGEND AND ABBREVIATIONS

C-002



GENERAL SHEET NOTES:

1. PROJECT UNITS ARE US SURVEY FEET.
2. THE COORDINATE SYSTEM USED FOR THIS SURVEY IS THE NORTH AMERICAN DATUM OF 1983 (NAD 83), NEW YORK STATE PLANE COORDINATE SYSTEM, LONG ISLAND ZONE. NAD 83 WAS ESTABLISHED FROM NAIK GPS OBSERVATION.
3. ELEVATIONS SHOWN HEREON ARE IN REFERENCE TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
4. TOPOGRAPHIC SURVEY PERFORMED BY NAIK USING A LEICA C10 LASER SCANNER, GS12 RTK ROVER, AND LEICA TS15i TOTAL STATION.
5. CONDITIONS AND INFORMATION SHOWN HEREIN ARE FROM A SURVEY DATED NOVEMBER, 2018 AND UPDATED ON APRIL 12, 2019.
6. EXISTING IRRIGATION SYSTEM HEADS INCLUDING SPRINKLERS, GATE VALVES, AIR RELIEF VALVES, FLUSHING VALVES, EXHAUST HEADER AND DRIP ZONE SUPPLY ETC., ARE NOT SHOWN IN THESE DRAWINGS. THEY ARE LOCATED THROUGHOUT THE SITE.
7. EXISTING BIOSWALE DRIP LINES AND LATERAL LINES ARE NOT SHOWN.
8. EXISTING UNDERGROUND UTILITIES COVERED BY TURF OR BURIED HAVE NOT BEEN SURVEYED OR FIELD VERIFIED. EXISTING UTILITY INFORMATION SHOWN ON THESE DRAWINGS HAS BEEN EXTRACTED FROM RECORD DRAWINGS.

EXISTING CONDITIONS STREET LEVEL TOPOGRAPHIC PLAN

1 / C-101

1"=30'

30' 0 30'

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EXISTING CONDITIONS STREET LEVEL

C-101

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EXISTING CONDITIONS UTILITY PLAN

1 / C-102

1"=30'

30' 0 30'

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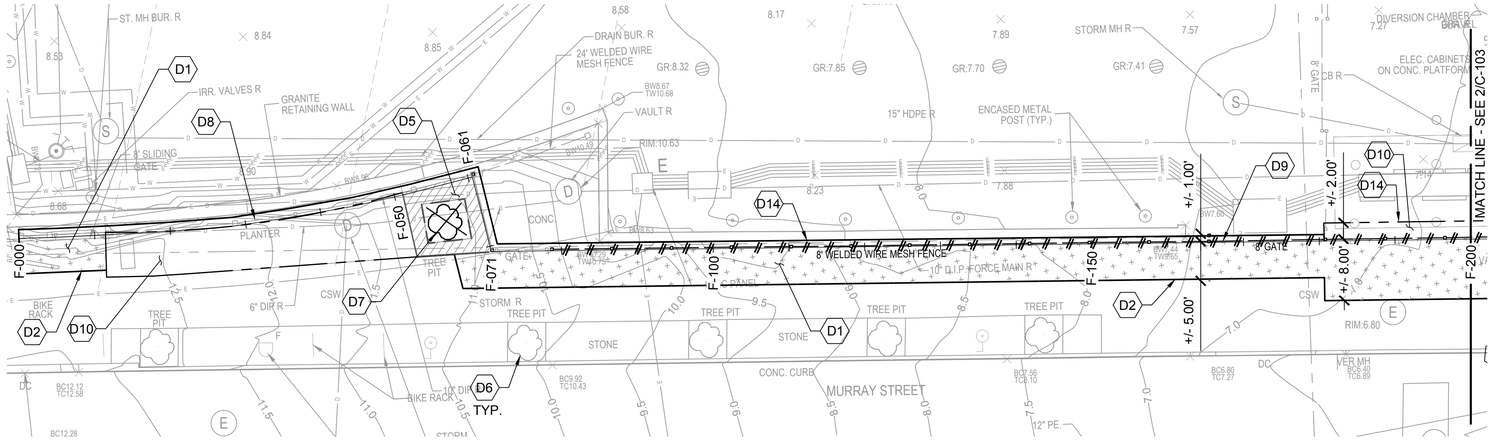
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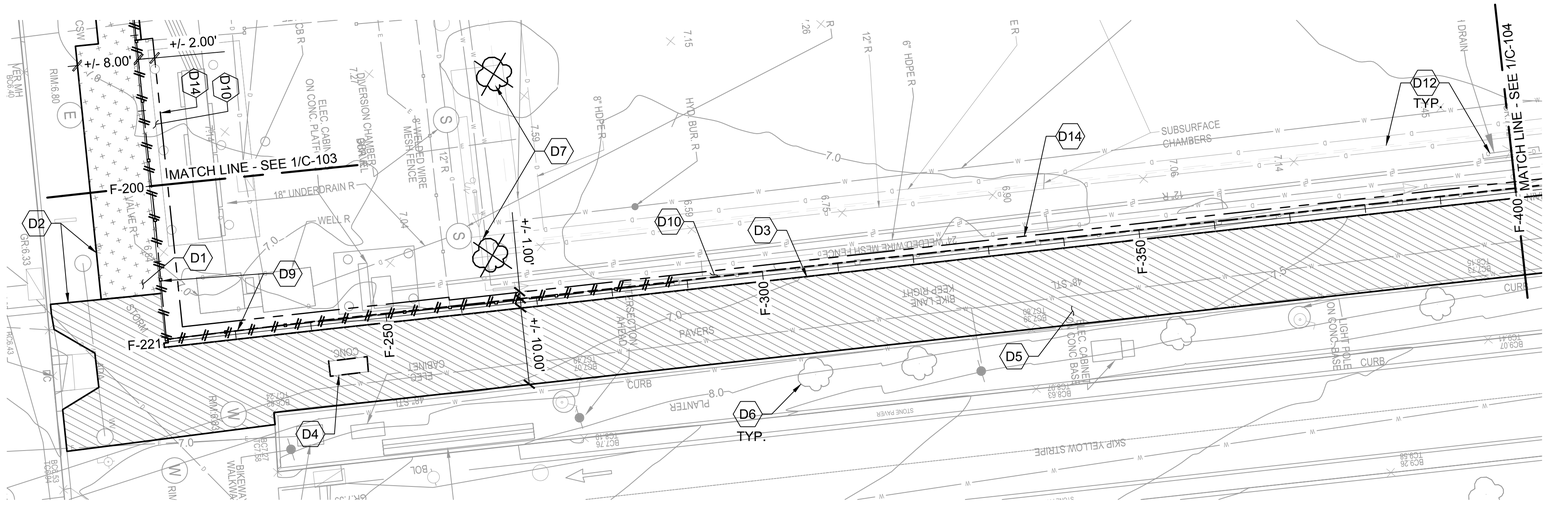
EXISTING CONDITIONS UTILITY PLAN

C-102



1 C-103 SITE DEMOLITION PLAN - AREA 1

1"=10' 10' 5' 0 10'



2 C-103 SITE DEMOLITION PLAN - AREA 2

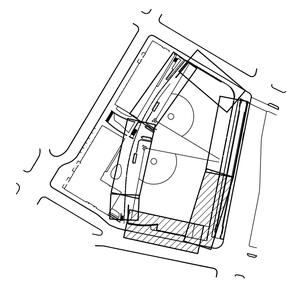
1"=10' 10' 5' 0 10'

GENERAL SHEET NOTES

1. REFER TO C-001 AND C-002 FOR CIVIL GENERAL NOTES, LEGEND, AND ABBREVIATIONS.
2. REFER TO LANDSCAPING DRAWINGS AND G-003 FOR TREE PROTECTION PLAN.
3. REFER TO C-131 AND C-132 FOR EROSION AND SEDIMENT CONTROL PLANS.

SHEET KEYNOTES

D1. REMOVE EXISTING CONCRETE PAVING OR SIDEWALK INCLUDING SUBBASE. IF SIDEWALK REMOVAL CUTS INTO ADJACENT SLAB EXTEND SIDEWALK REMOVAL AND REPLACEMENT TO NEAREST JOINT.
D2. SAWCUT EXISTING CONCRETE PAVING OR SIDEWALK TO NEAREST JOINT.
D3. REMOVE EXISTING CONCRETE CURB IN ITS ENTIRETY.
D4. REMOVE AND SALVAGE EXISTING CONCRETE BARRIER.
D5. REMOVE EXISTING PAVERS AND SUBBASE. SALVAGE PAVERS IN GOOD CONDITION FOR REUSE.
D6. PROTECT EXISTING TREES WITHIN THE LIMITS OF CONSTRUCTION. SEE LANDSCAPING DRAWINGS FOR DETAILS.
D7. REMOVE EXISTING TREE IN ITS ENTIRETY. SEE LANDSCAPING DRAWINGS FOR DETAILS.
D8. EXISTING FENCE TO REMAIN IN PLACE AND BE PROTECTED DURING CONSTRUCTION.
D9. REMOVE AND SALVAGE HIGH WELDED WIRE MESH FENCE AND GATE, FOR REUSE.
D10. CLEAR AND GRUB AS REQUIRED FOR INSTALLATION OF NEW FLOOD WALL.
D11. INSPECT EXISTING CATCH BASIN TO DETERMINE IF STRUCTURE AND ASSOCIATED PIPING HAVE BEEN CAPPED OR FILLED. IF ABANDONED, REMOVE CATCH BASIN AND ASSOCIATED STORM PIPING WITHIN THE WORK LIMITS. INFORM ENGINEER IF OTHERWISE.
D12. PROTECT EXISTING TRENCH DRAINS AND BELOW GRADE BIOSWALE AND DETENTION SYSTEM DURING CONSTRUCTION.
D13. REMOVE EXISTING TOP LAYER OF TURF AS NEEDED FOR INSTALLATION OF NEW WORK. ALIGN REMOVAL EDGE WITH EDGE OF EXISTING PLANTING BED.
D14. DO NOT DISTURB BEYOND THIS POINT. WORK SHALL NOT TOUCH OR AFFECT THE EXISTING SYNTHETIC TURF SYSTEM IN ANY WAY.



KEY PLAN

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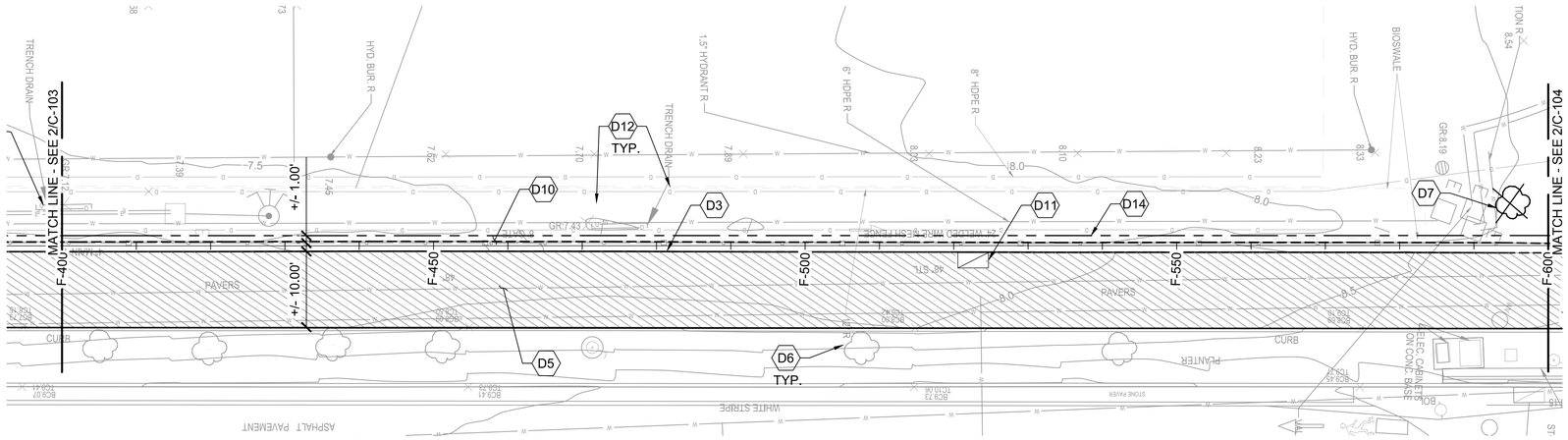
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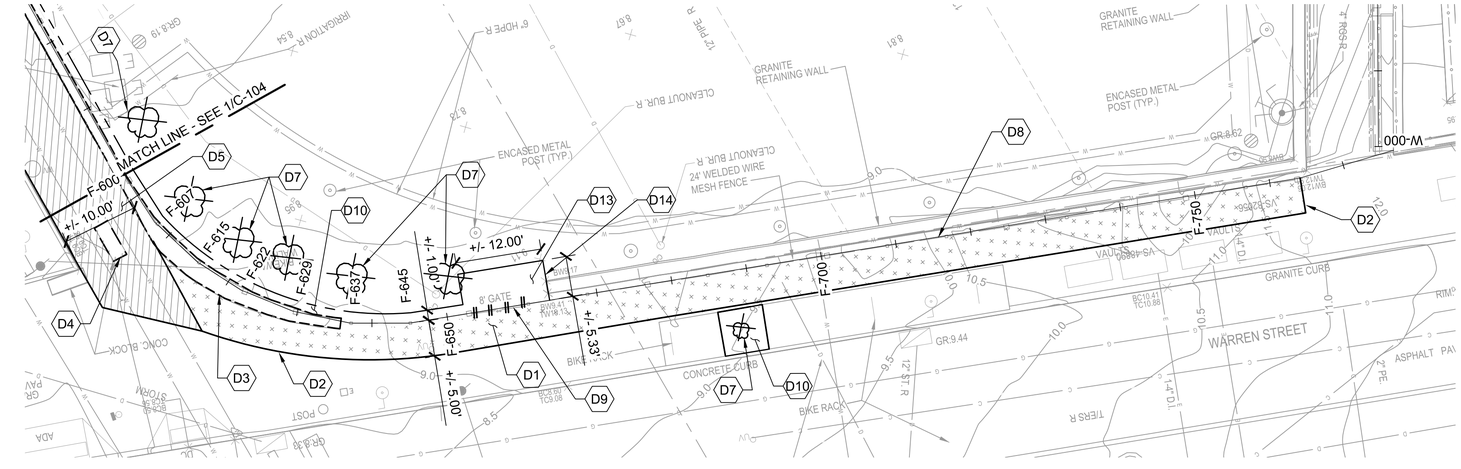
SITE DEMOLITION PLAN SHEET 1 OF 2

C-103



1 C-104 SITE DEMOLITION PLAN - AREA 3

1"=10' 10' 5' 0 10'



2 C-104 SITE DEMOLITION PLAN - AREA 4

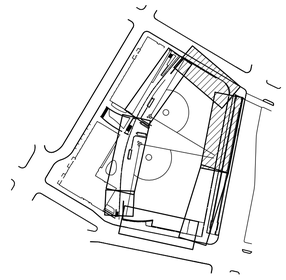
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GENERAL SHEET NOTES

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SHEET KEYNOTES

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D9. REMOVE AND SALVAGE HIGH WELDED WIRE MESH FENCE AND GATE, FOR REUSE.
D10. CLEAR AND GRUB AS REQUIRED FOR INSTALLATION OF NEW FLOOD WALL.
D11. INSPECT EXISTING CATCH BASIN TO DETERMINE IF STRUCTURE AND ASSOCIATED PIPING HAVE BEEN CAPPED OR FILLED. IF ABANDONED, REMOVE CATCH BASIN AND ASSOCIATED STORM PIPING WITHIN THE WORK LIMITS. INFORM ENGINEER IF OTHERWISE.
D12. PROTECT EXISTING TRENCH DRAINS AND BELOW GRADE BIOSWALE AND DETENTION SYSTEM DURING CONSTRUCTION.
D13. REMOVE EXISTING TOP LAYER OF TURF AS NEEDED FOR INSTALLATION OF NEW WORK. ALIGN REMOVAL EDGE WITH EDGE OF EXISTING PLANTING BED.
D14. DO NOT DISTURB BEYOND THIS POINT. WORK SHALL NOT TOUCH OR AFFECT THE EXISTING SYNTHETIC TURF SYSTEM IN ANY WAY.



KEY PLAN

NOT TO SCALE

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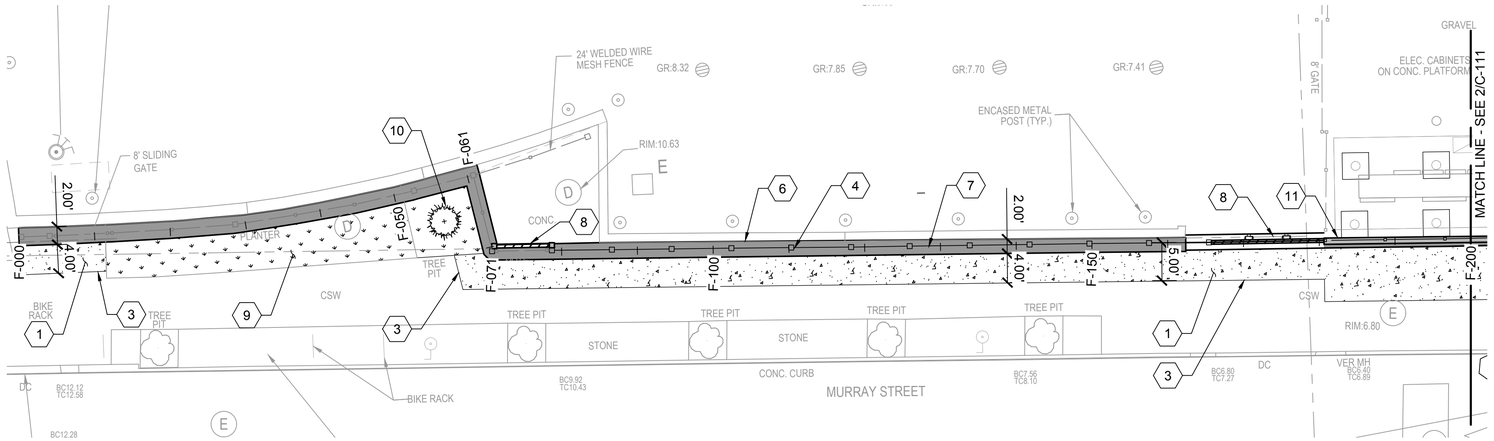
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SHEET TITLE

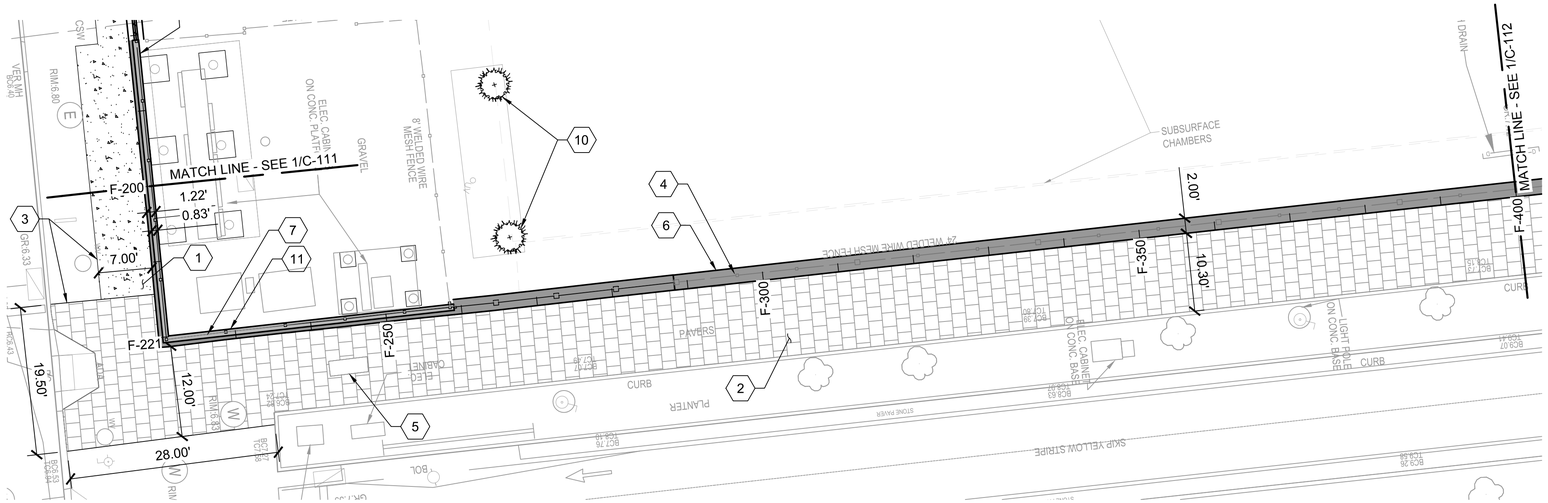
SITE DEMOLITION PLAN SHEET 2 OF 2

C-104



1 SITE LAYOUT PLAN - AREA 1

C-111 | 1"=10' | 10' 5' 0 10'



2 SITE LAYOUT PLAN - AREA 2

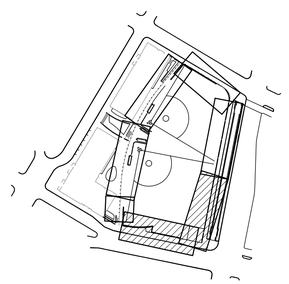
C-111 | 1"=10' | 10' 5' 0 10'

GENERAL SHEET NOTES

1. REFER TO C-001 AND C-002 FOR CIVIL GENERAL NOTES, LEGEND, AND ABBREVIATIONS.
2. REFER TO LANDSCAPING DRAWINGS FOR ARCHITECTURAL PANEL DETAILS.
3. REFER TO STRUCTURAL DRAWINGS FOR INTERIM FLOOD WALL PLANS, ELEVATIONS, AND DETAILS.

SHEET KEYNOTES

1. FURNISH AND INSTALL NYCDOT STANDARD CONCRETE SIDEWALK. REFER TO DETAIL 1/C-501.
2. FURNISH AND INSTALL PAVERS AND BASE COURSE TO MATCH ADJACENT PAVERS IN NYS DOT RIGHT OF WAY. SEE DETAIL 2/C-501. REUSE EXISTING PAVERS IN GOOD CONDITION OTHERWISE PROVIDE NEW PAVERS TO MATCH.
3. MATCH EXISTING CONCRETE PAVING OR PAVERS.
4. STEEL PLATE FLOOD WALL WITH ARCHITECTURAL PANEL ATTACHED TO EXISTING WELDED WIRE MESH FENCE. REFER TO STRUCTURAL AND LANDSCAPING DRAWINGS FOR DETAILS.
5. REINSTALL SALVAGED CONCRETE BARRIERS.
6. 24" WIDE CONCRETE GRADE BEAM. SEE STRUCTURAL DRAWINGS FOR DETAILS.
7. REINSTALL SALVAGED WELDED WIRE MESH FENCE. SEE STRUCTURAL DRAWINGS FOR DETAILS.
8. FURNISH AND INSTALL FLOOD GATE. REINSTALL SALVAGED SECURITY GATES AT THE ORIGINAL LOCATION AFTER INSTALLATION OF FLOOD GATE.
9. RESTORE LANDSCAPED AREA.
10. INSTALL TREE. SEE LANDSCAPING DRAWINGS FOR DETAILS.
11. 10" WIDE CONCRETE FLOOD WALL. SEE STRUCTURAL DRAWINGS.
12. RESTORE TURF AREA. SEE LANDSCAPING DRAWING LA-502 FOR DETAILS.
13. INSTALL PAVERS AND SUBBASE IN NYC DOT RIGHT OF WAY TO MATCH ADJACENT PAVERS. REFER TO LATEST NYCDOT STANDARDS AND SPECIFICATIONS.



KEY PLAN

NOT TO SCALE

STV INCORPORATED
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CONSULTANTS

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SUITE 605
NEW YORK, NY 10001
www.siteworkscm.com

SEALS

PROJECT IDENTIFICATION

NEW YORK STATE OF OPPORTUNITY. Battery Park City Authority

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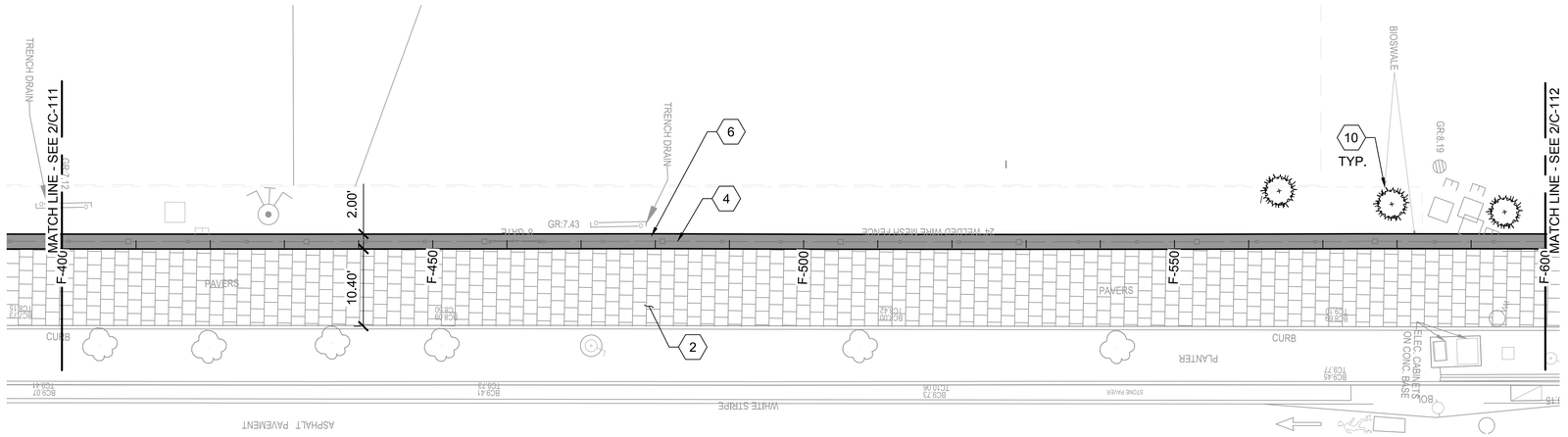
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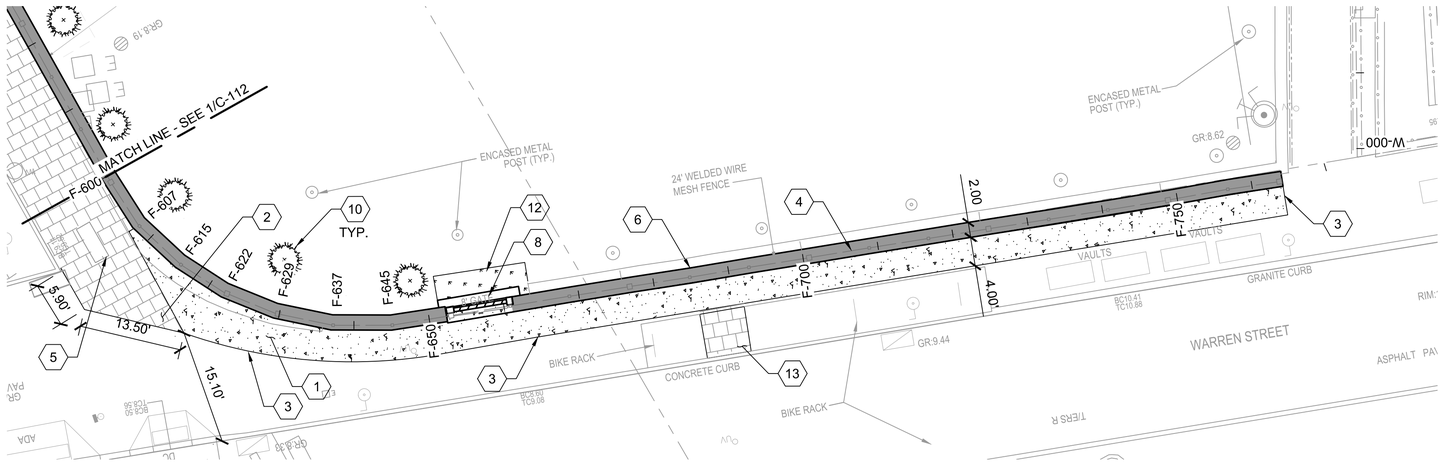
SITE LAYOUT PLAN
SHEET 1 OF 2

C-111



1 C-112 SITE LAYOUT PLAN - AREA 3

1"=10' 10' 5' 0 10'



2 C-112 SITE LAYOUT PLAN - AREA 4

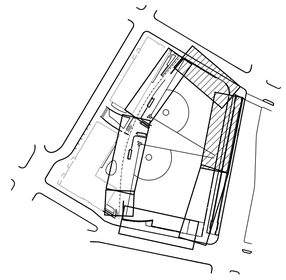
1"=10' 10' 5' 0 10'

GENERAL SHEET NOTES

1. REFER TO C-001 AND C-002 FOR CIVIL GENERAL NOTES, LEGEND, AND ABBREVIATIONS.
2. REFER TO LANDSCAPING DRAWINGS FOR ARCHITECTURAL PANEL DETAILS.
3. REFER TO STRUCTURAL DRAWINGS FOR INTERIM FLOOD WALL PLANS, ELEVATIONS, AND DETAILS.

SHEET KEYNOTES

1. FURNISH AND INSTALL NYCDOT STANDARD CONCRETE SIDEWALK. REFER TO DETAIL 1/C-501.
2. FURNISH AND INSTALL PAVERS AND BASE COURSE TO MATCH ADJACENT PAVERS IN NYS DOT RIGHT OF WAY. SEE DETAIL 2/C-501. REUSE EXISTING PAVERS IN GOOD CONDITION OTHERWISE PROVIDE NEW PAVERS TO MATCH.
3. MATCH EXISTING CONCRETE PAVING OR PAVERS.
4. STEEL PLATE FLOOD WALL WITH ARCHITECTURAL PANEL ATTACHED TO EXISTING WELDED WIRE MESH FENCE. REFER TO STRUCTURAL AND LANDSCAPING DRAWINGS FOR DETAILS.
5. REINSTALL SALVAGED CONCRETE BARRIERS.
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8. FURNISH AND INSTALL FLOOD GATE. REINSTALL SALVAGED SECURITY GATES AT THE ORIGINAL LOCATION AFTER INSTALLATION OF FLOOD GATE.
9. RESTORE LANDSCAPED AREA.
10. INSTALL TREE. SEE LANDSCAPING DRAWINGS FOR DETAILS.
11. 10" WIDE CONCRETE FLOOD WALL. SEE STRUCTURAL DRAWINGS.
12. RESTORE TURF AREA. SEE LANDSCAPING DRAWING LA-502 FOR DETAILS.
13. INSTALL PAVERS AND SUBBASE IN NYC DOT RIGHT OF WAY TO MATCH ADJACENT PAVERS. REFER TO LATEST NYCDOT STANDARDS AND SPECIFICATIONS.



KEY PLAN

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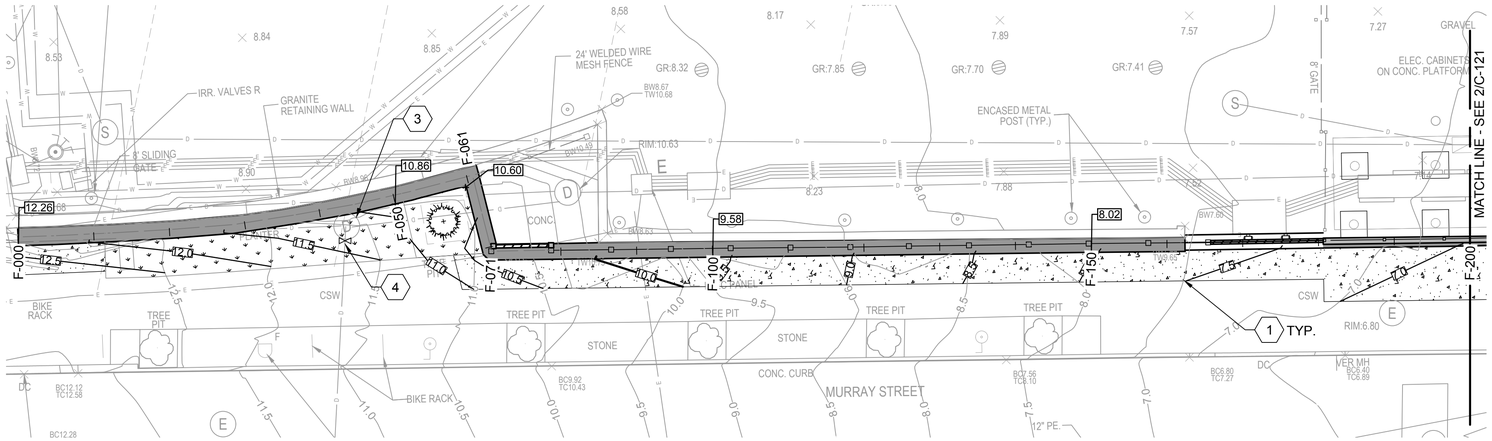
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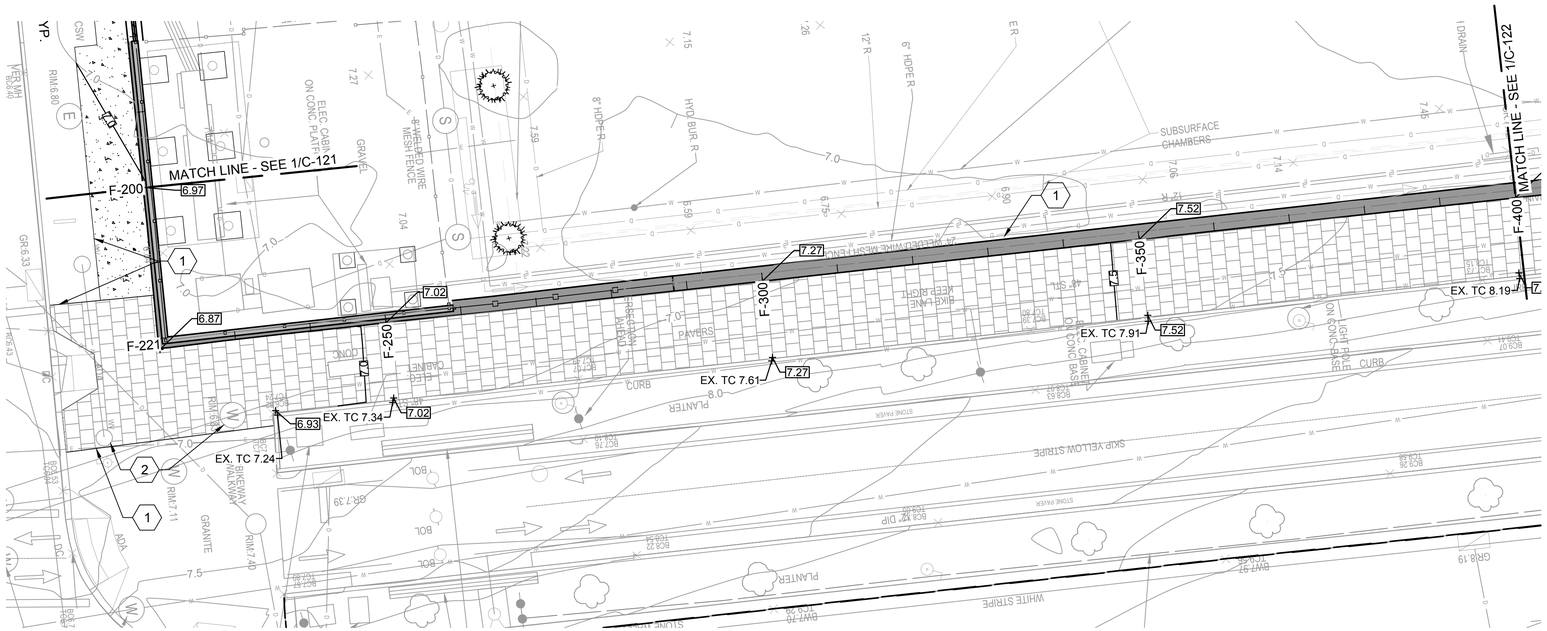
SITE LAYOUT PLAN
SHEET 2 OF 2

C-112



1 C-121 GRADING, DRAINAGE, AND UTILITY PLAN - AREA 1

1"=10' 10' 5' 0 10'



2 C-121 GRADING, DRAINAGE, AND UTILITY PLAN - AREA 2

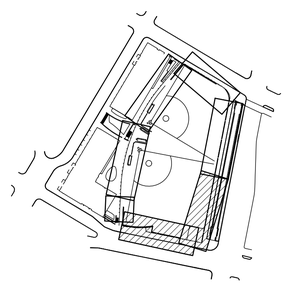
1"=10' 10' 5' 0 10'

GENERAL SHEET NOTES

1. REFER TO C-001 AND C-002 FOR CIVIL GENERAL NOTES, LEGEND, AND ABBREVIATIONS.
2. REFER TO GENERAL NOTES FOR HORIZONTAL COORDINATES AND ELEVATION DATUM.
3. REFER TO LANDSCAPING DRAWINGS FOR ARCHITECTURAL PANEL DETAILS.
4. REFER TO STRUCTURAL DRAWINGS FOR FLOOD WALL PLANS, ELEVATIONS, AND DETAILS.

SHEET KEYNOTES

1. MATCH EXISTING GRADE.
2. RESET EXISTING STRUCTURE TO FINISH GRADE ELEVATION.
3. PROVIDE HEAVY DUTY WATERTIGHT MANHOLE COVER TO WITHSTAND DESIGN FLOOD LOAD.
4. INSTALL INLINE CHECK VALVE ON OUTGOING 15" DUCTILE IRON PIPE WITHIN BPC PROPERTY LINE. SIZE AND INVERT OF PIPE SHALL BE VERIFIED IN FIELD.
5. SEAL EXISTING ELECTRICAL CONDUITS IN CON EDISON VAULTS BELOW THE DFE. COORDINATE WITH CON EDISON.



KEY PLAN
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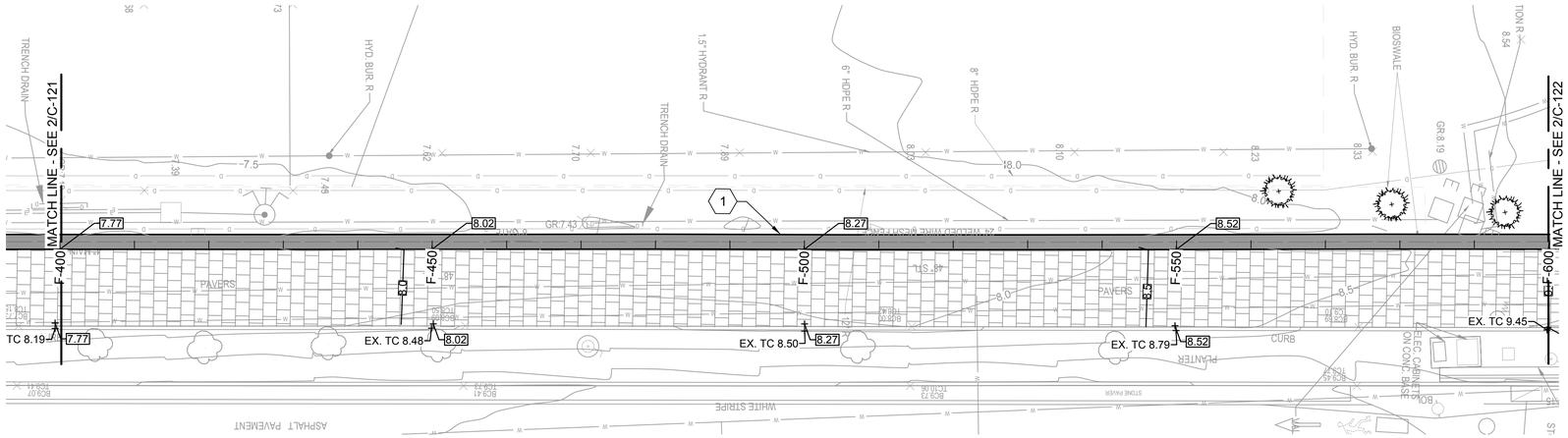
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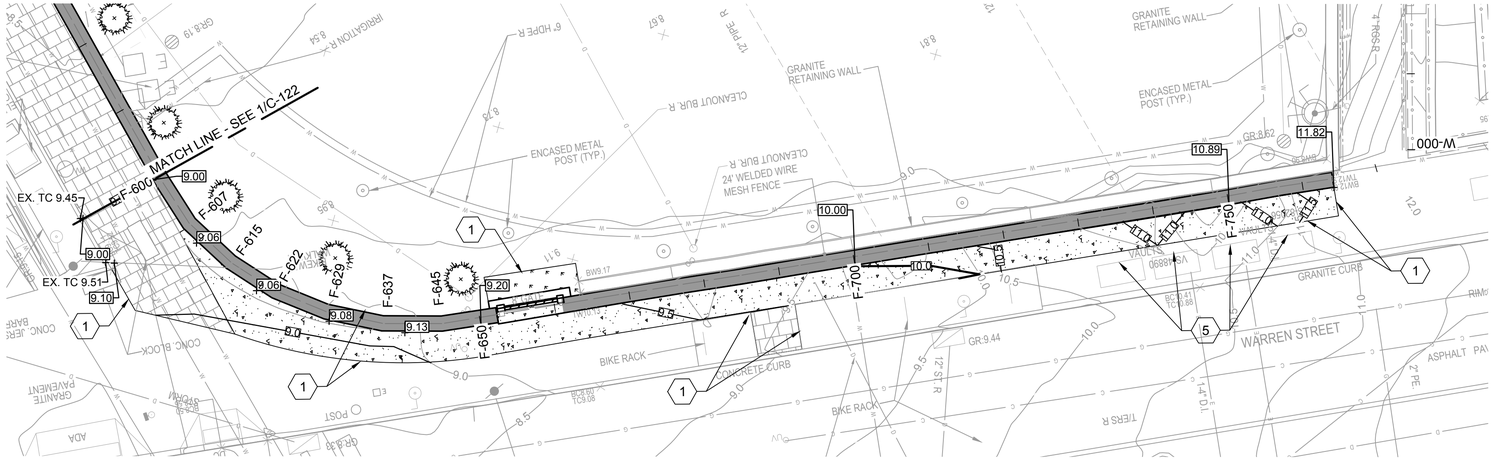
GRADING, DRAINAGE, AND UTILITY PLAN SHEET 1 OF 2

C-121



1 C-122 GRADING, DRAINAGE, AND UTILITY PLAN - AREA 3

1"=10' 10' 5' 0 10'



2 C-122 GRADING, DRAINAGE, AND UTILITY PLAN - AREA 4

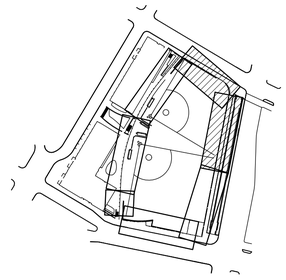
1"=10' 10' 5' 0 10'

GENERAL SHEET NOTES

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2. REFER TO GENERAL NOTES FOR HORIZONTAL COORDINATES AND ELEVATION DATUM.
3. REFER TO LANDSCAPING DRAWINGS FOR ARCHITECTURAL PANEL DETAILS.
4. REFER TO STRUCTURAL DRAWINGS FOR FLOOD WALL PLANS, ELEVATIONS, AND DETAILS.

SHEET KEYNOTES

1. MATCH EXISTING GRADE.
2. RESET EXISTING STRUCTURE TO FINISH GRADE ELEVATION.
3. PROVIDE HEAVY DUTY WATERTIGHT MANHOLE COVER TO WITHSTAND DESIGN FLOOD LOAD.
4. INSTALL INLINE CHECK VALVE ON OUTGOING 15" DUCTILE IRON PIPE WITHIN BPC PROPERTY LINE. SIZE AND INVERT OF PIPE SHALL BE VERIFIED IN FIELD.
5. SEAL EXISTING ELECTRICAL CONDUITS IN CON EDISON VAULTS BELOW THE DFE. COORDINATE WITH CON EDISON.



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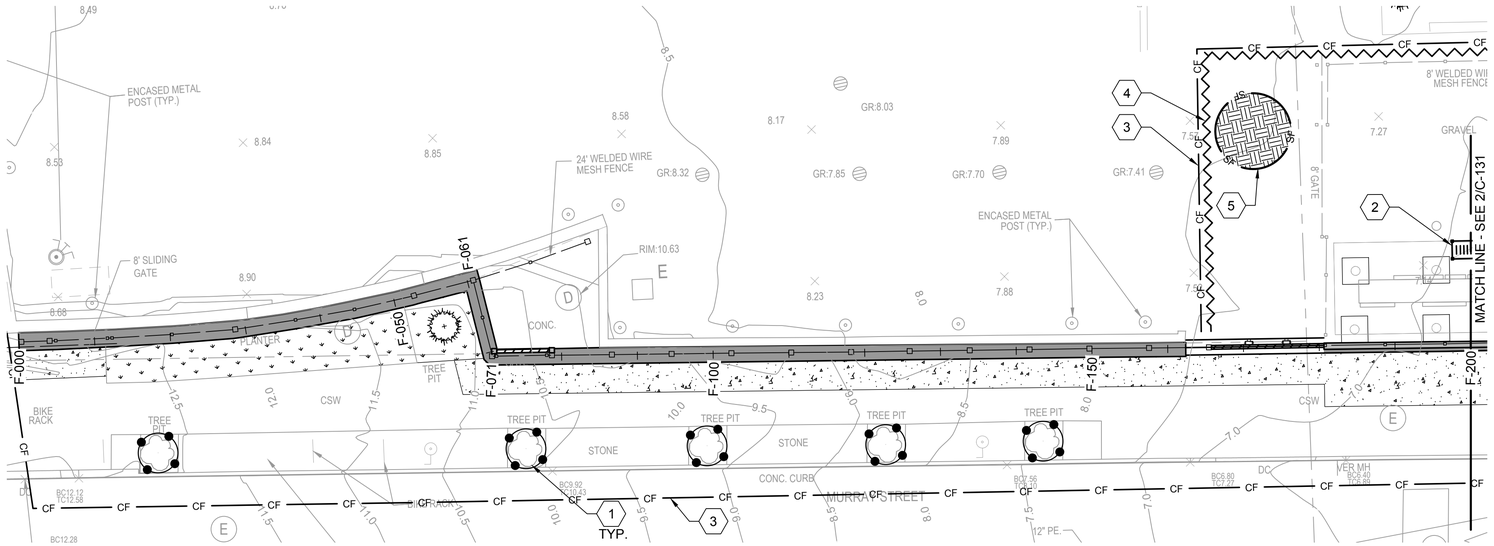
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SHEET TITLE

GRADING, DRAINAGE, AND UTILITY PLAN SHEET 2 OF 2

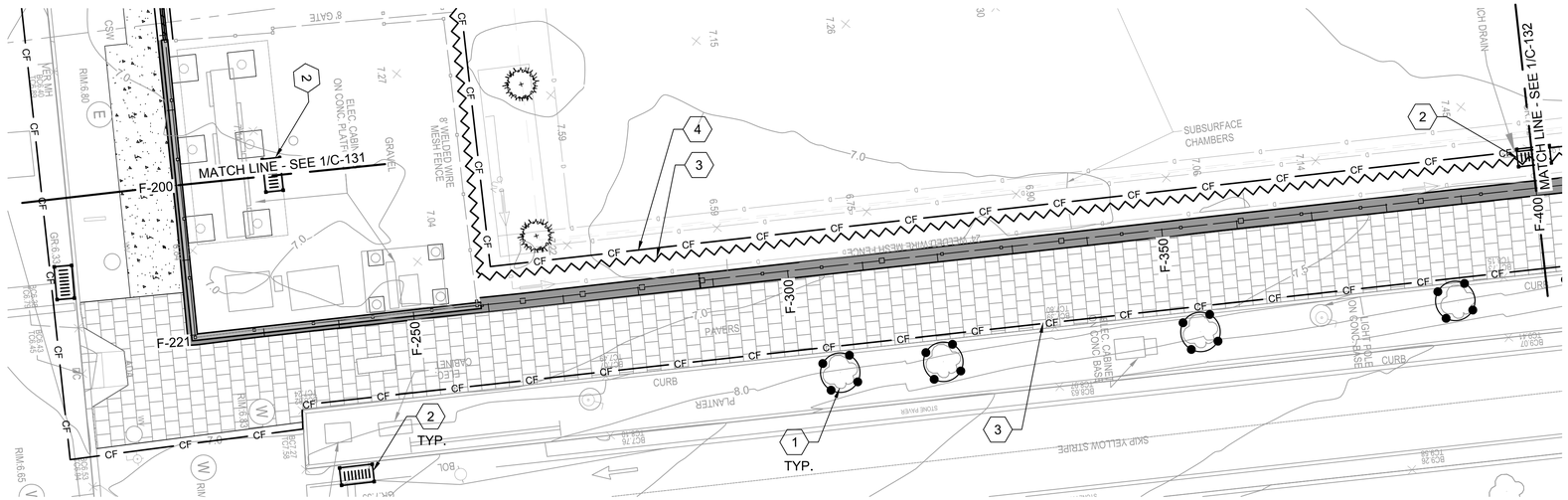
C-122



1 C-131 EROSION AND SEDIMENT CONTROL PLAN - AREA 1

1"=10'

10' 5' 0 10'



2 C-131 EROSION AND SEDIMENT CONTROL PLAN - AREA 2

1"=10'

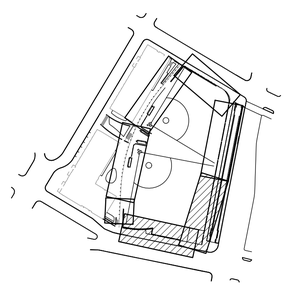
10' 5' 0 10'

GENERAL SHEET NOTES

1. REFER TO C-001 AND C-002 FOR CIVIL GENERAL NOTES, LEGEND, AND ABBREVIATIONS.
2. SEE G-003 FOR TREE PROTECTION PLAN.
3. THIS PLAN IS INTENDED TO SERVE AS A GUIDE FOR EROSION AND SEDIMENT CONTROL MEASURES. THE CONTRACTOR SHALL PROVIDE AN EROSION AND SEDIMENT CONTROL PLAN IN CONJUNCTION WITH PHASING AND LOGISTICS PLAN FOR APPROVAL PRIOR TO CONSTRUCTION START.
4. PROPOSED WORK SHALL NOT TOUCH OR AFFECT THE EXISTING SYNTHETIC TURF IN ANYWAY.

SHEET KEYNOTES

1. TREE PROTECTION. SEE LANDSCAPING DRAWINGS FOR DETAILS.
2. INLET PROTECTION. SEE DETAIL 1/C-502.
3. CONSTRUCTION FENCE. FENCE WITHIN TURF AREAS SHALL NOT DAMAGE THE EXISTING TURF TO REMAIN.
4. SEDIMENT FILTER LOG. SEE DETAIL 3/C-502.
5. STOCKPILE. SEE DETAIL 2/C-502.
6. STABILIZED CONSTRUCTION ENTRANCE. SEE DETAIL 5/C-502.



KEY PLAN

NOT TO SCALE

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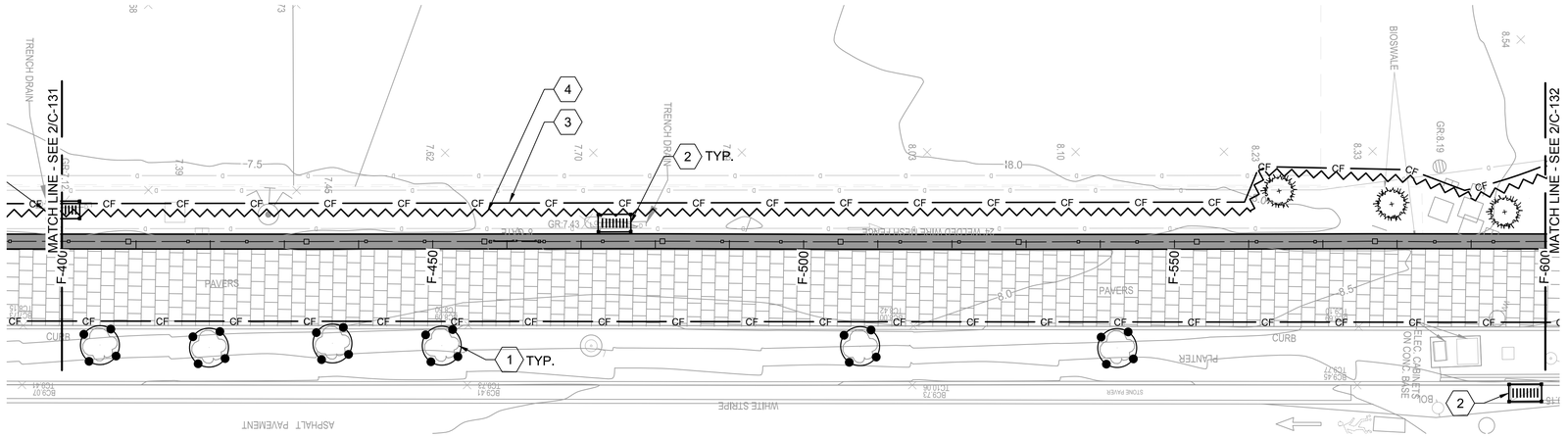
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SHEET TITLE

EROSION AND SEDIMENT CONTROL PLAN SHEET 1 OF 2

C-131



1 C-132 EROSION AND SEDIMENT CONTROL PLAN - AREA 3

1"=10'

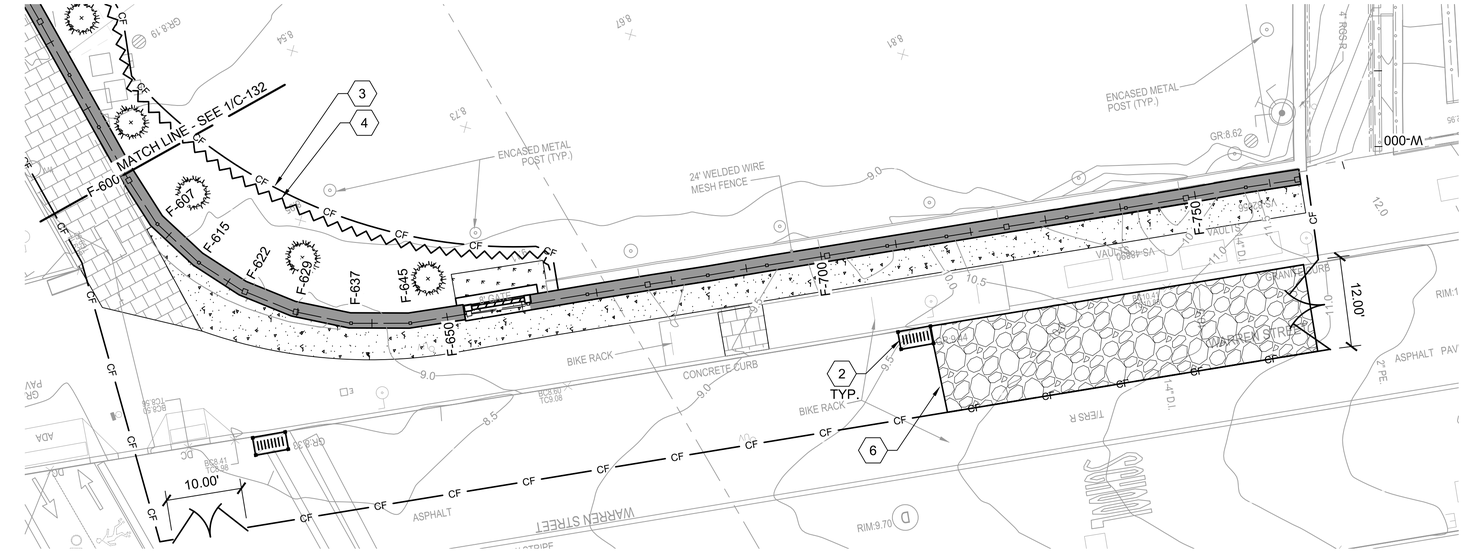
10' 5' 0 10'

GENERAL SHEET NOTES

1. REFER TO C-001 AND C-002 FOR CIVIL GENERAL NOTES, LEGEND, AND ABBREVIATIONS.
2. SEE G-003 FOR TREE PROTECTION PLAN.
3. THIS PLAN IS INTENDED TO SERVE AS A GUIDE FOR EROSION AND SEDIMENT CONTROL MEASURES. THE CONTRACTOR SHALL PROVIDE AN EROSION AND SEDIMENT CONTROL PLAN IN CONJUNCTION WITH PHASING AND LOGISTICS PLAN FOR APPROVAL PRIOR TO CONSTRUCTION START.
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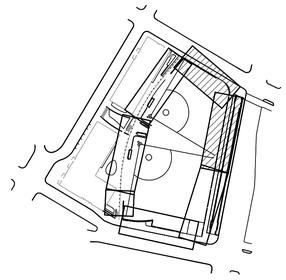
1. TREE PROTECTION. SEE LANDSCAPING DRAWINGS FOR DETAILS.
2. INLET PROTECTION. SEE DETAIL 1/C-502.
3. CONSTRUCTION FENCE. FENCE WITHIN TURF AREAS SHALL NOT DAMAGE THE EXISTING TURF TO REMAIN.
4. SEDIMENT FILTER LOG. SEE DETAIL 3/C-502.
5. STOCKPILE. SEE DETAIL 2/C-502.
6. STABILIZED CONSTRUCTION ENTRANCE. SEE DETAIL 5/C-502.



2 C-132 EROSION AND SEDIMENT CONTROL PLAN - AREA 4

1"=10'

10' 5' 0 10'



KEY PLAN

NOT TO SCALE

STV 100 Years
STV INCORPORATED
225 PARK AVENUE SOUTH
5TH FLOOR
NEW YORK, NY 10003
www.stvinc.com

CONSULTANTS

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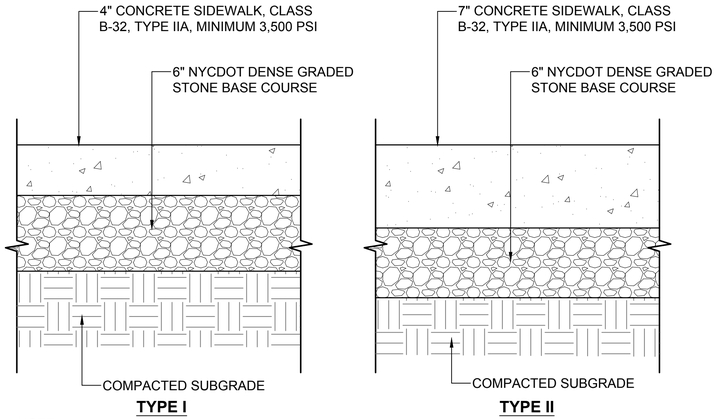
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SHEET TITLE

EROSION AND SEDIMENT CONTROL PLAN SHEET 2 OF 2

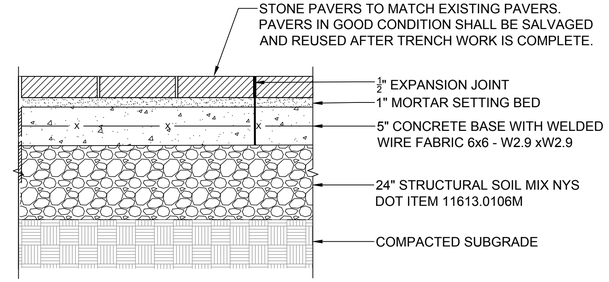
C-132



NOTE:

1. ALL MATERIALS AND CONSTRUCTION METHODS USED ARE TO CONFORM TO SECTION #4.13 OF THE LATEST NYC DEPARTMENT OF TRANSPORTATION (DOT) STANDARD HIGHWAY SPECIFICATIONS AND STANDARD DETAIL H-1045.
2. TYPE II CONCRETE SIDEWALK SHALL BE USED IN DRIVEWAYS AND CORNER QUADRANTS.

1 NYC DOT CONCRETE SIDEWALK
NTS



NOTE:

1. ALL STONE PAVER RESTORATION SHALL MEET THE LATEST NYS DOT STANDARDS AND SPECIFICATIONS.
2. PAVERS SHALL MATCH THE STYLE, COLOR, AND SIZE OF ADJACENT EXISTING PAVERS IN THE NYS DOT RIGHT OF WAY.
3. EXISTING PAVER SUBBASE IS UNKNOWN. CONTRACTOR SHALL VERIFY THE EXISTING SUBBASE CONDITIONS AND NOTIFY THE ENGINEER.
4. FULL DEPTH PAVER RESTORATION MAY NOT BE REQUIRED IN AREAS WITH LITTLE OR NO GRADE CHANGE.

2 PAVER RESTORATION
NTS

STV INCORPORATED
225 PARK AVENUE SOUTH
5TH FLOOR
NEW YORK, NY 10003
www.stvinc.com

CONSULTANTS

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B	10/18/19	75% DESIGN SUBMITTAL	SB
A	09/06/19	50% DESIGN SUBMITTAL	SB

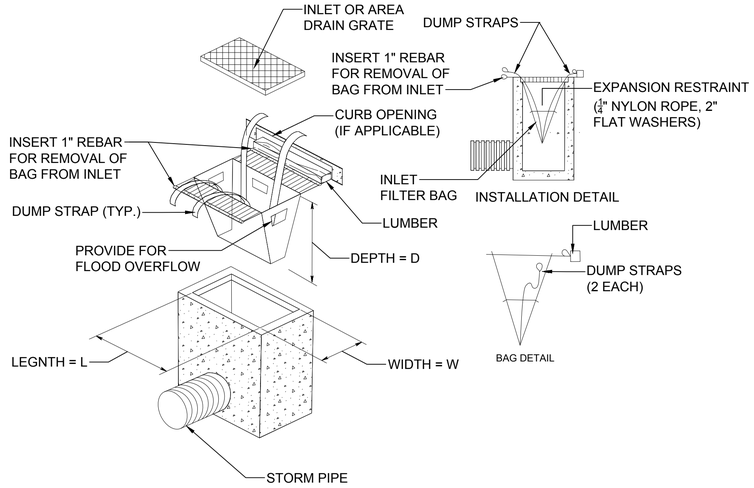
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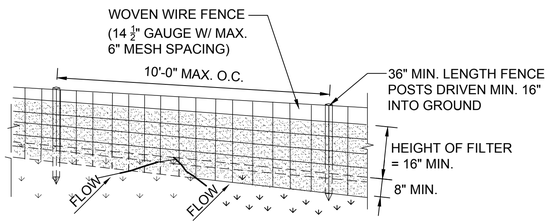
SITE DETAILS

C-501

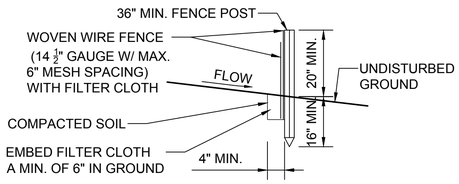


1 DROP INLET PROTECTION

NTS



PERSPECTIVE VIEW



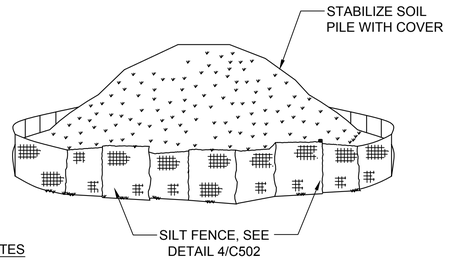
SECTION VIEW

NOTES

1. SILT FENCE SHALL BE INSTALLED AT LEVEL GRADE. BOTH ENDS OF EACH FENCE SECTION SHALL BE EXTENDED AT LEAST 8 FEET UPSLOPE AT 45 DEGREES TO THE MAIN FENCE ALIGNMENT.
2. WOVEN WIRE FENCE TO BE FASTENED SECURELY TO FENCE POSTS WITH WIRE TIES OR STAPLES. POSTS SHALL BE STEEL EITHER "T" OR "U" TYPE OR HARDWOOD.
3. FILTER CLOTH SHALL BE FASTENED SECURELY TO WOVEN WIRE FENCE WITH TIES SPACED EVERY 24" AT TOP AND MID SECTION. FENCE SHALL BE WOVEN WIRE 14 ½" GAUGE, 6" MAXIMUM MESH OPENING.
4. WHERE ENDS OF GEOTEXTILE FABRIC COME TOGETHER, THE FABRIC SHALL BE OVERLAPPED, FOLDED, AND STAPLED TO PREVENT SEDIMENT BYPASS. THE FENCE FABRIC SHALL BE ANCHORED AT THE TOE THEN BACKFILLED AND COMPACTED TO A DENSITY EQUAL TO THE SURROUNDING SOILS.
5. SEDIMENT SHALL BE REMOVED WHEN ACCUMULATIONS REACH ½ THE ABOVE GROUND HEIGHT OF THE FENCE.
6. GEOTEXTILE FABRIC SHALL BE AS SPECIFIED IN THE LATEST NEW YORK STATE STANDARDS AND SPECIFICATIONS FOR EROSION AND SEDIMENT CONTROL.

4 SILT FENCE

NTS



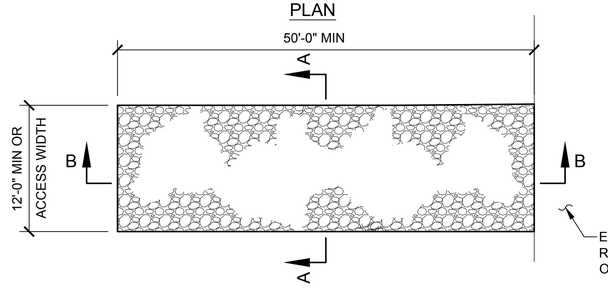
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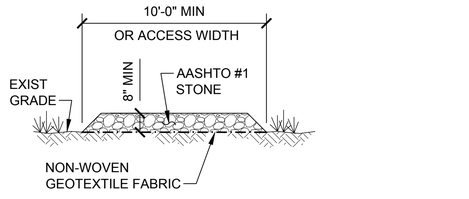
1. AREA CHOSEN FOR STOCKPILING OPERATIONS SHALL BE DRY AND STABLE.
2. MAXIMUM SLOPE OF STOCKPILE SHALL BE 2H:IV
3. UPON COMPLETION OF SOIL STOCKPILING, EACH PILE SHALL BE SURROUNDED WITH SILT FENCING.
4. A MINIMUM OF 12" MUST BE MAINTAINED BETWEEN THE TOE OF THE STOCKPILE AND THE EDGE OF THE FENCE ON ALL SIDES.
5. THE GROUND SURFACE WHERE SOIL WILL BE STOCKPILED SHALL BE COVERED WITH A MINIMUM OF 0.25 MM OR 2 LAYERS OF 0.15 MM POLYETHYLENE SHEETING OR AN APPROVED EQUAL MATERIAL.
6. PRIOR TO THE END OF EACH WORK DAY, STOCKPILES SHALL BE COMPLETELY COVERED WITH THE POLYETHYLENE SHEETING. STOCK PILE COVERS SHALL BE WEIGHTED OR SECURED BY APPROPRIATE MEANS. ALL SEAMS SHALL BE OVERLAPPED AND SEALED. DAMAGED COVERED SHALL BE REPAIRED OR REPLACED BY THE CONTRACTOR WITHIN 24 HOURS AFTER NOTIFICATION.

2 SOIL STOCKPILING

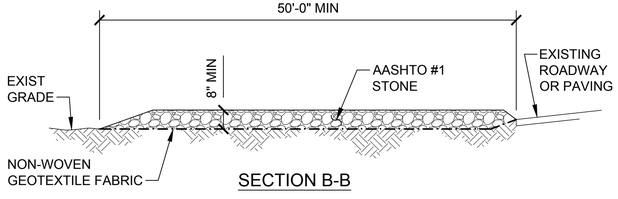
NTS

PLAN





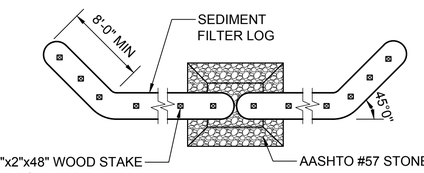
SECTION A-A



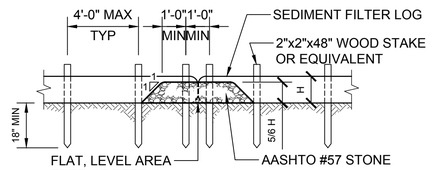
SECTION B-B

5 STABILIZED CONSTRUCTION ENTRANCE

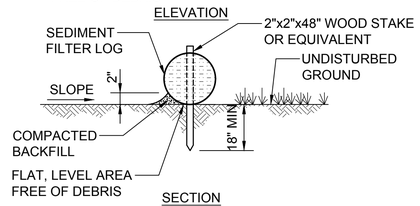
NTS



PLAN



ELEVATION



SECTION

NOTES

1. THE SEDIMENT LOG PLACEMENT AREA SHALL BE PREPARED SO THAT IT IS FREE OF ALL DEBRIS, INCLUDING ROCKS, STICKS, ROOTS, ETC. A 2 INCH LAYER OF COMPACTED FILL MATERIAL SHALL BE PLACED ON THE UPSLOPE SIDE OF THE LOG TO PREVENT UNDERCUTTING. WHERE MORE THAN ONE LOG IS REQUIRED TO OBTAIN SPECIFIED LENGTH, LOGS SHALL BE TIGHTLY ABUTTED AND SECURELY STAKED (OR OVERLAPPED BY 12 INCHES MINIMUM). A LAYER OF AASHTO #57 STONE SHALL BE PLACED WHERE ABUTTING LOGS COME TOGETHER (EXTENDING 2 FEET ON BOTH SIDES OF THE LOG).
2. SEDIMENT FILTER LOGS SHALL BE PLACED AT EXISTING LEVEL GRADE. ENDS SHALL BE EXTENDED UPSLOPE AT 45 DEGREES TO THE MAIN FILTER LOG ALIGNMENT FOR A MINIMUM OF 8 FEET.
3. SEDIMENT FILTER LOGS SHALL BE INSPECTED WEEKLY AND AFTER EACH RUNOFF EVENT.
4. SEDIMENT DEPOSITS SHALL BE CLEANED FROM THE LOG WHEN IT REACHES HALF THE HEIGHT OF THE LOG.
5. DAMAGED FILTER LOGS SHALL BE REPLACED WITHIN 24 HOURS OF INSPECTION. A SUPPLY OF FILTER LOGS SHALL BE MAINTAINED ON SITE FOR THIS PURPOSE.
6. THE CONTRACTOR MAY PROPOSE AN ALTERNATE METHOD TO SECURE SEDIMENT FILTER LOGS IN TURF AREAS WHERE STAKING MAY DAMAGE THE TURF.

3 SEDIMENT FILTER LOG

NTS

NOTES:

1. STONE SIZE - USE 2-INCH STONE
2. LENGTH - AS REQUIRED, BUT NOT LESS THAN 50 FEET.
3. THICKNESS - NOT LESS THAN 12 INCHES.
4. WIDTH - 12 FT. MINIMUM, BUT NOT LESS THAN THE FULL WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCUR.
5. FILTER FABRIC - PLACE OVER THE ENTIRE AREA PRIOR TO PLACEMENT OF STONE.
6. SURFACE WATER - ALL SURFACE WATER FLOWING OR DIVERTED TOWARD CONSTRUCTION ENTRANCES SHALL BE PIPED ACROSS THE ENTRANCE. IF PIPING IS IMPRACTICAL, A MOUNTABLE BERM WITH 5H:IV SLOPES WILL BE PERMITTED.
7. MAINTENANCE - THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT OUTSIDE OF THE DESIGNATED CONSTRUCTION AREA. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED OUTSIDE OF THE CONSTRUCTION LIMITS MUST BE REMOVED IMMEDIATELY.
8. WASHING - WHEELS SHALL BE CLEANED TO REMOVE SEDIMENT PRIOR TO ENTRANCE OUTSIDE THE CONSTRUCTION LIMITS. WHEN WASHING IS REQUIRED IT SHALL BE DONE ON AN AREA STABILIZED WITH STONE AND WHICH DRAINS INTO AN APPROVED SEDIMENT TRAPPING DEVICE.
9. PERIODIC INSPECTION AND NEEDED MAINTENANCE SHALL BE PROVIDED AFTER EACH RAINFALL OR RUNOFF EVENT.

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BATTERY PARK CITY
BALLFIELD AND COMMUNITY
CENTER

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	11/15/19	100% DESIGN SUBMITTAL	SB
C	11/01/19	ISSUE FOR BID - 95%	SB
B	10/18/19	75% DESIGN SUBMITTAL	SB
	09/06/19	50% DESIGN SUBMITTAL	SB

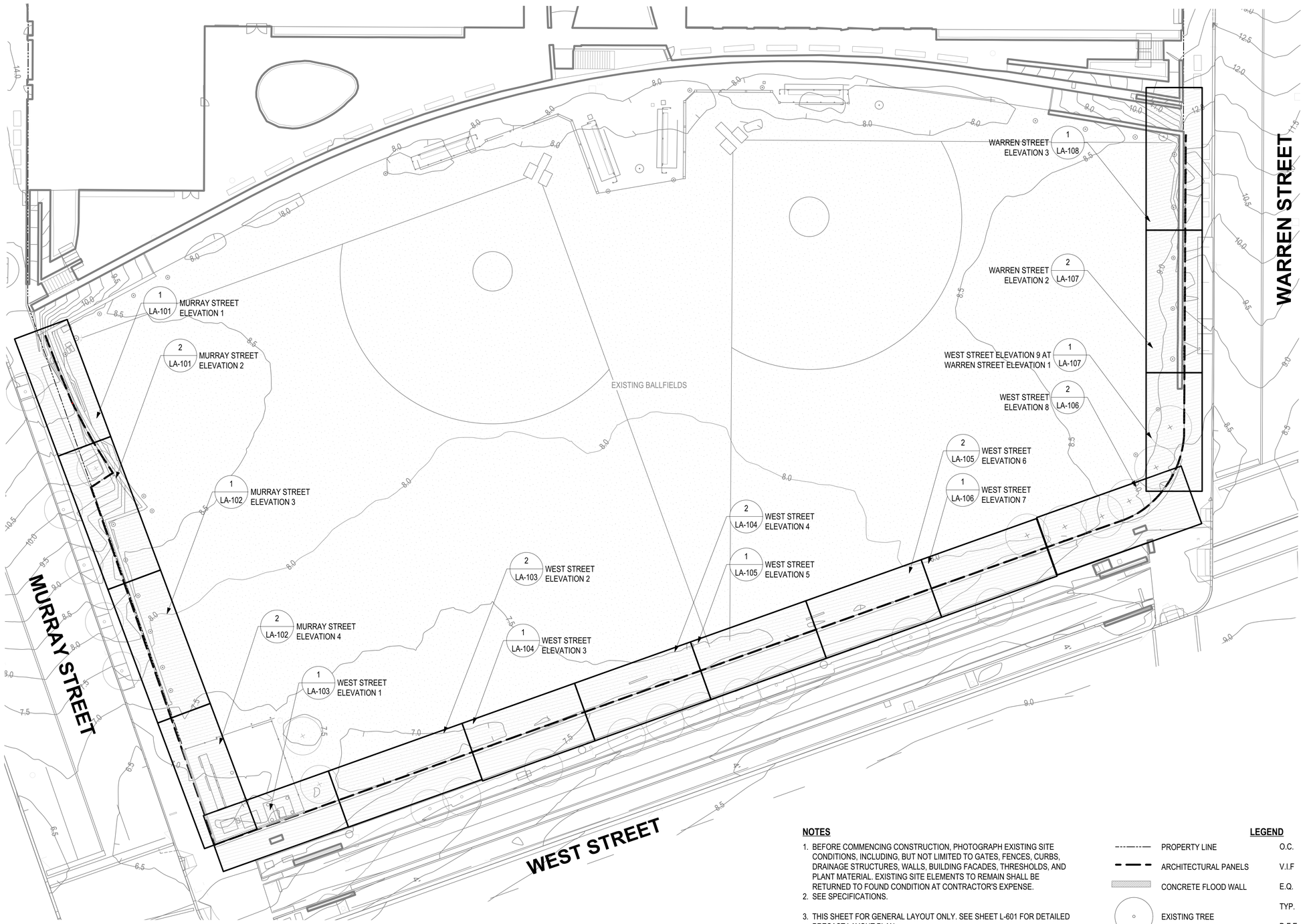
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EROSION AND SEDIMENT CONTROL DETAILS

C-502



1 LA-100 SITE PLAN
SCALE: 1" = 20'-0"

NOTES

1. BEFORE COMMENCING CONSTRUCTION, PHOTOGRAPH EXISTING SITE CONDITIONS, INCLUDING, BUT NOT LIMITED TO GATES, FENCES, CURBS, DRAINAGE STRUCTURES, WALLS, BUILDING FACADES, THRESHOLDS, AND PLANT MATERIAL. EXISTING SITE ELEMENTS TO REMAIN SHALL BE RETURNED TO FOUND CONDITION AT CONTRACTOR'S EXPENSE.
2. SEE SPECIFICATIONS.
3. THIS SHEET FOR GENERAL LAYOUT ONLY. SEE SHEET L-601 FOR DETAILED PRECAST LAYOUT PLAN.
4. NO CHANGE SHALL BE MADE TO THE DESIGN OR LAYOUT OF THIS PROJECT WITHOUT THE WRITTEN APPROVAL OF THE LANDSCAPE ARCHITECT.

LEGEND

	PROPERTY LINE	O.C.	ON CENTER
	ARCHITECTURAL PANELS	V.I.F	VERIFY IN FIELD
	CONCRETE FLOOD WALL	E.Q.	EQUAL
○	EXISTING TREE	TYP.	TYPICAL
		D.F.E.	DESIGN FLOOD ELEVATION
+	PROPOSED TREE	TW	TOP OF WALL

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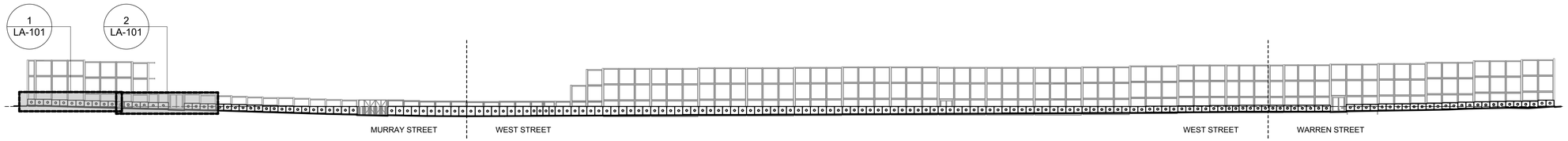
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SITE PLAN

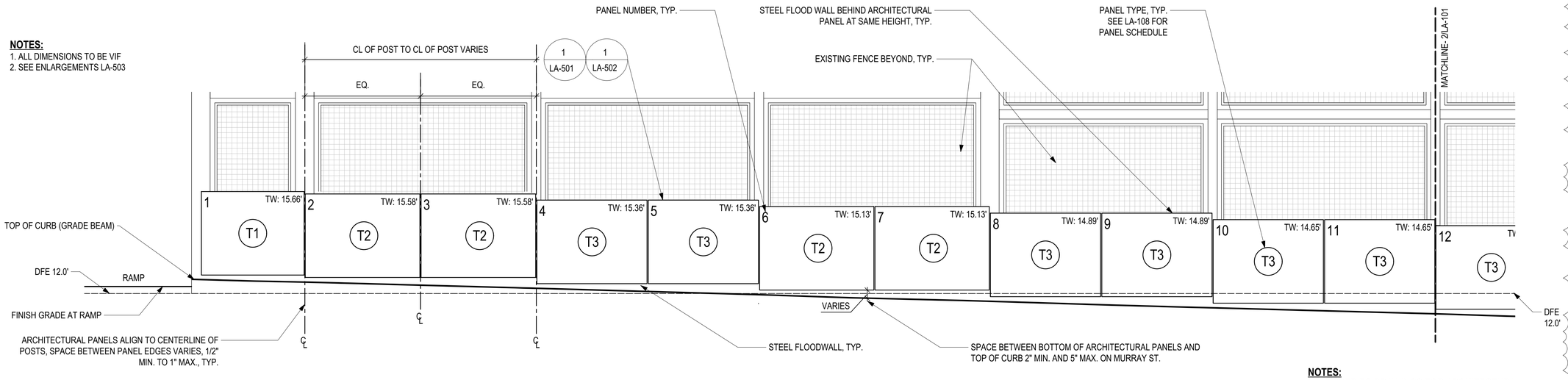
LA-100



ELEVATION KEY PLAN

SCALE: 1" = 30'-0"

NOTES:
1. ALL DIMENSIONS TO BE VIF
2. SEE ENLARGEMENTS LA-503

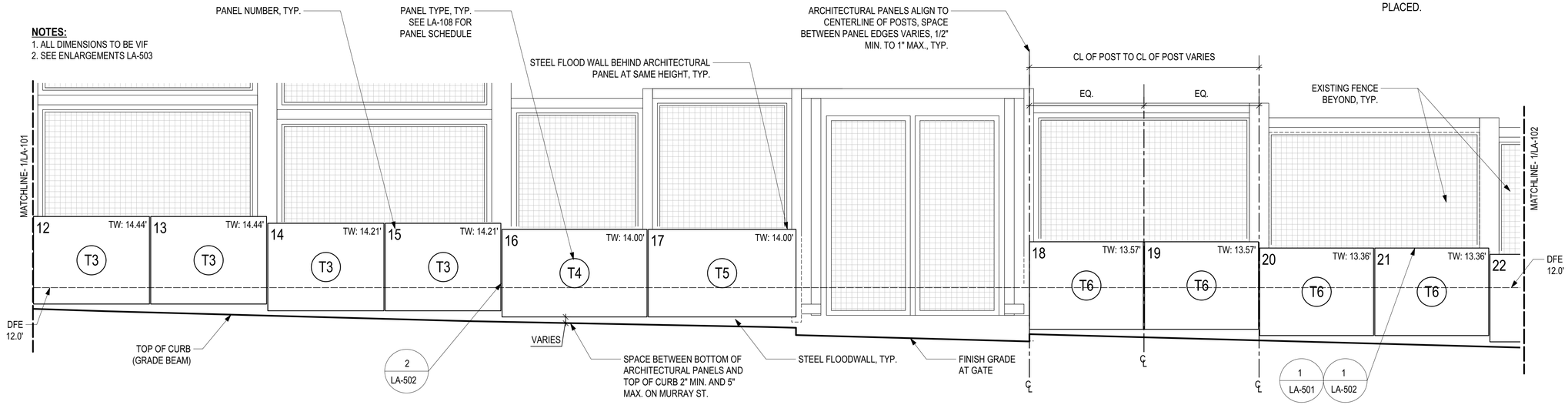


NOTES:
1. 'LA' SERIES DRAWINGS FOR ARCHITECTURAL PANELS ONLY. SEE 'S' SERIES FOR ALL STEEL FLOODWALL INFORMATION AND DETAILS.
2. TW ELEVATIONS ARE FOR BOTH STRUCTURAL STEEL AND ARCHITECTURAL PANELS.
3. TW ELEVATIONS ARE BASED ON CIVIL DRAWINGS, VIF ONCE STEEL FLOODWALLS ARE PLACED.

1 LA-101 MURRAY STREET ELEVATION 1

SCALE: 1/2" = 1'-0"

NOTES:
1. ALL DIMENSIONS TO BE VIF
2. SEE ENLARGEMENTS LA-503



2 LA-101 MURRAY STREET ELEVATION 2

SCALE: 1/2" = 1'-0"

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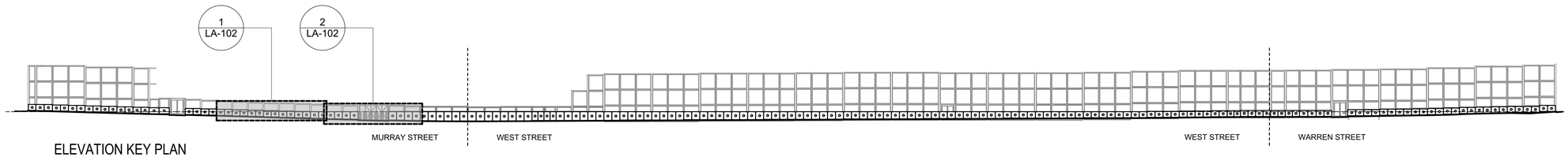
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SHEET TITLE

FENCE PANEL ELEVATIONS

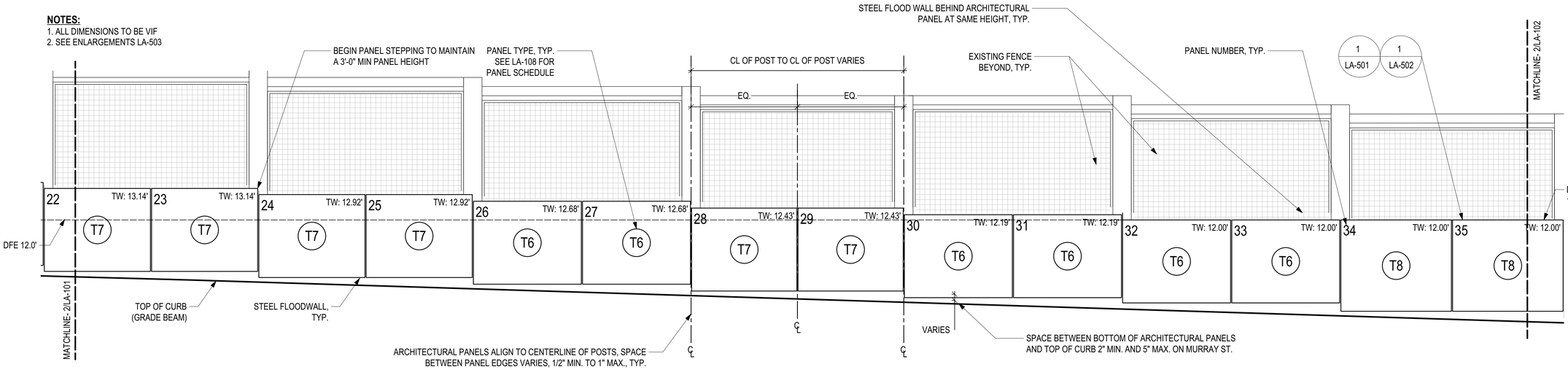
LA-101

1



ELEVATION KEY PLAN
SCALE: 1" = 30'-0"

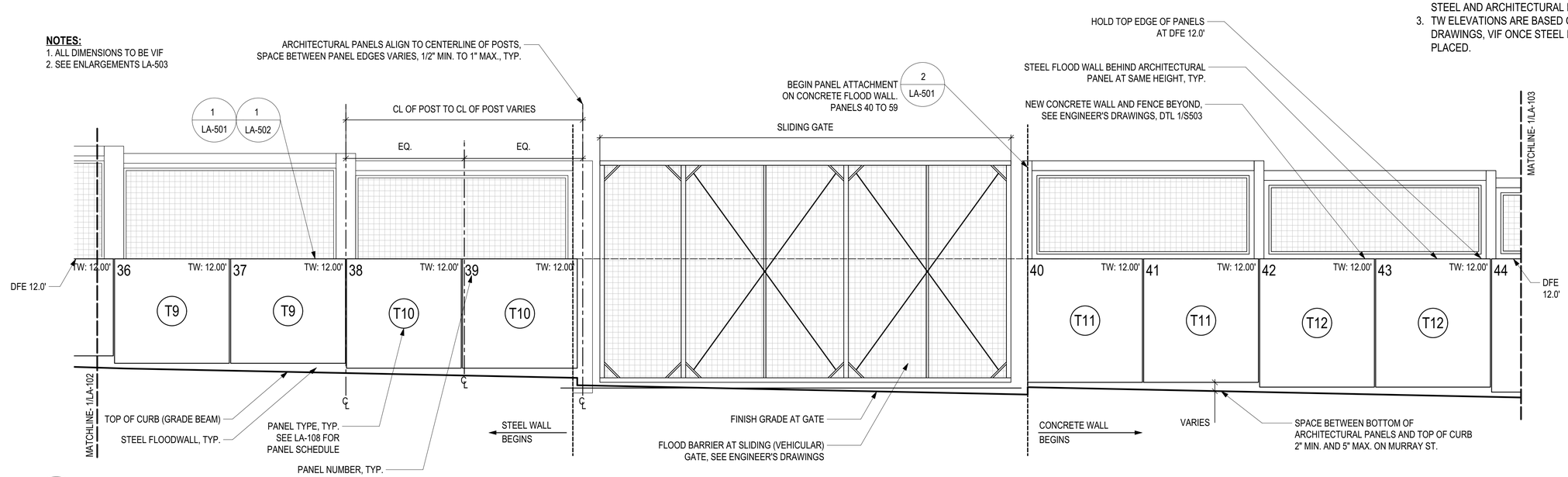
NOTES:
1. ALL DIMENSIONS TO BE VIF
2. SEE ENLARGEMENTS LA-503



1 LA-102 MURRAY STREET ELEVATION 3
SCALE: 1/2" = 1'-0"

NOTES:
1. 'LA' SERIES DRAWINGS FOR ARCHITECTURAL PANELS ONLY. SEE 'S' SERIES FOR ALL STEEL FLOODWALL INFORMATION AND DETAILS.
2. TW ELEVATIONS ARE FOR BOTH STRUCTURAL STEEL AND ARCHITECTURAL PANELS.
3. TW ELEVATIONS ARE BASED ON CIVIL DRAWINGS, VIF ONCE STEEL FLOODWALLS ARE PLACED.

NOTES:
1. ALL DIMENSIONS TO BE VIF
2. SEE ENLARGEMENTS LA-503



2 LA-102 MURRAY STREET ELEVATION 4
SCALE: 1/2" = 1'-0"

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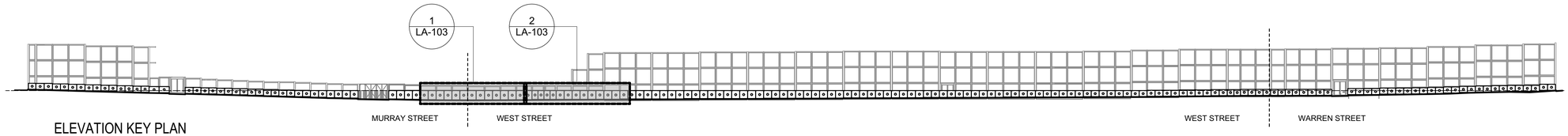
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FENCE PANEL ELEVATIONS

LA-102

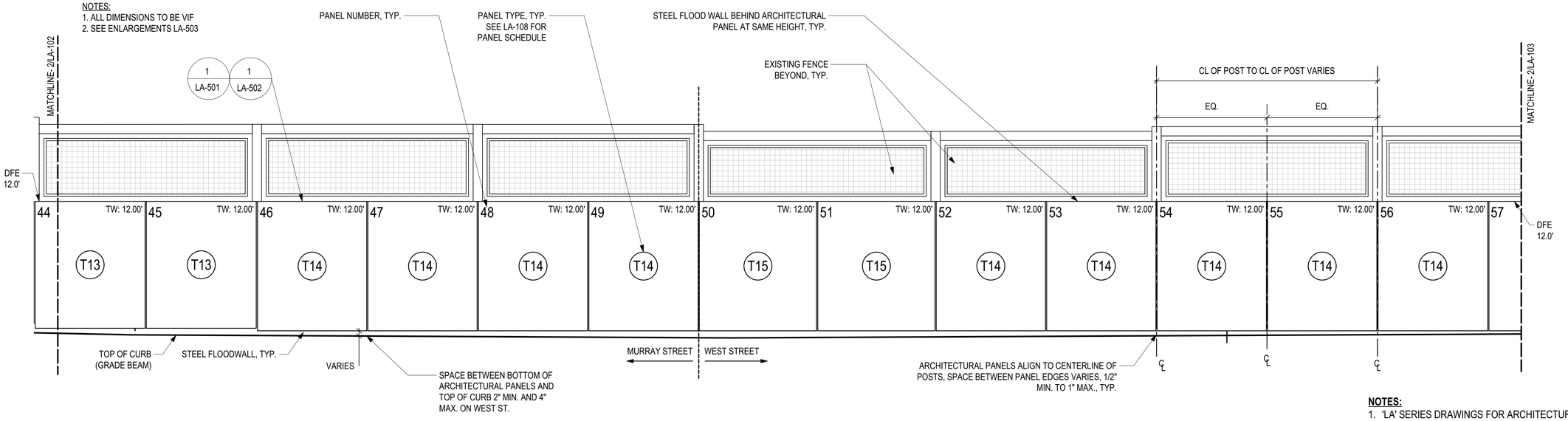
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ELEVATION KEY PLAN

SCALE: 1" = 30'-0"

NOTES:
1. ALL DIMENSIONS TO BE VIF
2. SEE ENLARGEMENTS LA-503

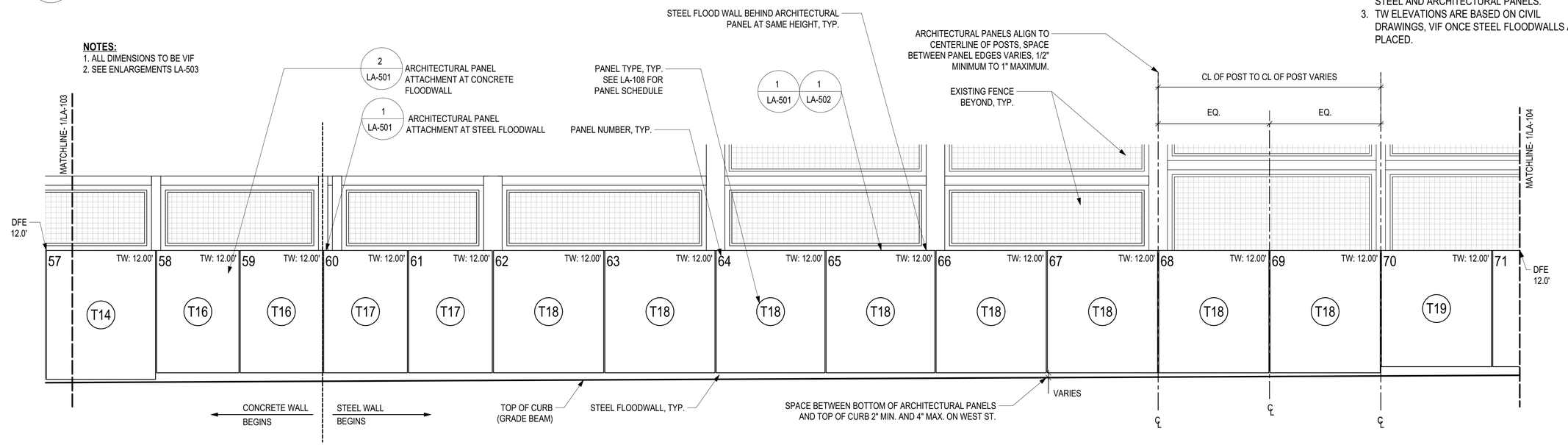


1 LA-103 WEST STREET ELEVATION 1

SCALE: 1/2" = 1'-0"

NOTES:
1. 'LA' SERIES DRAWINGS FOR ARCHITECTURAL PANELS ONLY. SEE 'S' SERIES FOR ALL STEEL FLOODWALL INFORMATION AND DETAILS.
2. TW ELEVATIONS ARE FOR BOTH STRUCTURAL STEEL AND ARCHITECTURAL PANELS.
3. TW ELEVATIONS ARE BASED ON CIVIL DRAWINGS, VIF ONCE STEEL FLOODWALLS ARE PLACED.

NOTES:
1. ALL DIMENSIONS TO BE VIF
2. SEE ENLARGEMENTS LA-503



2 LA-103 WEST STREET ELEVATION 2

SCALE: 1/2" = 1'-0"

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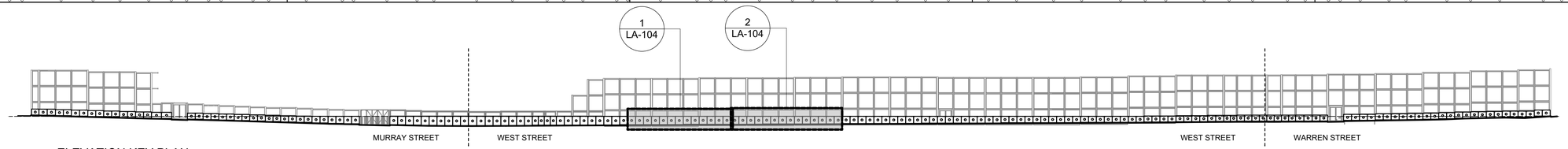
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FENCE PANEL ELEVATIONS

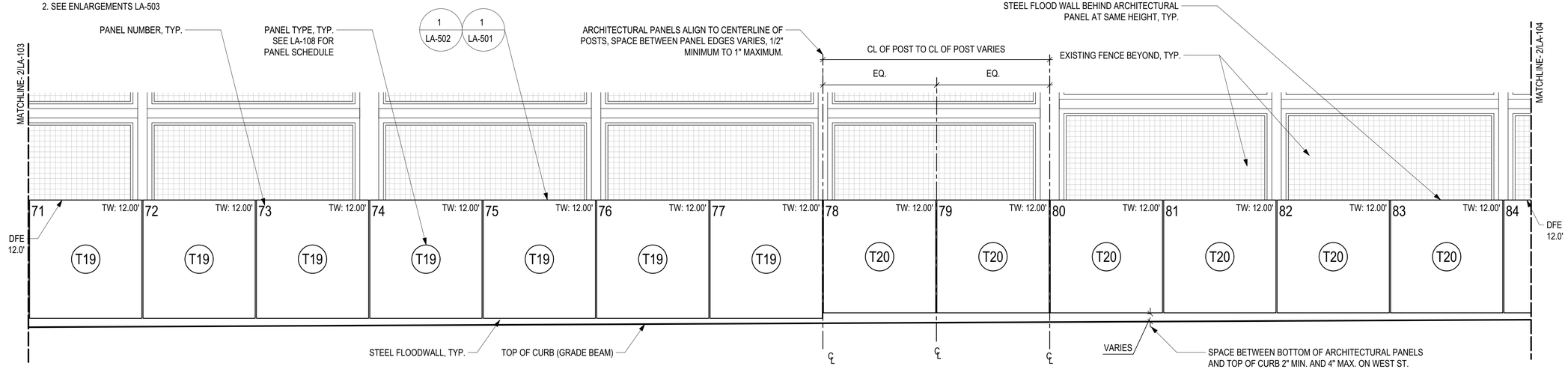
LA-103



ELEVATION KEY PLAN

SCALE: 1" = 30'-0"

NOTES:
1. ALL DIMENSIONS TO BE VIF
2. SEE ENLARGEMENTS LA-503

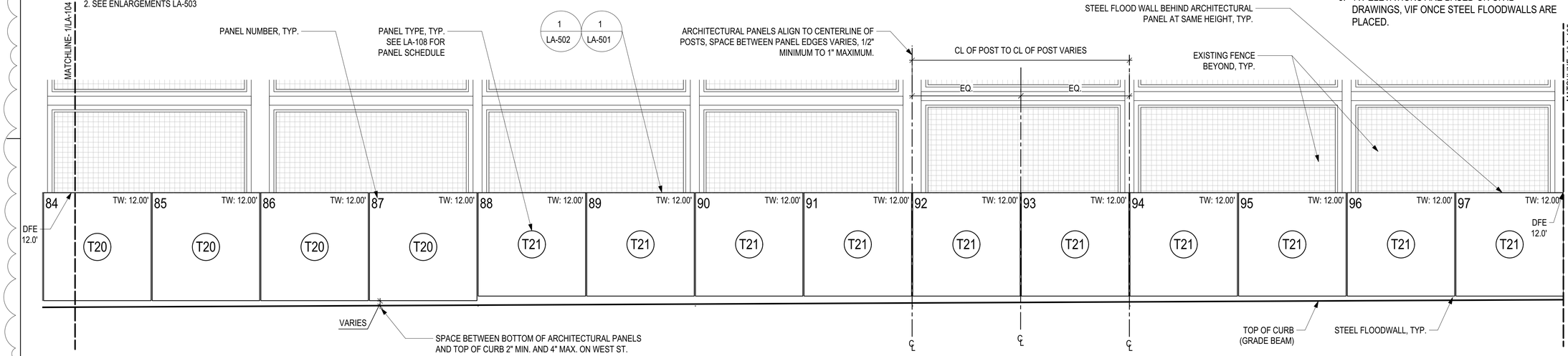


1 LA-104 WEST STREET ELEVATION 3

SCALE: 1/2" = 1'-0"

NOTES:
1. 'LA' SERIES DRAWINGS FOR ARCHITECTURAL PANELS ONLY. SEE 'S' SERIES FOR ALL STEEL FLOODWALL INFORMATION AND DETAILS.
2. TW ELEVATIONS ARE FOR BOTH STRUCTURAL STEEL AND ARCHITECTURAL PANELS.
3. TW ELEVATIONS ARE BASED ON CIVIL DRAWINGS, VIF ONCE STEEL FLOODWALLS ARE PLACED.

NOTES:
1. ALL DIMENSIONS TO BE VIF
2. SEE ENLARGEMENTS LA-503



2 LA-104 WEST STREET ELEVATION 4

SCALE: 1/2" = 1'-0"

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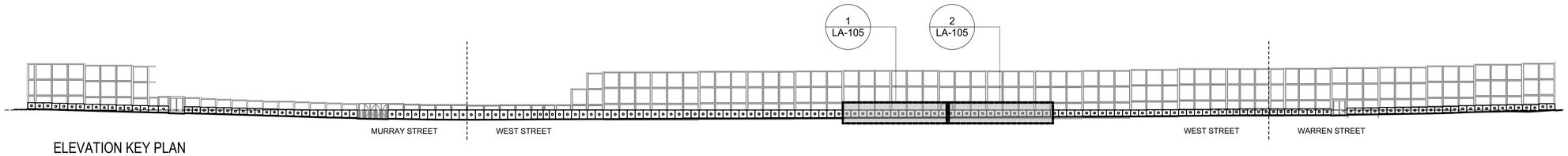
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FENCE PANEL ELEVATIONS

LA-104

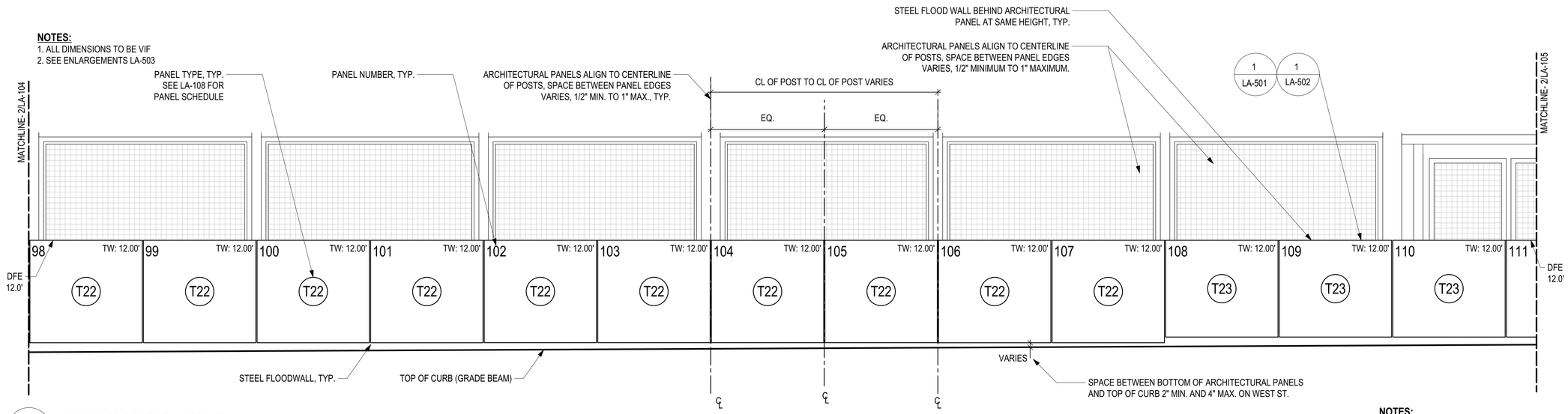
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ELEVATION KEY PLAN

SCALE: 1" = 30'-0"

NOTES:
1. ALL DIMENSIONS TO BE VIF
2. SEE ENLARGEMENTS LA-503

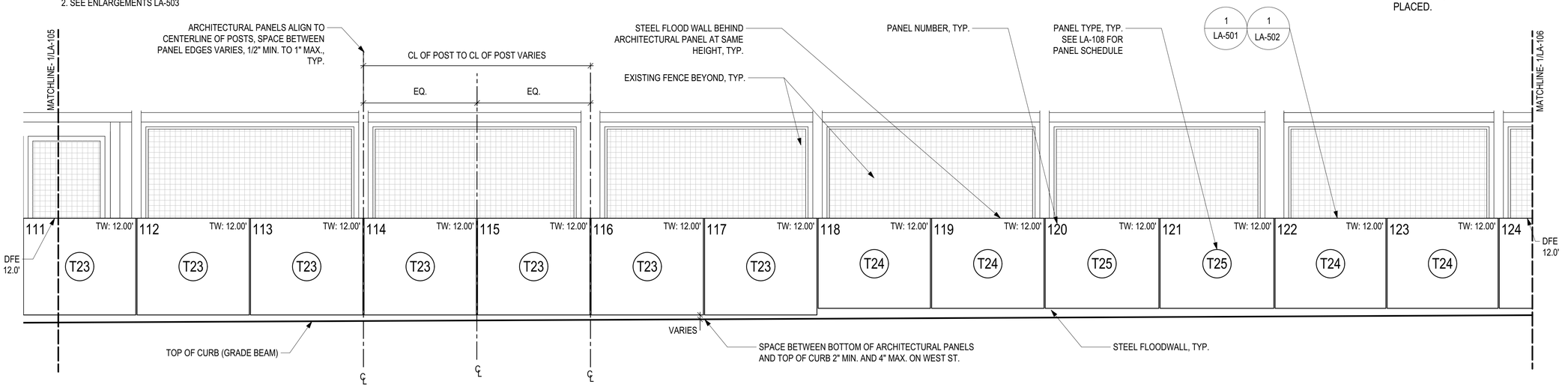


1 LA-105 WEST STREET ELEVATION 5

SCALE: 1/2" = 1'-0"

NOTES:
1. 'LA' SERIES DRAWINGS FOR ARCHITECTURAL PANELS ONLY. SEE 'S' SERIES FOR ALL STEEL FLOODWALL INFORMATION AND DETAILS.
2. TW ELEVATIONS ARE FOR BOTH STRUCTURAL STEEL AND ARCHITECTURAL PANELS.
3. TW ELEVATIONS ARE BASED ON CIVIL DRAWINGS, VIF ONCE STEEL FLOODWALLS ARE PLACED.

NOTES:
1. ALL DIMENSIONS TO BE VIF
2. SEE ENLARGEMENTS LA-503



2 LA-105 WEST STREET ELEVATION 6

SCALE: 1/2" = 1'-0"

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PROJECT IDENTIFICATION

NEW YORK STATE OF OPPORTUNITY. Battery Park City Authority

BATTERY PARK CITY BALLFIELD AND COMMUNITY CENTER

MARK	DATE	DESCRIPTION	BY
1	11/15/19	100% SUBMISSION	AW
A	11/01/19	ISSUED FOR BID - 95%	AW

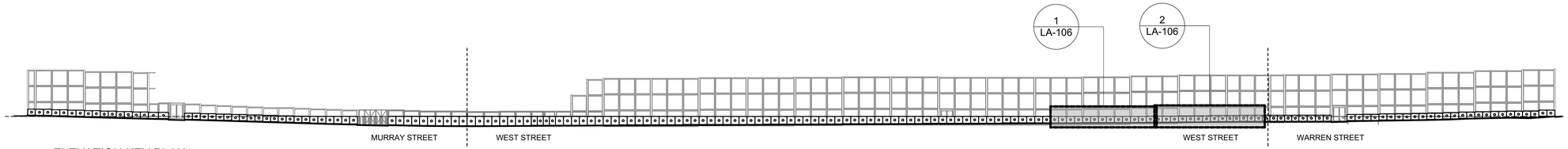
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FENCE PANEL ELEVATIONS

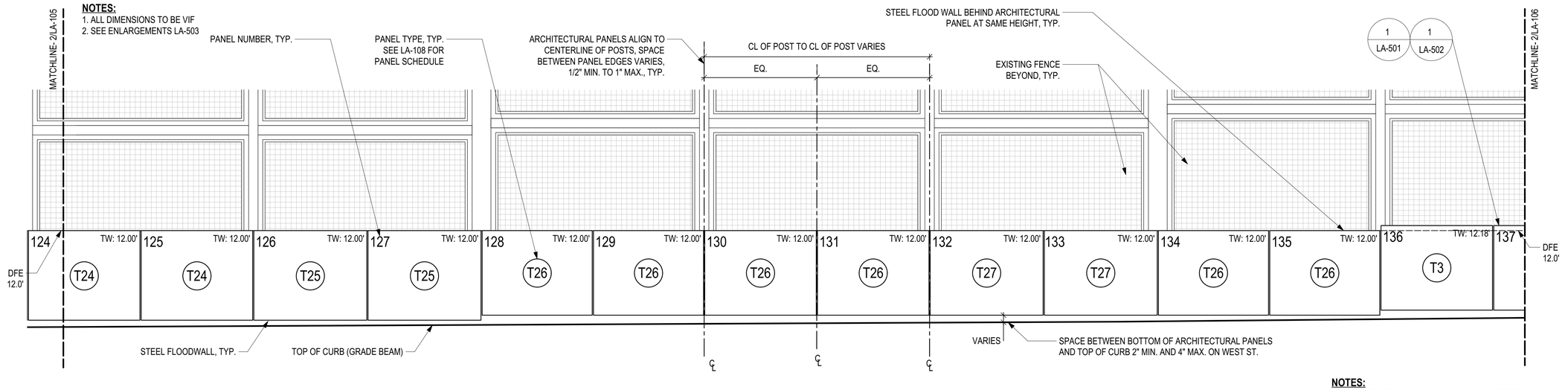
LA-105



ELEVATION KEY PLAN

SCALE: 1" = 30'-0"

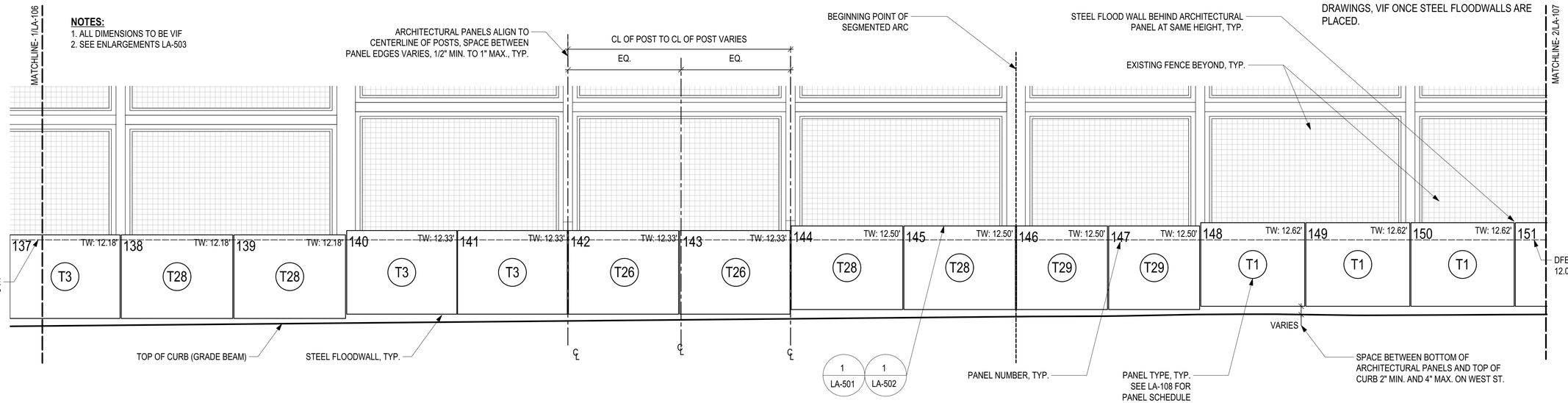
NOTES:
1. ALL DIMENSIONS TO BE VIF
2. SEE ENLARGEMENTS LA-503



1 LA-106 WEST STREET ELEVATION 7

SCALE: 1/2" = 1'-0"

NOTES:
1. ALL DIMENSIONS TO BE VIF
2. SEE ENLARGEMENTS LA-503



2 LA-106 WEST STREET ELEVATION 8

SCALE: 1/2" = 1'-0"

NOTES:
1. 'LA' SERIES DRAWINGS FOR ARCHITECTURAL PANELS ONLY. SEE 'S' SERIES FOR ALL STEEL FLOODWALL INFORMATION AND DETAILS.
2. TW ELEVATIONS ARE FOR BOTH STRUCTURAL STEEL AND ARCHITECTURAL PANELS.
3. TW ELEVATIONS ARE BASED ON CIVIL DRAWINGS, VIF ONCE STEEL FLOODWALLS ARE PLACED.

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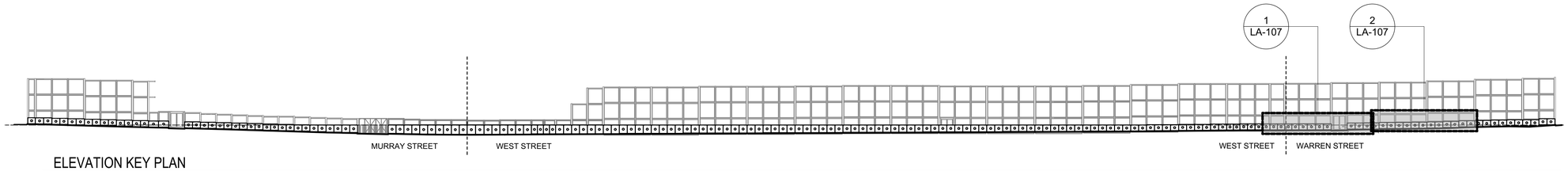
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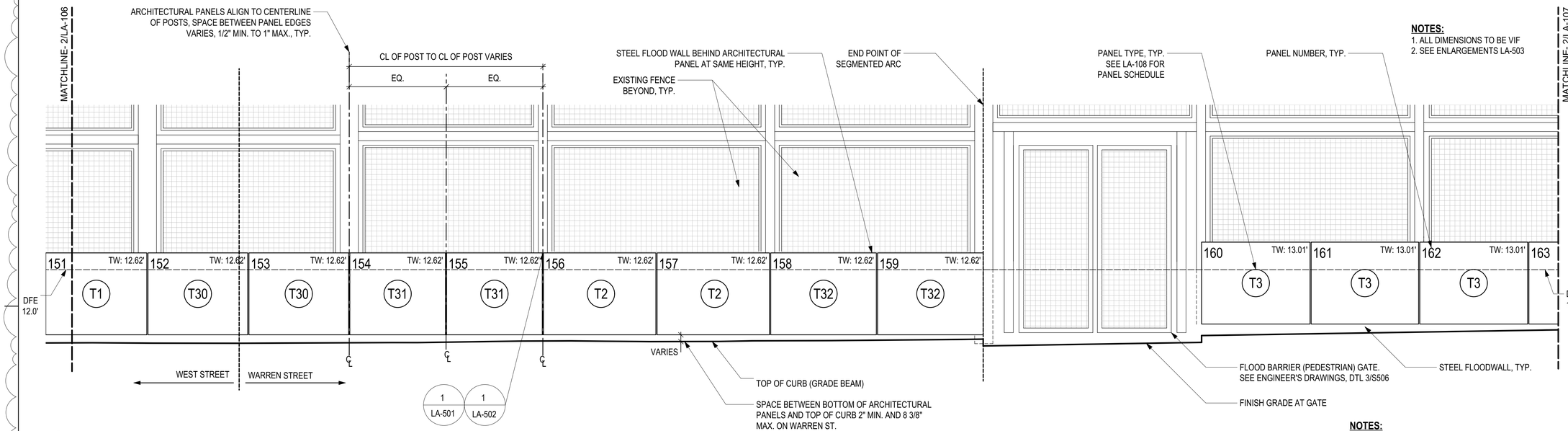
SHEET TITLE

FENCE PANEL ELEVATIONS

LA-106



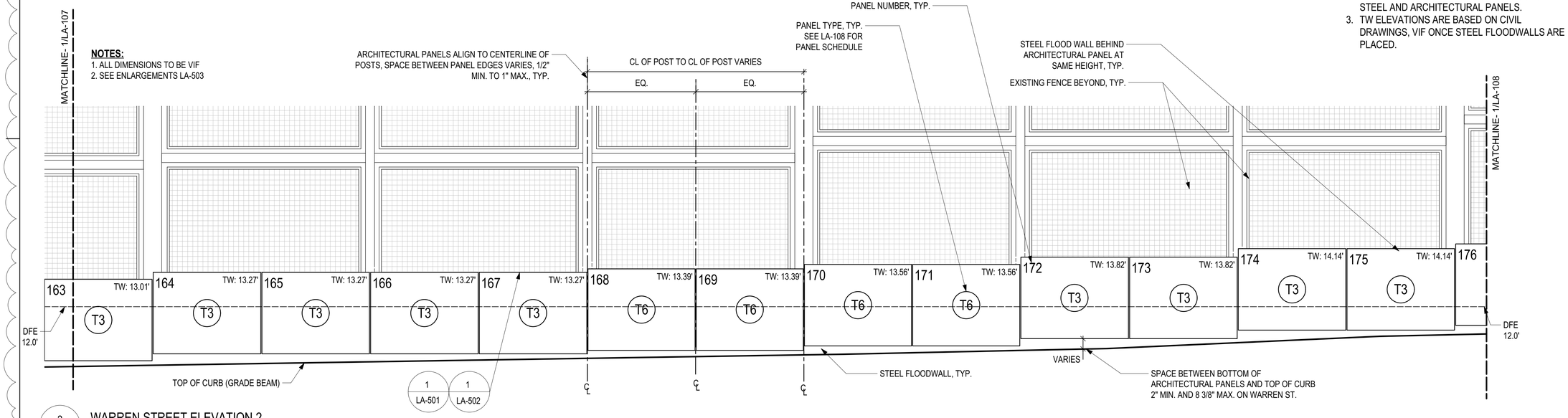
ELEVATION KEY PLAN
SCALE: 1" = 30'-0"



NOTES:
1. ALL DIMENSIONS TO BE VIF
2. SEE ENLARGEMENTS LA-503

NOTES:
1. 'LA' SERIES DRAWINGS FOR ARCHITECTURAL PANELS ONLY. SEE 'S' SERIES FOR ALL STEEL FLOODWALL INFORMATION AND DETAILS.
2. TW ELEVATIONS ARE FOR BOTH STRUCTURAL STEEL AND ARCHITECTURAL PANELS.
3. TW ELEVATIONS ARE BASED ON CIVIL DRAWINGS, VIF ONCE STEEL FLOODWALLS ARE PLACED.

1/LA-107 WEST STREET 9 AT WARREN STREET ELEVATION 1
SCALE: 1/2" = 1'-0"



2/LA-107 WARREN STREET ELEVATION 2
SCALE: 1/2" = 1'-0"

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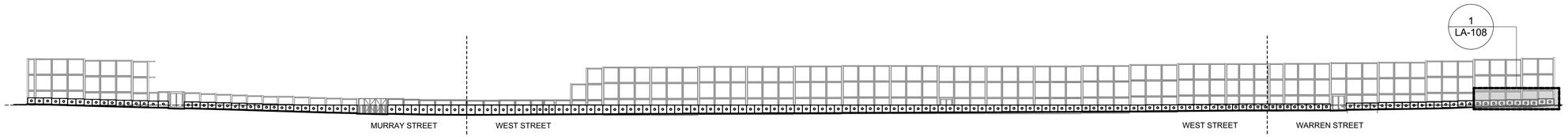
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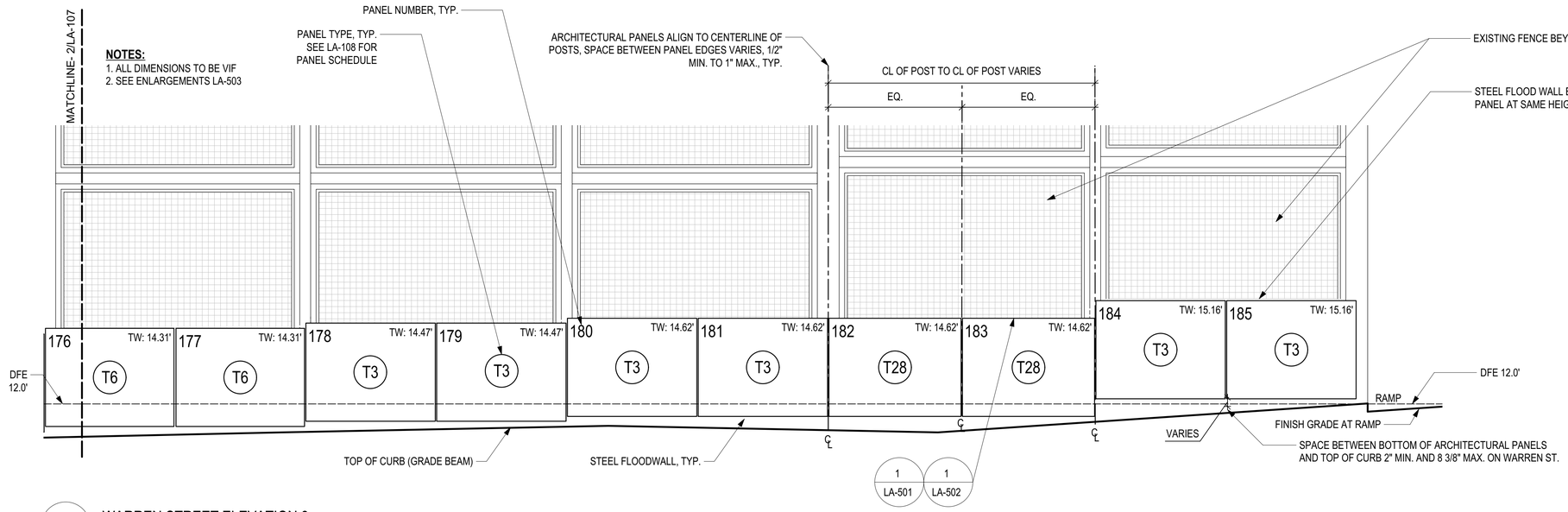
FENCE PANEL ELEVATIONS

LA-107



ELEVATION KEY PLAN

SCALE: 1" = 30'-0"



1 LA-108 WARREN STREET ELEVATION 3

SCALE: 1/2" = 1'-0"

NOTES:

1. 'LA' SERIES DRAWINGS FOR ARCHITECTURAL PANELS ONLY. SEE 'S' SERIES FOR ALL STEEL FLOODWALL INFORMATION AND DETAILS.
2. TW ELEVATIONS ARE FOR BOTH STRUCTURAL STEEL AND ARCHITECTURAL PANELS.
3. TW ELEVATIONS ARE BASED ON CIVIL DRAWINGS, VIF ONCE STEEL FLOODWALLS ARE PLACED.
4. ALL DIMENSIONS IN ARCHITECTURAL PANEL SCHEDULE TO BE VIF.

ARCHITECTURAL PANEL SCHEDULE

PANEL TYPE	QUANTITY	WIDTH	HEIGHT	THICKNESS
T1	5	3'8 1/4"	3'0"	1/4"
T2	6	4'1 1/4"	3'0"	1/4"
T3	32	3'11 3/8"	3'0"	1/4"
T4	1	4'11 3/4"	3'0"	1/4"
T5	1	5'0 7/8"	3'0"	1/4"
T6	16	3'10 3/4"	3'0"	1/4"
T7	6	3'9 5/8"	3'0"	1/4"
T8	2	4'0"	3'3 5/8"	1/4"
T9	2	3'10 7/8"	3'6 5/8"	1/4"
T10	2	3'10 7/8"	3'8 5/8"	1/4"
T11	2	3'10 7/8"	4'2 1/2"	1/4"
T12	2	3'10 7/8"	4'4 3/8"	1/4"
T13	2	3'11 1/4"	4'6 3/8"	1/4"
T14	10	3'10 7/8"	4'7 1/2"	1/4"
T15	2	4'2 3/8"	4'7 1/2"	1/4"
T16	2	2'11 1/2"	4'4 3/4"	1/4"

PANEL TYPE	QUANTITY	WIDTH	HEIGHT	THICKNESS
T17	2	3'0 1/8"	4'4 3/4"	1/4"
T18	8	3'10 7/8"	4'4 3/4"	1/4"
T19	8	3'11 1/2"	4'2"	1/4"
T20	10	3'11 1/2"	3'11 3/4"	1/4"
T21	10	3'11 1/2"	3'9 3/4"	1/4"
T22	10	3'11 1/2"	3'7 3/8"	1/4"
T23	10	3'11 1/2"	3'5"	1/4"
T24	6	3'10 7/8"	3'2 1/8"	1/4"
T25	4	4'0 1/8"	3'2 1/8"	1/4"
T26	8	3'10 7/8"	3'0"	1/4"
T27	2	4'0 1/8"	3'0"	1/4"
T28	6	4'0"	3'0"	1/4"
T29	2	3'3 1/4"	3'0"	1/4"
T30	2	3'7 7/8"	3'0"	1/4"
T31	2	3'6 1/8"	3'0"	1/4"
T32	2	3'10 1/2"	3'0"	1/4"
TOTAL	185			

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BALLFIELD AND COMMUNITY
CENTER

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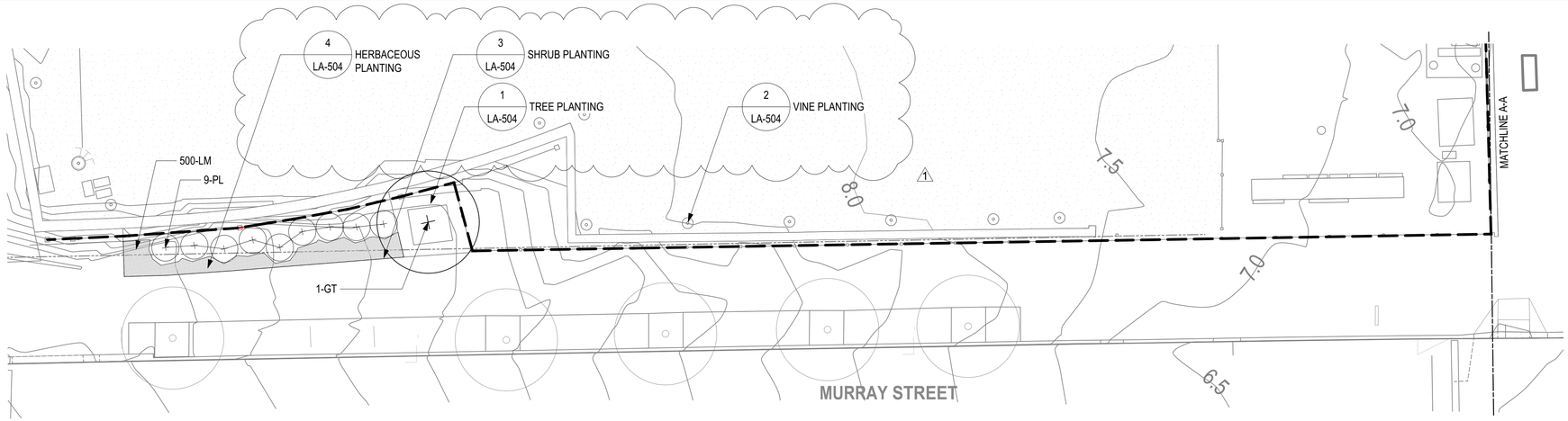
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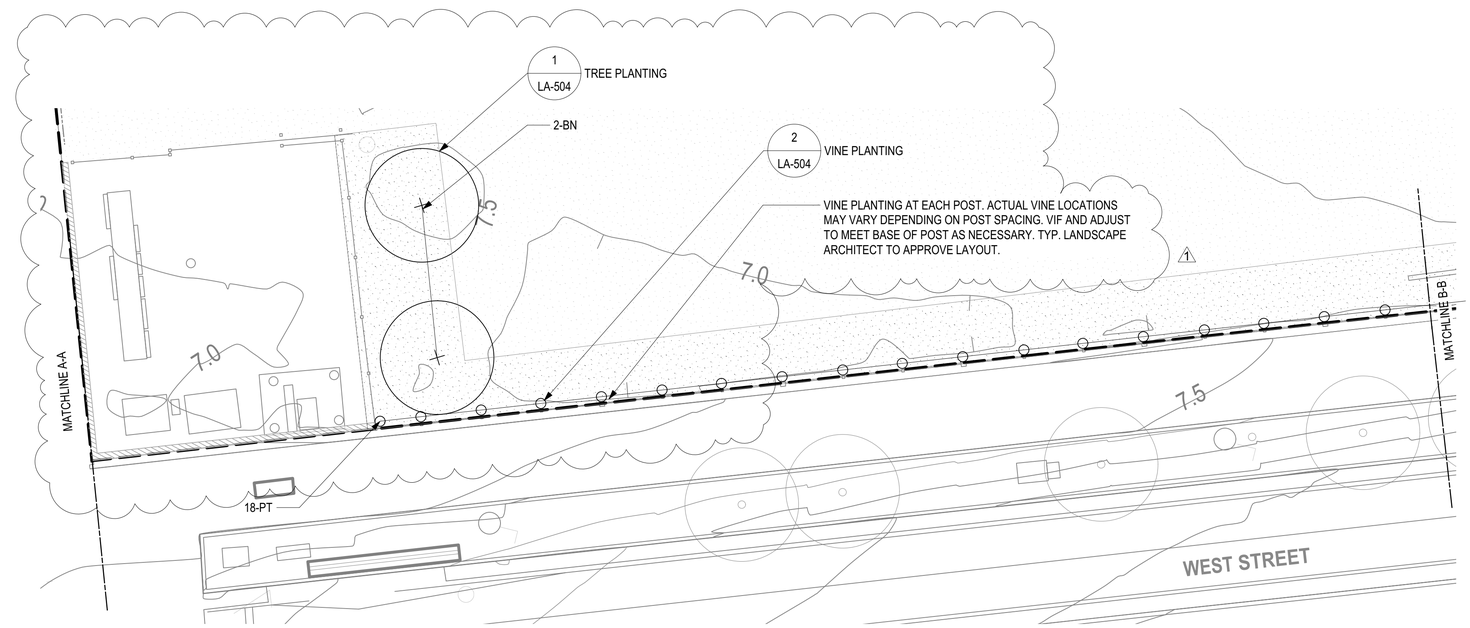
FENCE PANEL ELEVATION

LA-108

1



1 LA-109 PLANTING PLAN - MURRAY STREET
SCALE: 1" = 10'-0"



2 LA-109 PLANTING PLAN - WEST STREET
SCALE: 1" = 10'-0"

Plant Schedule

ID	Qty	Latin Name	Common Name	Scheduled Size	Remarks
BN	2	Betula nigra 'Heritage	Heritage River Birch	4"-4.5" Cal.	Multi-stem/clump (3)
GT	1	Gleditisa tricanthos 'Shademaster'	Honey Locust	4"-4.5" Cal.	
PT	18	Parthenocissus tricuspidata	Boston Ivy	1 gal.	
PL	9	Prunus laurocerasus 'Otto Luyken'	Cherry Laurel	3 gal.	
LM	500	Liriope muscari 'Variegata'	Varigated Lilly Turf	plugs	Spaced 6" O.C.

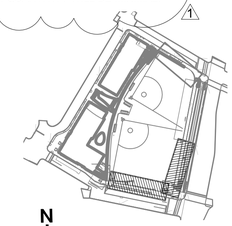
LEGEND

- PROPERTY LINE
- ARCHITECTURAL PANELS
- CONCRETE WALL
- EXISTING TREE
- PROPOSED TREE
- PROPOSED SHRUB
- PROPOSED GROUNDCOVER
- EXISTING PLANTING AREA
- EXISTING TURF FIELD

OC.	ON CENTER
VIF.	VERIFY IN FIELD
EQ.	EQUAL
TYP.	TYPICAL

PLANTING NOTES

1. DISCREPANCIES BETWEEN ACTUAL FIELD CONDITIONS AND THOSE SHOWN ON THE PLANS ARE TO BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE LANDSCAPE ARCHITECT. WORK SHALL NOT PROCEED UNTIL THE DISCREPANCY IS RESOLVED AND WRITTEN APPROVAL FROM THE LANDSCAPE ARCHITECT IS OBTAINED.
2. NOTIFY THE LANDSCAPE ARCHITECT, IN WRITING, OF DRAINAGE CONDITIONS DETRIMENTAL TO THE GROWTH OF PLANTS, PRIOR TO PLANTING.
3. PLANTS SHALL BE FRESHLY DUG; NEITHER HEELED-IN PLANTS NOR PLANTS FROM COLD STORAGE WILL BE ACCEPTED.
4. PLANTS SHALL BE SUBJECT TO INSPECTION AND APPROVAL BY THE LANDSCAPE ARCHITECT. THE LANDSCAPE ARCHITECT RESERVES THE RIGHT TO REJECT UNACCEPTABLE PLANT MATERIAL ON OR AFTER DELIVERY TO THE SITE.
5. TOPSOIL SHALL BE FREE OF SOIL-BORNE DISEASE AND PESTS, AS WELL AS WEED SEEDS.
6. PLANTING SHALL BE MULCHED AS PER SPEC IMMEDIATELY AFTER PLANTING. MULCH SHALL BE FREE OF INJURIOUS SUBSTANCE AND DEBRIS. MULCH SHALL BE SPREAD TO THE DEPTHS INDICATED ON THE DRAWINGS.
7. PLANTS SHALL BE IN ACCORDANCE WITH ANSI Z60.1 (LATEST ADDITION) FOR THE SIZES AND SPECIES INDICATED.
8. BEFORE COMMENCING CONSTRUCTION, CONTRACTOR SHALL FIELD VERIFY DIMENSIONS AND CONDITIONS OF THE SITE.
9. LANDSCAPE ARCHITECT SHALL APPROVE FINAL LAYOUT PRIOR TO PLANTING. PROVIDE 72 HOURS NOTICE OF ARRIVAL OF PLANT MATERIAL TO SITE.
10. SOIL SUPPLEMENTATION MAY OCCUR WHERE NEW PLANTS ARE PLANTED. QUANTITITY WILL BE MINIMAL.



KEY PLAN
NOT TO SCALE

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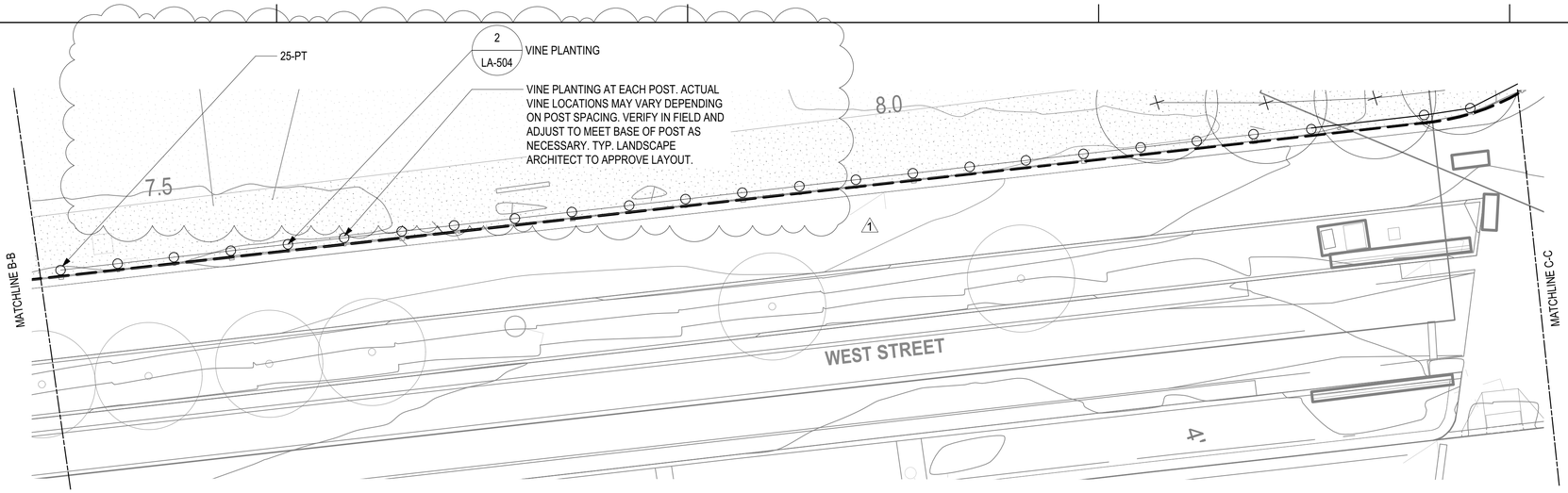
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PLANTING PLAN 1

LA-109

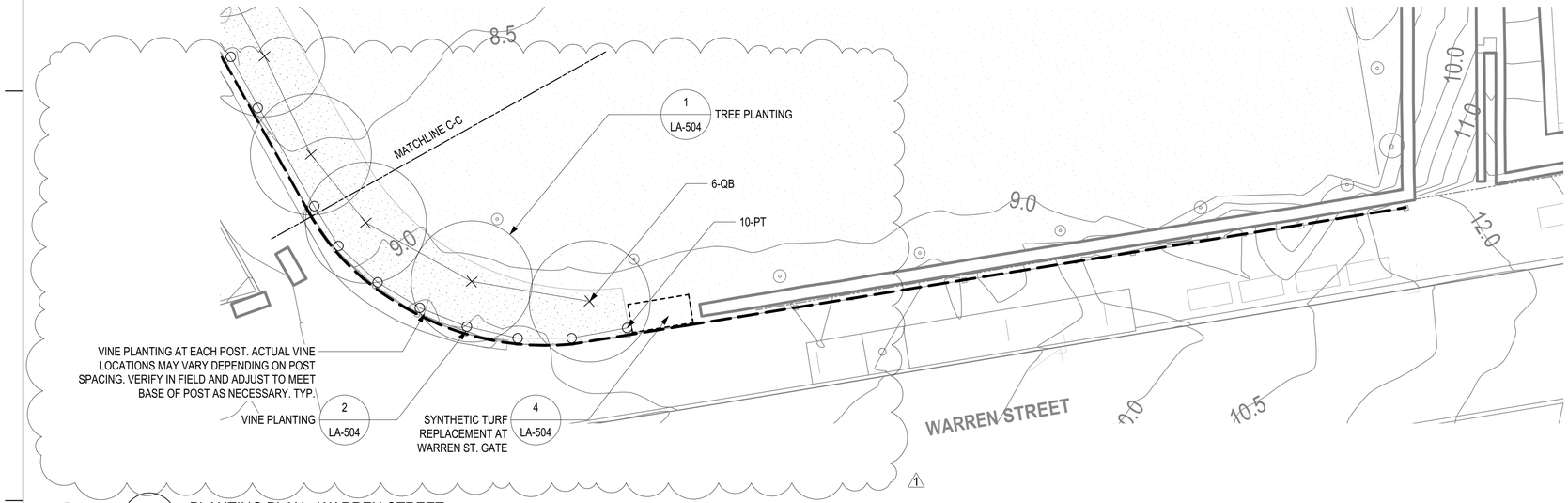


N

1
LA-110

PLANTING PLAN - WEST STREET

SCALE: 1" = 10'-0"



N

2
LA-110

PLANTING PLAN - WARREN STREET

SCALE: 1" = 10'-0"

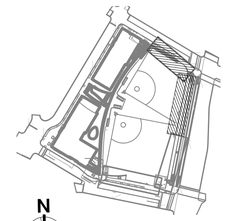
Plant Schedule

ID	Qty	Latin Name	Common Name	Scheduled Size	Remarks
QB	6	Quercus bicolor	Swamp Oak	4"-4.5" Cal.	
PT	35	Parthenocissus tricuspidata	Boston Ivy	1 gal.	

LEGEND

- PROPERTY LINE
- ARCHITECTURAL PANELS
- CONCRETE WALL
- EXISTING TREE
- PROPOSED TREE
- PROPOSED SHRUB
- PROPOSED GROUNDCOVER
- EXISTING PLANTING AREA
- EXISTING TURF FIELD

OC.	ON CENTER
VIF.	VERIFY IN FIELD
EQ.	EQUAL
TYP.	TYPICAL



KEY PLAN
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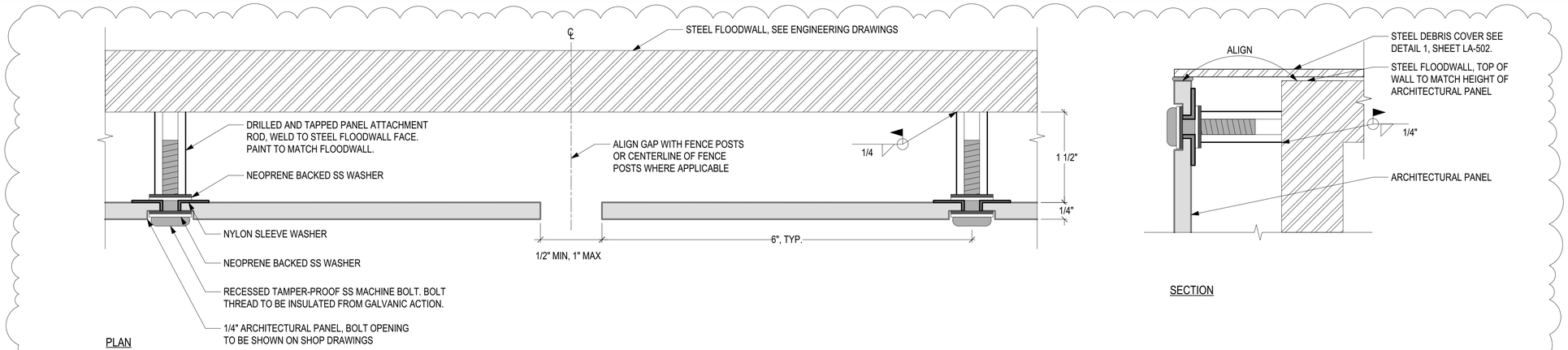
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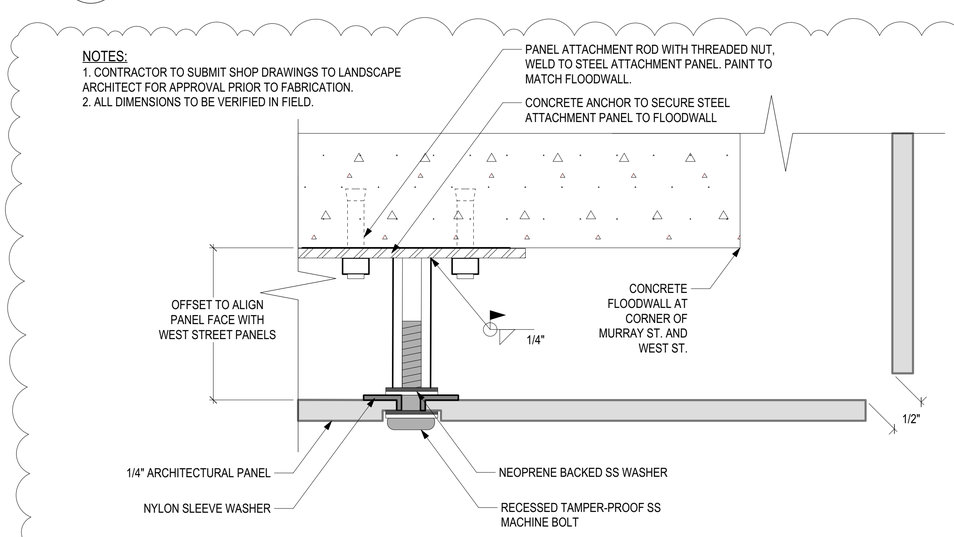
PLANTING
PLAN 2

LA-110



1 LA-501 ARCHITECTURAL PANEL ATTACHMENT TO STEEL FLOOD WALL
SCALE: 1:1

NOTES:
1. TOP HEIGHT OF STEEL FLOODWALL TO MATCH TOP HEIGHT OF ARCHITECTURAL PANEL.
2. PANEL ATTACHMENT ROD TO SIT 1.5" FROM STEEL FLOODWALL TO ALLOW CLEARANCE FOR STEEL FLOODWALL ATTACHMENT HARDWARE. SEE ENGINEERING DRAWINGS.
3. ARCHITECTURAL PANEL PATTERN TO BE 'STIX' BY ANOVA. CONTACT DAVID TRAPHAGEN AT ANOVA FOR MORE INFORMATION (312) 405-1773.
3. CONTRACTOR TO SUBMIT SHOP DRAWINGS TO LANDSCAPE ARCHITECT FOR APPROVAL PRIOR TO FABRICATION.
4. ALL DIMENSIONS TO BE VERIFIED IN FIELD.



2 LA-501 ARCHITECTURAL PANEL ATTACHMENT TO CONCRETE FLOOD WALL AT MURRAY STREET AND WEST STREET CORNER
SCALE: 1:1

NOTE:
'LA' SERIES DRAWINGS FOR ARCHITECTURAL PANELS ONLY. SEE 'S' SERIES FOR ALL STEEL FLOODWALL INFORMATION AND DETAILS.

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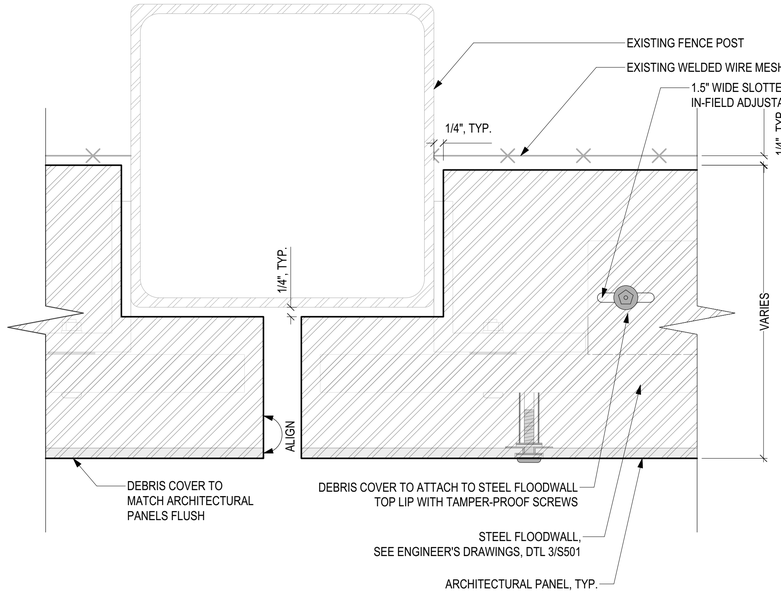
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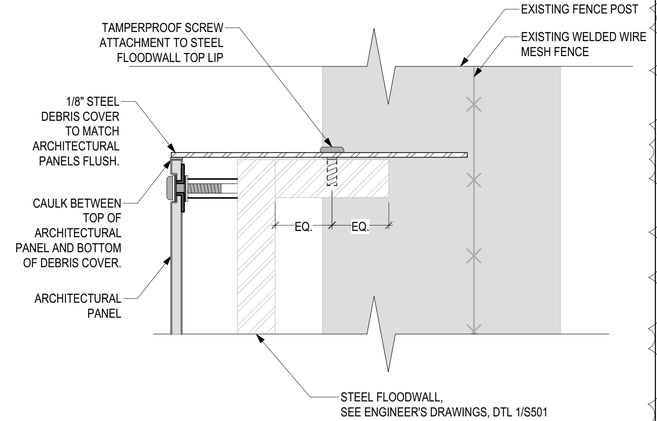
ARCHITECTURAL PANEL DETAILS- A

LA-501

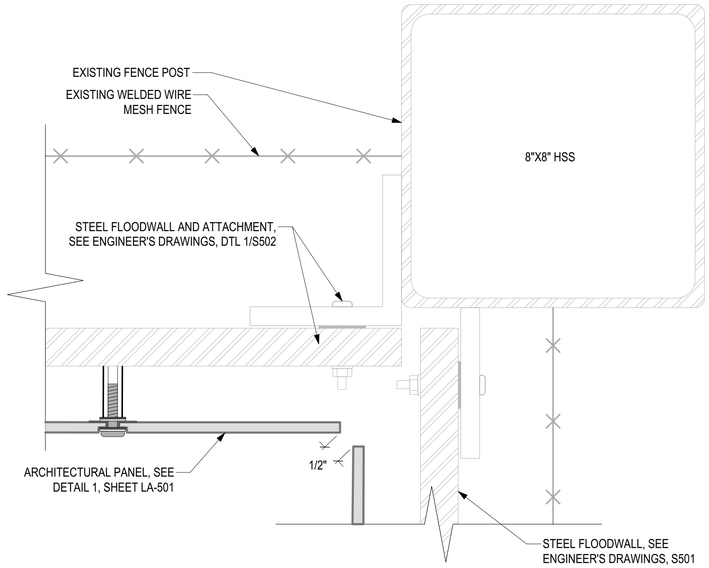
NOTE:
'LA' SERIES DRAWINGS FOR ARCHITECTURAL PANELS ONLY. SEE 'S' SERIES FOR ALL STEEL FLOODWALL INFORMATION AND DETAILS.



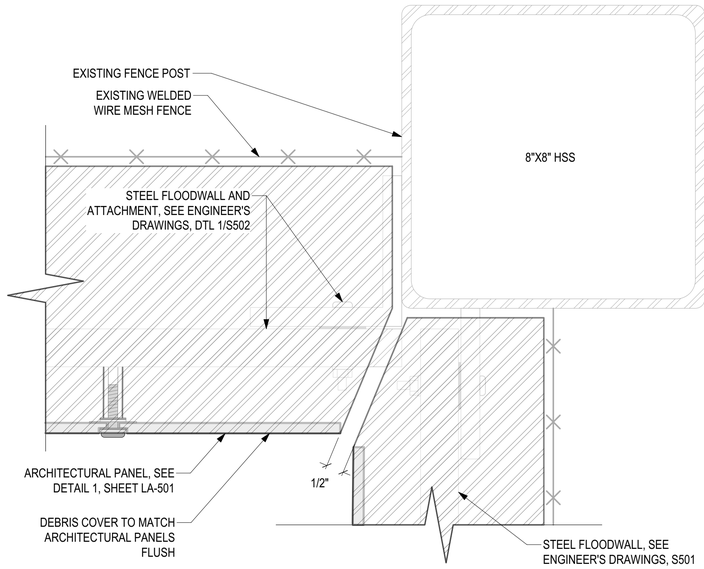
PLAN



SECTION

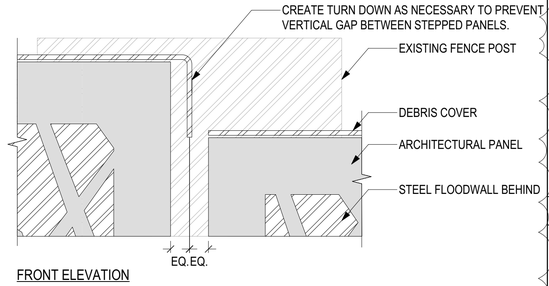


2 LA-502 ARCHITECTURAL PANEL ATTACHMENT AT INTERIOR CORNER
SCALE: 1:2



PLAN AT CORNER

1 LA-502 DEBRIS COVER ATTACHMENT
SCALE: 1:2



FRONT ELEVATION

NOTES:
1. DEBRIS COVER SCREWS TO BE EQUALLY SPACED EVERY 12", MIN.
2. DEBRIS COVER TO MAINTAIN 1/4" GAP BETWEEN FACES OF FENCE POSTS AND WELDED WIRE MESH FENCE.
3. ALIGN EDGE OF DEBRIS COVER WITH EDGE OF ARCHITECTURAL PANEL.
4. INSTALL DEBRIS COVER OVER ALL ARCHITECTURAL PANELS MOUNTED TO STEEL FLOODWALL - NO DEBRIS COVER OVER ARCHITECTURAL PANELS MOUNTED TO CONCRETE FLOODWALL.
5. VERIFY ALL EXISTING DIMENSIONS IN FIELD.
6. DEBRIS COVER MATERIALS AND FINISH TO MATCH STEEL FLOODWALL.

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SEALS

PROJECT IDENTIFICATION

NEW YORK STATE OF OPPORTUNITY. Battery Park City Authority

BATTERY PARK CITY BALLFIELD AND COMMUNITY CENTER

MARK	DATE	DESCRIPTION	BY
1	11/15/19	100% SUBMISSION	AW
A	11/01/19	ISSUED FOR BID - 95%	AW

ISSUE BLOCK

PROJECT NO.:	3019666
DESIGNED BY:	KM
DRAWN BY:	JAG
CHECKED BY:	AW
APPROVED BY:	
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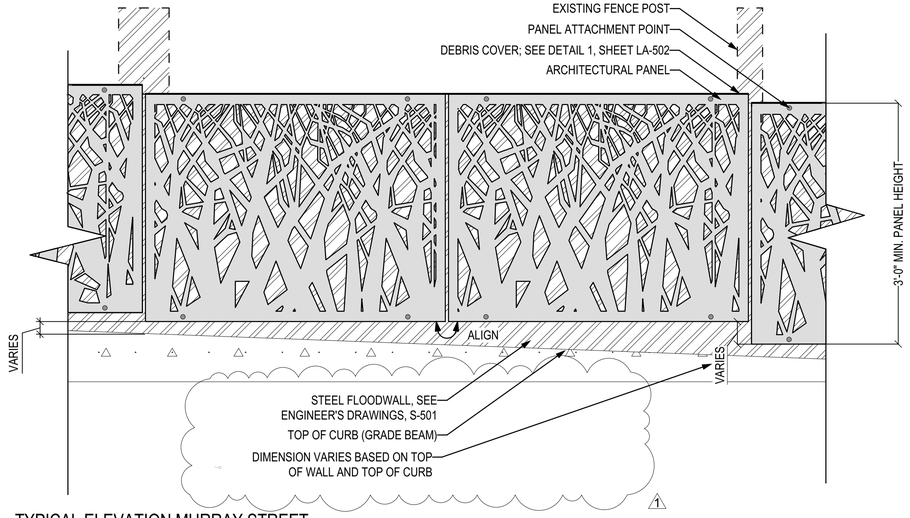
SHEET TITLE

ARCHITECTURAL PANEL DETAILS- B

LA-502

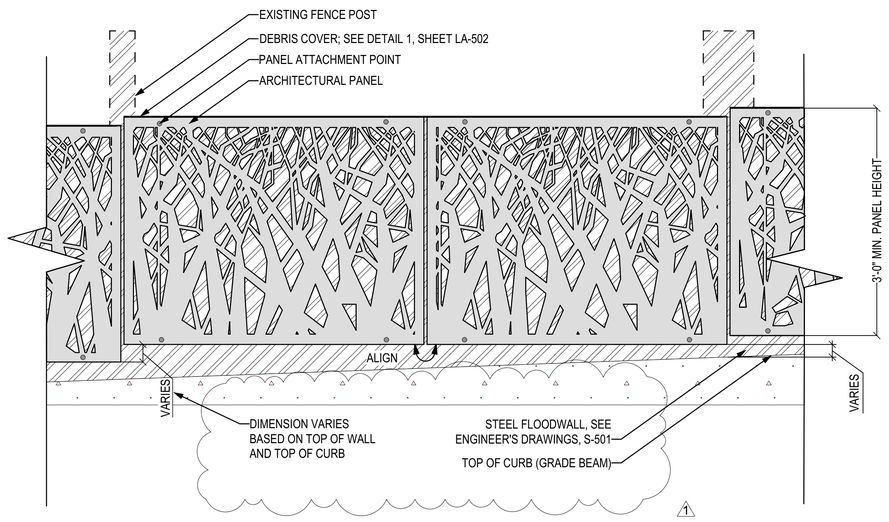
1

NOTES:
1. TOP OF STEEL FLOODWALL AND ARCHITECTURAL PANEL TO SIT FLUSH.
2. DISTANCE BETWEEN TOP OF CURB AND BOTTOM OF ARCHITECTURAL PANELS VARIES BASED ON TOPOGRAPHY, VERIFY DIMENSIONS IN FIELD.
3. ELEVATIONS SHOW VARIATIONS AT EACH STREET WITH STIX PATTERN.

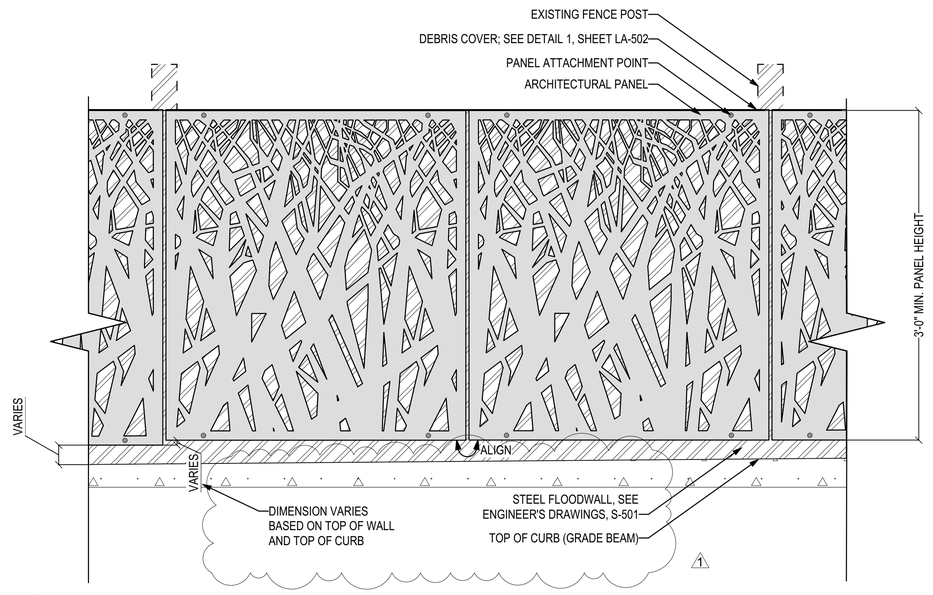


1 / LA-503 TYPICAL ELEVATION MURRAY STREET
SCALE: 1" = 1'-0"

NOTE:
'LA' SERIES DRAWINGS FOR ARCHITECTURAL PANELS ONLY. SEE 'S' SERIES FOR ALL STEEL FLOODWALL INFORMATION AND DETAILS.



3 / LA-503 TYPICAL ELEVATION WARREN STREET
SCALE: 1" = 1'-0"



2 / LA-503 TYPICAL ELEVATION WEST STREET
SCALE: 1" = 1'-0"

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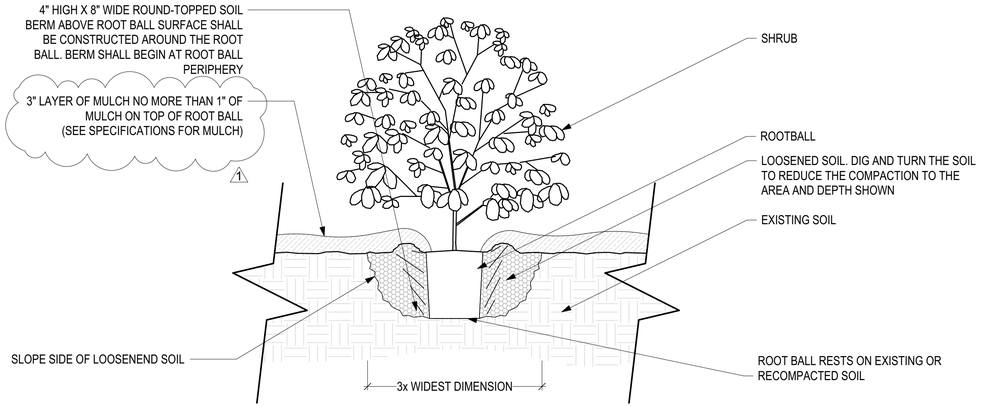
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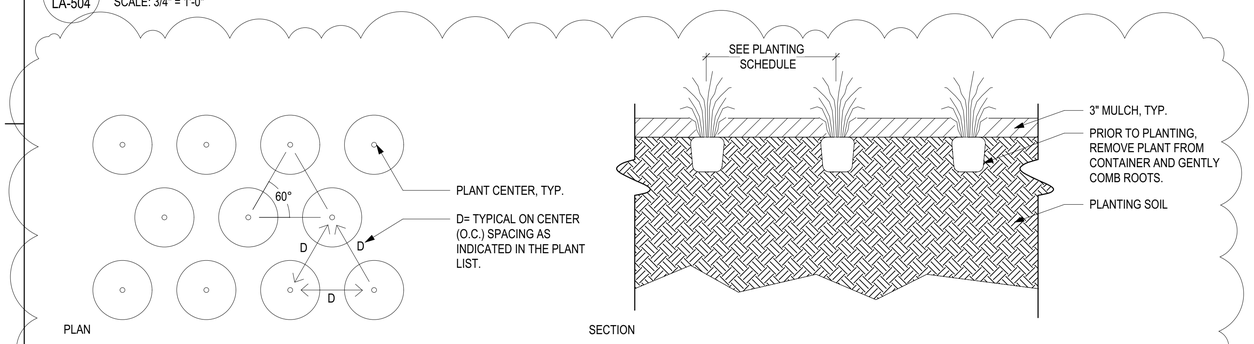
ARCHITECTURAL PANEL ENLARGEMENTS

LA-503

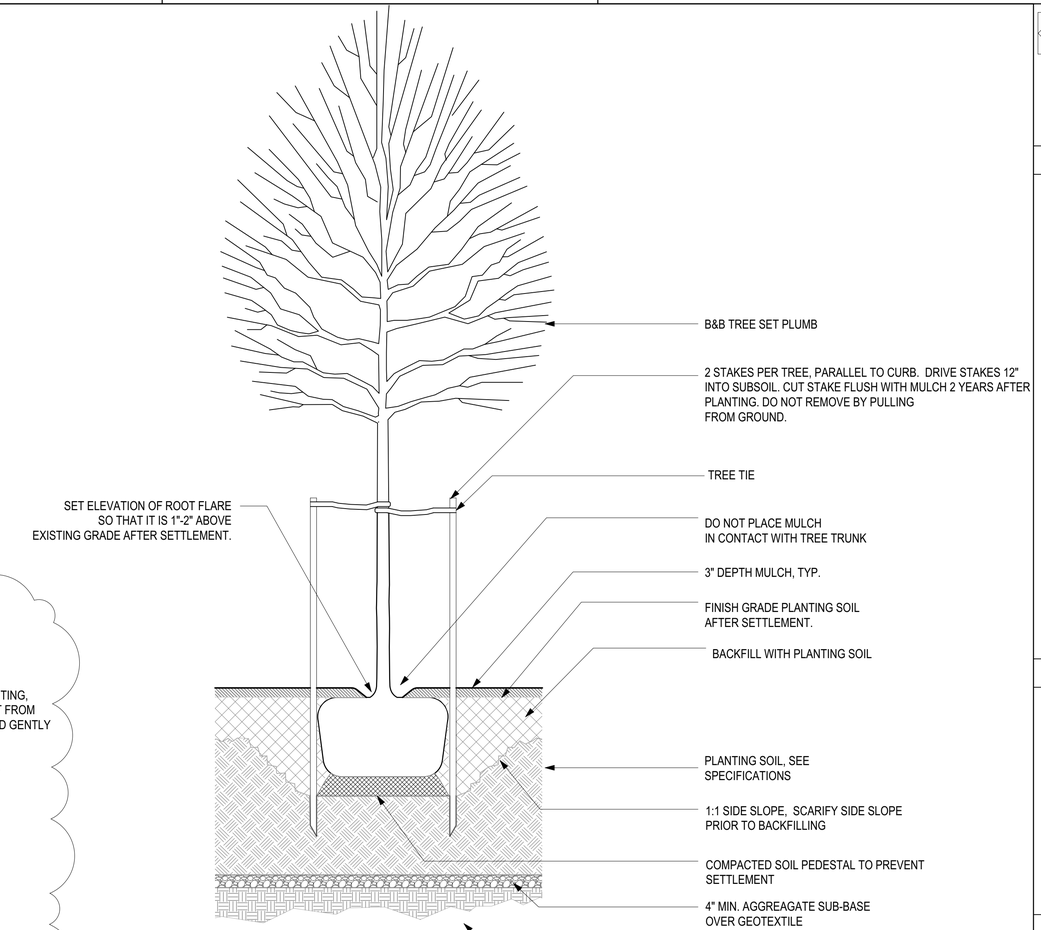


NOTES:
1. SHRUBS SHALL BE OF QUALITY PRESCRIBED IN THE ROOT OBSERVATIONS DETAIL AND SPECIFICATIONS.
2. SEE SPECIFICATIONS FOR FURTHER REQUIREMENTS RELATED TO THIS DETAIL.

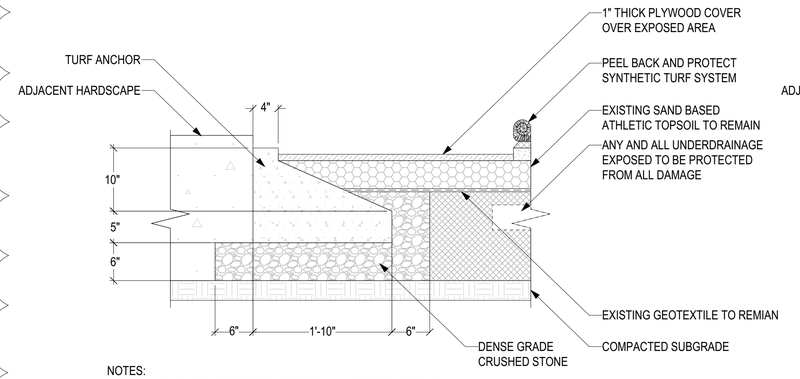
3 / LA-504 **SHRUB PLANTING**
SCALE: 3/4" = 1'-0"



4 / LA-504 **HERBACEOUS PLANTING**
SCALE: 1" = 1'-0"

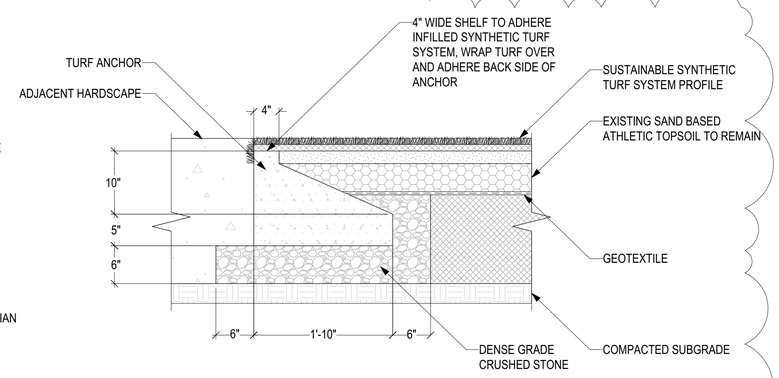


1 / LA-504 **TREE PLANTING**
SCALE: 1/2" = 1'-0"



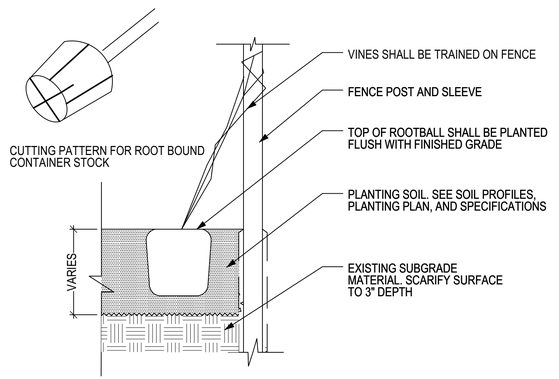
NOTES:
1. PEEL BACK SYNTHETIC TURF WHERE IT WILL BE DISTURBED BY CONSTRUCTION AND REPLACE TO MATCH EXISTING CONDITION.
2. LANDSCAPE ARCHITECT TO BE PRESENT FOR REMOVAL PROCESS.

REMOVAL/PROTECTION



EXISTING CONDITION / RESTORED CONDITION

5 / LA-504 **SYNTHETIC TURF REPLACEMENT AT WARREN ST. GATE**
SCALE: 1" = 1'-0"



2 / LA-504 **VINE PLANTING**
SCALE: 3/4" = 1'-0"

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PLANTING DETAILS

LA-504

GENERAL NOTES:

1. THE FLOODWALL STRUCTURES ARE DESIGNED IN ACCORDANCE WITH THE 2014 BUILDING CODE OF THE CITY OF NEW YORK (NYCBC 2014) AND ASSOCIATED REFERENCE STANDARDS.
2. THESE DRAWINGS SHALL BE USED IN CONJUNCTION WITH THE LANDSCAPE ARCHITECTURE AND CIVIL DRAWINGS AND SPECIFICATIONS.
3. THE METHODS, PROCEDURES AND SEQUENCES OF CONSTRUCTION ARE THE RESPONSIBILITY OF THE GENERAL CONTRACTOR.
4. THE PRESENCE OF THE ENGINEER OR OWNER REPRESENTATIVES AT THE JOBSITE SHALL NOT CHANGE ANY RESPONSIBILITY FOR THE CONTRACTOR'S MEANS AND METHODS OF CONSTRUCTION AND FOR ALL SAFETY PRECAUTIONS ON THE JOB SITE.
5. ANY SUBSTITUTIONS OR ALTERNATES PROPOSED BY THE CONTRACTOR MAY BE USED IF SUCH SUBSTITUTIONS OR ALTERNATES ARE SUBMITTED IN WRITING TO THE ENGINEER FOR REVIEW AND ACCEPTANCE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR AND COVER ANY ADDITIONAL EXPENSES FOR THE DESIGN OF SUCH ALTERNATES AND SUBSTITUTIONS.
6. THE GENERAL CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO MAINTAIN AND ENSURE THE INTEGRITY OF THE EXISTING STRUCTURE AT ALL STAGES OF CONSTRUCTION. DESIGN OF ANY NECESSARY MEASURES TO MAINTAIN THIS INTEGRITY IS SOLELY THE RESPONSIBILITY OF THE CONTRACTOR.
7. DETAILS HAVE BEEN PREPARED BASED UPON RECORD DRAWINGS AND VISUAL OBSERVATIONS. CONTRACTOR IS TO VERIFY ALL ELEVATIONS AND DIMENSIONS IN THE FIELD FOR INCORPORATION INTO THE SHOP DRAWINGS. NOTIFY ENGINEER IMMEDIATELY OF AN MAJOR DIMENSIONAL DISCREPANCIES.
8. DEFICIENT WORK SHALL BE REPLACED OR REPAIRED BY CONTRACTOR, AS DETERMINED BY THE ENGINEER, AT NO COST TO THE OWNER.
9. ALL ELEVATIONS SHOWN ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).

DESIGN CRITERIA:

1. WIND LOADS (ASCE 7-05):
   BASIC WIND SPEED.....98 MPH
   EXPOSURE CLASSIFICATION.....D
   RISK CATEGORY.....CATEGORY II
2. FLOOD AND WAVE LOADS (ASCE 7-10):
   FEMA FIRM BASE FLOOD ELEVATION.....EL. +11.0'
   DESIGN FLOOD ELEVATION.....EL. + 12.0'
   RISK CATEGORY.....CATEGORY II
   WATER DENSITY.....64 PCF
   SEE S-003 FOR ADDITIONAL FLOOD LOAD INFORMATION.

SPECIAL CONSTRUCTION CONSIDERATIONS:

1. UNDERGROUND UTILITIES ARE SHOWN AS PER THE AVAILABLE RECORD DRAWINGS. THE CONTRACTOR IS RESPONSIBLE FOR PERFORMING AN UNDERGROUND UTILITY INVESTIGATION PRIOR TO CONSTRUCTION OF THE PERIMETER WALL. IN AREAS WHERE A GRADE BEAM IS TO BE INSTALLED, EXCAVATION DEPTH SHALL BE HAND DUG. IN AREAS OF A NEW FOUNDATION WALL, HAND DIG A 5-FT DEEP TRENCH TO ENSURE NO UTILITY CONFLICTS PRIOR TO COMPLETING THE EXCAVATION. CONTRACTOR IS RESPONSIBLE TO REPAIR ANY UTILITIES DAMAGED DURING CONSTRUCTION.
2. EXCAVATION FOR NEW FOUNDATION ELEMENTS OCCURS BETWEEN EXISTING SHALLOW FENCE FOUNDATIONS. EXISTING FENCE IS TO BE FULLY SHORED TO ENSURE MOVEMENT AND UNDERMINING IS MINIMAL DURING ALL CONSTRUCTION ACTIVITIES. SHORING WILL LIKELY EXTEND INTO THE ADJACENT SIDEWALK OR BALLFIELD AND MUST BE COORDINATED WITH THESE STAKEHOLDERS FOR ACCEPTABLE OUTAGES, EXTENTS, AND LOCATIONS. SHORING SUBMITTAL SHALL BE SIGNED AND SEALED BY A NY PE AND SUBMITTED TO THE ENGINEER AND STAKEHOLDERS FOR REVIEW AND APPROVAL. SUBMITTAL MUST CLEARLY DENOTE TIMING AND PHASING OF EACH SHORING LOCATION. THIS PHASING SHALL CORRESPOND TO THAT LISTED IN THE DIVISION 1 SPECIFICATIONS.
3. THE PROJECT IS INTENDED TO CREATE A FULLY SEALED STRUCTURAL PERIMETER TO ELEVATION +12-FT. AS SUCH ALL DETAILS AND MATERIAL INTERSECTIONS SHALL HAVE NO VOIDS. ALL MATERIAL INTERSECTIONS SHALL HAVE AN EXPANSIVE BENTONITE STRIP OR APPLIED SEALANT BY SIKA OR APPROVED EQUAL. NOTIFY THE ENGINEER IMMEDIATELY IF A DETAILING GAP BETWEEN ELEMENTS EXISTS. ANY TEMPORARY GAPS, FORM TIE OR OTHER HOLES USED FOR ERECTION MUST BE CLOSED IN A WATERTIGHT MANNER AS APPROVED BY THE ENGINEER.
4. THIS PROJECT WORKS AROUND MANY EXISTING FENCE ELEMENTS. THE INTENTION IS TO SALVAGE AND REUSE AS MANY EXISTING ELEMENTS AS POSSIBLE UNLESS COST PROHIBITIVE. ALL NEW STEEL IS GALVANIZED, AND GALVANIZING TOUCH UP ON ALL STEEL SHALL BE PROVIDED WHERE DAMAGED. EXISTING FENCE MESH CAN BE REMOVED FOR ACCESS TO PERFORM WORK AT CONTRACTOR'S OPTION. FOR USE IN DETERMINATION, AVAILABLE EXISTING DRAWINGS ARE ATTACHED FOR REFERENCE.

SPECIAL CONSTRUCTION CONSIDERATIONS (CONTINUED):

5. A DETAILED SURVEY SHALL BE COMPLETED TO VERIFY EXISTING DIMENSIONS AND ALIGNMENT OF FENCE MEMBERS, FENCE FOUNDATIONS, AND DIMENSIONS TO ADJACENT STRUCTURES SUCH AS RETAINING WALLS, ELECTRICAL EQUIPMENT PLATFORMS, SLIDING GATE, ETC. PRIOR TO ALL MATERIAL ORDERING AND FABRICATION. THE SURVEY SHALL BE SUBMITTED TO THE ENGINEER OF RECORD FOR REVIEW.
6. MOCKUP OF THE COMPLETE TYPICAL FLOOD WALL ASSEMBLY, INCLUDING CONCRETE AND STEEL STRUCTURAL ELEMENTS SHALL BE ERECTED BY THE CONTRACTOR. REFER TO THE LANDSCAPE ARCHITECTURAL METAL PANEL SPECIFICATION 323120 FOR SCOPE, EXTENTS, AND REQUIREMENTS OF MOCKUP.

FOUNDATIONS:

1. FOUNDATION DESIGN IS BASED UPON THE GEOTECHNICAL INVESTIGATION AND REPORT PROVIDED BY YU & ASSOCIATES DATED OCTOBER 18, 2019.
2. THE FOUNDATION CONTRACTOR SHALL VERIFY ALL FIELD CONDITIONS BEFORE EXCAVATION HAS BEGUN. CONTRACTOR SHALL SUBMIT FIELD SKETCHES TO ENGINEERS FOR REVIEW AND APPROVAL WHERE CONDITION DEVIATES FROM CONTRACT DOCUMENTS.
3. BOTTOM 3" OF EXCAVATION FOR FOOTINGS AND GRADE BEAMS SHALL BE FINISHED BY HAND SHOVEL OR AS DIRECTED BY TESTING AGENCIES AND INSPECTED AND CERTIFIED BY PROFESSIONAL AND /OR GEOTECHNICAL ENGINEERS.
4. FOUNDATIONS SHALL BEAR ON SOIL WITH A MINIMUM ALLOWABLE BEARING PRESSURE OF 2 TONS PER SQUARE FOOT AND PILES SHALL HAVE AN AXIAL CAPACITY OF 20T AND A LATERAL CAPACITY OF 3T. REFER TO YU & ASSOCIATES GEOTECHNICAL REPORT FOR FURTHER INFORMATION.
5. THE SOIL BEARING CAPACITY MUST BE VERIFIED BY THE CONTRACTOR AND SPECIAL INSPECTOR. IF PROBLEMS ARE ENCOUNTERED, IMMEDIATELY NOTIFY THE PROJECT GEOTECHNICAL ENGINEER. IF ADEQUATE SOIL IS NOT FOUND AT THE DEPTH SHOWN ON THESE DRAWINGS, THE FOOTING SHALL REMAIN AT ITS SPECIFIED BEARING ELEVATION AND THE UNDERLYING UNSUITABLE MATERIAL SHALL BE REMOVED AND REPLACED WITH COMPACTED GRAVEL FILL OR CONCRETE (f'c = 3,500 PSI). SUBGRADE FOR ALL FOOTINGS SHALL BE SUBJECT TO SPECIAL INSPECTION PRIOR TO PLACEMENT OF CONCRETE.
6. CONTRACTOR SHALL NOT UNDERMINE EXISTING FOOTINGS OR SLABS.
7. PROVIDE TEMPORARY SUPPORTS AS REQUIRED, SO THAT NO HORIZONTAL MOVEMENT OR VERTICAL SETTLEMENT OCCURS TO EXISTING STRUCTURES AT THE PROJECT SITE.
8. DEWATERING OF THE SITE DURING CONSTRUCTION IS SOLELY THE RESPONSIBILITY OF THE CONTRACTOR.
9. BACKFILL UNDER AND ADJACENT TO ANY PORTION OF THE STRUCTURE SHALL BE COMPACTED TO 98% OF THE MAXIMUM DRY DENSITY PER ASTM D-698 IN 6" LIFTS.

CONCRETE:

1. ALL CONCRETE WORK SHALL COMPLY WITH THE AMERICAN CONCRETE INSTITUTE ("ACI") "BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE" ACI 318-11 AND "SPECIFICATIONS FOR STRUCTURAL CONCRETE FOR BUILDINGS" ACI 301-05.
2. CONCRETE MIXES SHALL BE PREPARED IN ACCORDANCE WITH THE NYC BUILDING CODE REQUIREMENTS AND SUBMITTED FOR REVIEW AT LEAST 14 DAYS PRIOR TO THE PLACEMENT OF CONCRETE.
3. ALL CONCRETE SHALL BE NORMAL WEIGHT WITH A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 5,000 PSI AND A MAXIMUM WATER/CEMENT RATIO OF 0.40 BY WEIGHT.
4. ALL CONCRETE SHALL BE AIR ENTRAINED PER ASTM C231 AND SHALL BE SELF-CONSOLIDATING WITH A MAXIMUM SHRINKAGE OF 0.02%.
5. ALL REINFORCING STEEL SHALL BE GALVANIZED CONFORMING TO ASTM A767 CLASS I.
6. ALL STEEL SHALL BE SECURELY HELD IN PLACE DURING POURING OF CONCRETE. IF REQUIRED, CHAIRS, REBARS, TIES, SPACERS OR ADDITIONAL BARS AND STIRRUPS SHALL BE PROVIDED BY THE GENERAL CONTRACTOR TO FURNISH SUPPORT FOR ALL BARS.
7. LOCATION OF ALL CONSTRUCTION JOINTS SHALL BE SUBMITTED TO THE STRUCTURAL ENGINEER FOR APPROVAL PRIOR TO DETAILING OF REINFORCEMENT. THE STRUCTURAL ENGINEER MAY REQUIRE ADDITIONAL REINFORCING AT SUCH JOINTS.
8. CHAMFER ALL EXPOSED CONCRETE 3/4" UNLESS OTHERWISE NOTED.

CONCRETE CONTINUED:

CONCRETE COVER			
ELEMENT	BOTTOM	TOP	SIDE
GRADE BEAMS	3"	2"	2"*
STRIP FOOTINGS	3"	2"	2"*
PIERS/WALLS	1-1/2" (STIRRUPS)	2"	1-1/2"

*COVER IS 2" WHERE CONCRETE IS FORMED AND 3" WHERE POURED AGAINST EARTH

ALL STEEL REINFORCING BAR DEVELOPMENT LENGTHS, UNLESS INDICATED OTHERWISE, SHALL SATISFY THE FOLLOWING:

WALLS		
BAR SIZE	VERTICAL BARS	HORIZONTAL BARS
#3	13	17
#4	17	23
#5	22	28
#6	26	34
#7	38	49
#8	43	56
#9	48	63
#10	54	71
#11	60	78

BAR SIZE	GRADE BEAMS PIERS FOOTINGS
#3	17
#4	23
#5	28
#6	34
#7	73
#8	83
#9	94
#10	106
#11	117

TABLE NOTES:
1. TABLE ABOVE LISTS VALUES OF "Ld" IN INCHES.
2. ALL LAP SPLICES SHALL BE 1.3 Ld UNLESS NOTED OTHERWISE ON THE DRAWINGS.

STRUCTURAL STEEL:

1. ALL WORK SHALL CONFORM TO THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION "SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS-ALLOWABLE STRESS DESIGN AND LOAD RESISTANCE FACTOR DESIGN", AISC 360-05, AS MODIFIED BY CHAPTER 22 OF THE NYC BUILDING CODE 2014.
2. ALL WORK SHALL CONFORM TO THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION "CODE OF STANDARD PRACTICE" AISC 303-05.
3. ALL PLATES, CHANNELS, ANGLES AND MISCELLANEOUS PIECES SHALL BE ASTM A572 GRADE 50. STRUCTURAL STEEL TUBING SHALL BE ASTM A500, GRADE C.
4. ALL STEEL, CONNECTIONS, AND CONNECTION COMPONENTS ARE TO BE GALVANIZED PER ASTM A123, A385, AND A653 AS APPLICABLE. ALL STEEL, CONNECTIONS, AND CONNECTION COMPONENTS WITH GALVANIC COATING DAMAGED DURING THE COMPLETION OF THIS PROJECT ARE TO BE REPAIRED PER ASTM A780.
5. SHOP DRAWINGS, PREPARED IN ACCORDANCE WITH AISC "DETAILING FOR STEEL CONSTRUCTION", SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW AND ACCEPTED PRIOR TO PERFORMING WORK.
6. OBTAIN ALL FIELD MEASUREMENTS REQUIRED FOR PROPER FABRICATION AND INSTALLATION PRIOR TO THE START OF DETAILING AND FABRICATION. PRECISE MEASUREMENTS ARE THE SOLE RESPONSIBILITY OF THE CONTRACTOR.
7. BOLTS SHALL BE 3/4 INCHES IN DIAMETER MINIMUM, UNLESS OTHERWISE NOTED. BOLTS, NUTS AND WASHERS SHALL CONFORM TO THE REQUIREMENTS OF ASTM A325 OR A490. PROVIDE A MINIMUM OF 2 BOLTS PER CONNECTION.
8. ALL WELDING ELECTRODES SHALL BE E70XX. MINIMUM FILLET WELD SIZES SHALL COMPLY WITH THE AISC SPECIFICATION, BUT SHALL NOT BE LESS THAN 1/4 INCH, UNLESS OTHERWISE NOTED. IN THESE DRAWINGS.
9. ALL WELDING SHALL BE DONE BY NEW YORK CITY CERTIFIED WELDERS AND SHALL CONFORM TO THE AMERICAN WELDING SOCIETY AWS D1.1.
10. ALL PIPES AND TUBES SHALL BE COMPLETELY SEALED WITH CAP PLATES.
11. LOCATION AND TYPE OF SPLICE SHALL BE SPECIFICALLY DETAILED ON SHOP DRAWINGS. SPLICING OF STRUCTURAL STEEL MEMBERS ARE PROHIBITED WITHOUT PRIOR APPROVAL FROM THE ENGINEER.
12. FIELD CUTTING OF STEEL IS NOT PERMITTED UNLESS APPROVED BY THE ENGINEER.
13. SEE LANDSCAPE ARCHITECTURE DRAWING AND SPECIFICATIONS FOR ALL STEEL PAINTING.
14. SLIP-CRITICAL BOLTED CONNECTIONS SHALL BE FULLY PRETENSIONED WITH THREADS EXCLUDED FROM THE SHEAR PLANE AND WITH GALVANIZED - CLASS C SURFACE.

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B	10/18/19	75% DESIGN SUBMITTAL	AC
A	09/06/19	50% DESIGN SUBMITTAL	AC

ISSUE BLOCK

PROJECT NO.:	3019666
DESIGNED BY:	N. TOLLI
DRAWN BY:	N. TOLLI
CHECKED BY:	A. CERINO P.E.
APPROVED BY:	A. CERINO P.E.
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SHEET TITLE

STRUCTURAL NOTES SHEET 1 OF 3

S-001

POST-INSTALLED ANCHORS:

1. EXCEPT WHERE INDICATED ON THE DRAWINGS, POST-INSTALLED ANCHORS SHALL CONSIST OF THE FOLLOWING ANCHOR TYPES AS PROVIDED BY HILTI, INC. OR APPROVED EQUAL AND INSTALLED IN ACCORDANCE WITH THEIR RESPECTIVE ICC-ES REPORT AND MANUFACTURER'S PUBLISHED INSTALLATION INSTRUCTIONS:

APPLICATION	ANCHORING SYSTEM	ICC-ES REPORT
ANCHORAGE TO CONCRETE	HILTI HIT-HY 200 ADHESIVE	ESR-3187
	HILTI KWIK BOLT TZ	ESR-1917
	HILTI KWIK HUS EZ	ESR-3027
REBAR DOWELING	HILTI RE 500 V3 ADHESIVE	ESR-3814
	HILTI HIT-HY 200 ADHESIVE	ESR-3187

2. CONTRACTOR SHALL ARRANGE AN ANCHOR MANUFACTURER'S REPRESENTATIVE TO PROVIDE ON-SITE ANCHOR INSTALLATION TRAINING FOR ALL OF THEIR ANCHOR PRODUCTS SPECIFIED. CONTRACTOR SHALL SUBMIT DOCUMENTED CONFIRMATION THAT ALL OF THE CONTRACTOR'S PERSONNEL INSTALLING ANCHORS HAVE RECEIVED THE REQUIRED TRAINING PRIOR TO THE COMMENCEMENT OF WORK.

3. ANCHOR CAPACITY IS DEPENDENT UPON SPACING BETWEEN ANCHORS AND PROXIMITY OF ANCHORS TO EDGE OF BASE MATERIAL. INSTALL ANCHORS IN ACCORDANCE WITH SPACING AND EDGE CLEARANCES INDICATED ON THE DRAWINGS OR PER THE MANUFACTURER'S GUIDELINES.

4. CONTINUOUS OR PERIODIC SPECIAL INSPECTION FOR POST-INSTALLED ANCHORS SHALL BE PERFORMED IN ACCORDANCE WITH SECTION 4.3/4.4 OF THE ICC-ES REPORT FOR THE INDIVIDUAL ANCHOR. SPECIAL INSPECTOR SHALL BE NOTIFIED PRIOR TO COMMENCEMENT OF WORK TO COORDINATE INSPECTION EFFORTS.

5. EXISTING REINFORCING BARS IN THE CONCRETE STRUCTURE MAY CONFLICT WITH SPECIFIC ANCHOR LOCATIONS. UNLESS NOTED IN THE DRAWINGS THAT THE BARS CAN BE CUT, THE CONTRACTOR SHALL REVIEW THE EXISTING STRUCTURAL DRAWINGS AND SHALL UNDERTAKE TO LOCATE THE POSITION OF THE REINFORCING BARS AT THE LOCATIONS OF THE CONCRETE ANCHORS BY GPR, X-RAY OR OTHER NON-DESTRUCTIVE TESTING MEANS. MODIFICATION OF FINAL ANCHOR LOCATIONS AND ATTACHING ELEMENTS MAY BE REQUIRED BASED ON FIELD-VERIFIED CONDITIONS.

6. CONTRACTOR SHALL SUBMIT TECHNICAL PRODUCT DATA WITH RECOMMENDED DESIGN VALUES, SAMPLES, QUALITY ASSURANCE TESTING REPORTS, CERTIFICATES AND INSTALLATION PROCEDURES FOR REVIEW BY THE ENGINEER OF RECORD.

7. PROVIDE GALVANIC SEPARATION WHEN ANCHORS ARE IN CONTACT WITH DISSIMILAR METALS.

REQUIRED SPECIAL INSPECTIONS AND OTHER:

1. OWNER SHALL PAY FOR THE SERVICES OF A SPECIAL INSPECTION AGENCY LICENSED TO PROVIDE SERVICES IN ACCORDANCE WITH THE NYC BUILDING CODE FOR THE FOLLOWING STRUCTURAL ITEMS:
   a. 1704.3 STEEL CONSTRUCTION
   b. 1704.4 CONCRETE CONSTRUCTION
   c. 1704.7 SUBSURFACE CONDITIONS
   d. 1704.20 STRUCTURAL STABILITY
   e. 1704.32 POST INSTALLED ANCHORS
   f. G105.2 FLOOD ZONE COMPLIANCE SPECIAL INSPECTION
   g. G105.4 FLOOD SHIELD INSPECTION

2. ENGINEER SHALL INSPECT ALL CONSTRUCTION BEFORE AND AFTER PLACEMENT OF CONCRETE TO ENSURE NO VOIDS AT MATERIAL INTERFACES. PROVIDE ENGINEER WITH 48-HOUR PRIOR NOTIFICATION OF CONCRETE POURS TO ENSURE INSPECTIONS HAPPEN WITH NO PROJECT DELAY. THIS REVIEW IS IN ADDITION TO THE CODE REQUIRED SPECIAL INSPECTIONS LISTED ABOVE.

ABBREVIATIONS

ALUM.	ALUMINUM	LF	LINEAR FOOT/FEET
APPROX.	APPROXIMATE	MAX	MAXIMUM
BLDG	BUILDING	MECH	MECHANICAL
B.O.	BOTTOM OF	MIN	MINIMUM
CL	CENTERLINE	NIC	NOT IN CONTRACT
CMU	CONCRETE MASONRY UNIT	NTS	NOT TO SCALE
CONC	CONCRETE	OC	ON CENTER
CONT	CONTINUOUS	PCF	POUNDS PER CUBIC FOOT
DFE	DESIGN FLOOD ELEVATION	PSF	POUNDS PER SQUARE FOOT
DIA	DIAMETER	SF	SQUARE FOOT/FEET
DN	DOWN	T.O., T/	TOP OF
EL, ELEV.	ELEVATION	T.O.S.	TOP OF SLAB
ELEC	ELECTRICAL	T.O.W.	TOP OF WALL
E.W.	EACH WAY	TYP	TYPICAL
EXIST	EXISTING	U.O.N.	UNLESS OTHERWISE NOTED
EXT	EXTERIOR	VERT	VERTICAL
FT.	FOOT/FEET	W/C	WATER TO CEMENT RATIO
GA	GAUGE		
GALV	GALVANIZED		
HORIZ.	HORIZONTAL		
IN.	INCH(ES)		
INT	INTERIOR		
INV	INVERT		
KSI	KIPS PER SQUARE INCH		

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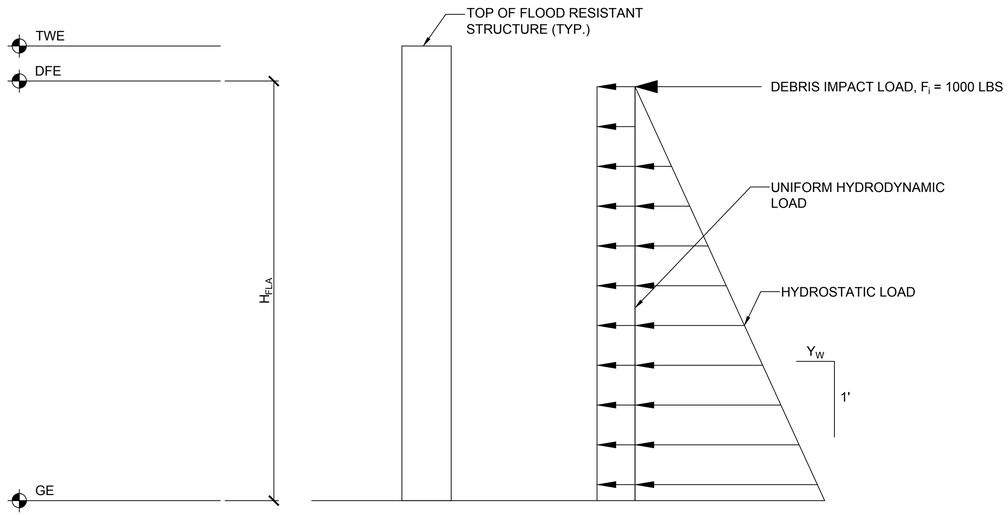
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STRUCTURAL NOTES SHEET 2 OF 3

S-002

FLOOD LOADING:



CASE 1 FLOOD LOAD DIAGRAM

APPLICABLE AT ALL BUILDING PERIMETERS

LEGEND

TWE	TOP OF WALL ELEVATION
DFE	DESIGN FLOOD ELEVATION = EL. 12.0' (NAVD88)
GE	GROUND ELEVATION
d_h	EQUIVALENT SURCHARGE DEPTH OF WATER $d_h = av^2/2g$ WHERE: a = 1.25 v = VARIES (SEE NOTE 3) g = 32.2 FT/SEC^2
Y_w	UNIT WEIGHT OF SEA WATER
F_i	DEBRIS IMPACT LOAD
H_{FLA}	HEIGHT OF FLOODWATER ABOVE GRADE (DFE-GE)

NOTES:

1. THE DESIGN FLOOD LOAD IS CALCULATED IN ACCORDANCE WITH ASCE 7-10, CHAPTER 5 WITH A DESIGN FLOOD ELEVATION REFERENCING NAVD88 DATUM.
2. PER ASCE 7 GUIDELINES, HYDRODYNAMIC PRESSURE IS CONVERTED TO AN EQUIVALENT HYDROSTATIC LOAD FOR ANALYSIS AND DESIGN PURPOSES.
3. AVERAGE VELOCITY COMPUTED PER EQUATIONS C5-1 AND C5-2 IN ASCE 7-10.

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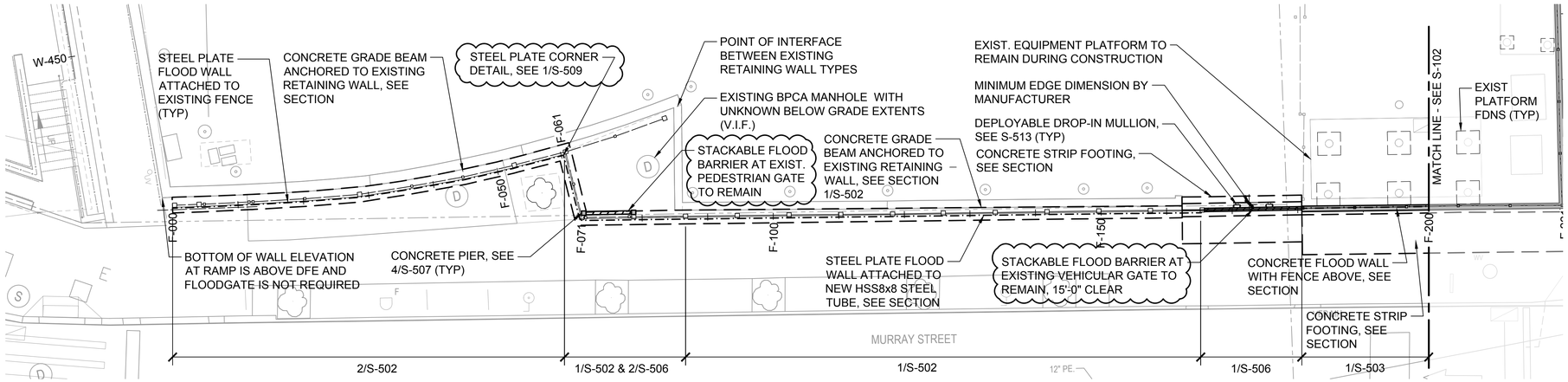
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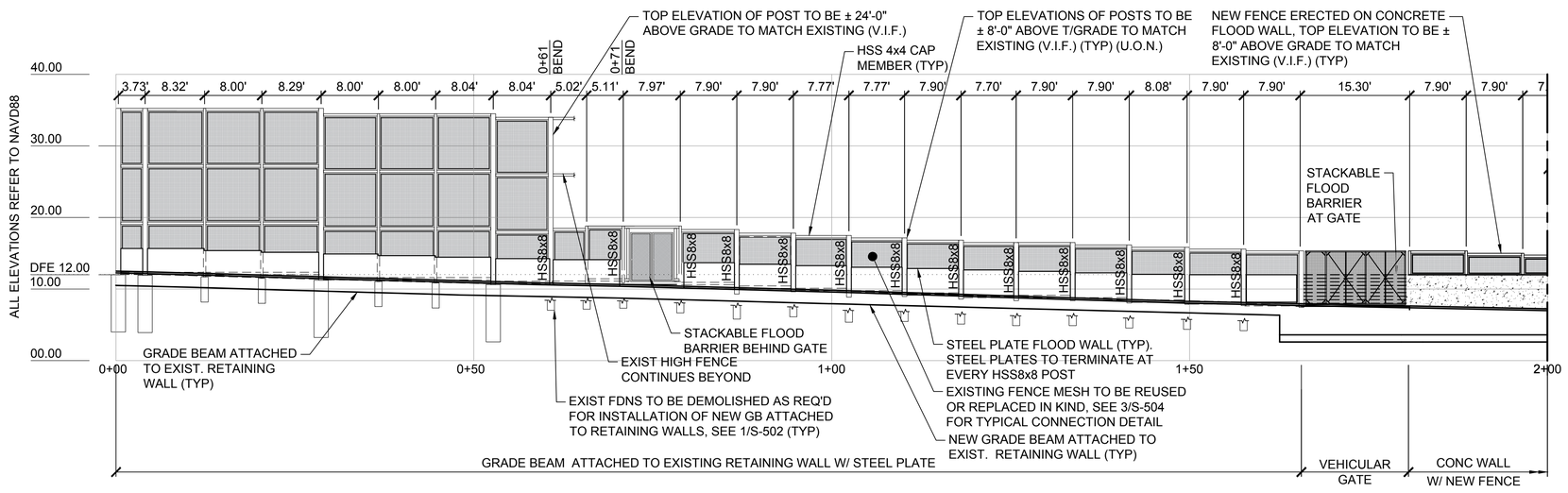
S-003



1 S-101 FENCE RING WALL PLAN - AREA 1

1"=10' 10' 5' 0 10'

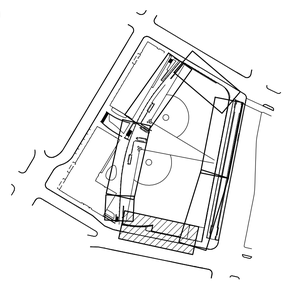
NOTES:
1. TOP OF CONCRETE GRADE BEAM IS TO BE LOCATED 3" ABOVE TOP OF GRADE AS SHOWN ON THE CIVIL DRAWINGS UNLESS OTHERWISE NOTED.
2. REFER TO 1/S-501 FOR REQUIRED DETAILING AT CONDITIONS WHERE TOP OF CONCRETE FALLS LESS THAN 4" ABOVE TOP OF FENCE POST BASE PLATE.
3. PROJECT INTENT IS FOR THE EXISTING PEDESTRIAN AND VEHICULAR GATE TO REMAIN IF POSSIBLE. THE GATES MAY BE REMOVED, STORED, AND REPLACED AT CONTRACTOR'S OPTION DURING CONSTRUCTION.



A S-101 ELEVATION

1"=10' 10' 5' 0 10'

NOTES:
1. AT NEW FENCE CONSTRUCTION LOCATIONS, TOP OF STEEL POSTS AND HORIZONTAL MEMBERS SHALL MATCH EXISTING (V.I.F.)
2. CHANGES IN GEOMETRY OF THE EXISTING FENCE ALIGNMENT ARE DENOTED BY THEIR CORRESPONDING BASELINE STATION AND "BEND", SEE PLAN.
3. ALL TOP OF STEEL PLATE ELEVATIONS MUST BE AT A MINIMUM OF THE DESIGN FLOOD ELEVATION (EL. +12.0' NAVD88). ALL STEEL PLATE HEIGHTS SHALL MATCH DECORATIVE PANEL HEIGHTS SHOWN ON LANDSCAPE ARCHITECT DRAWINGS INSOFAR AS THE PANEL TOP ELEVATIONS ARE EQUAL TO OR ABOVE THE DESIGN FLOOD ELEVATION.
4. TOP AND BOTTOM OF GATES IN RELATION TO PROPOSED GRADE SHALL MATCH RELATION TO EXISTING GRADE (V.I.F.)



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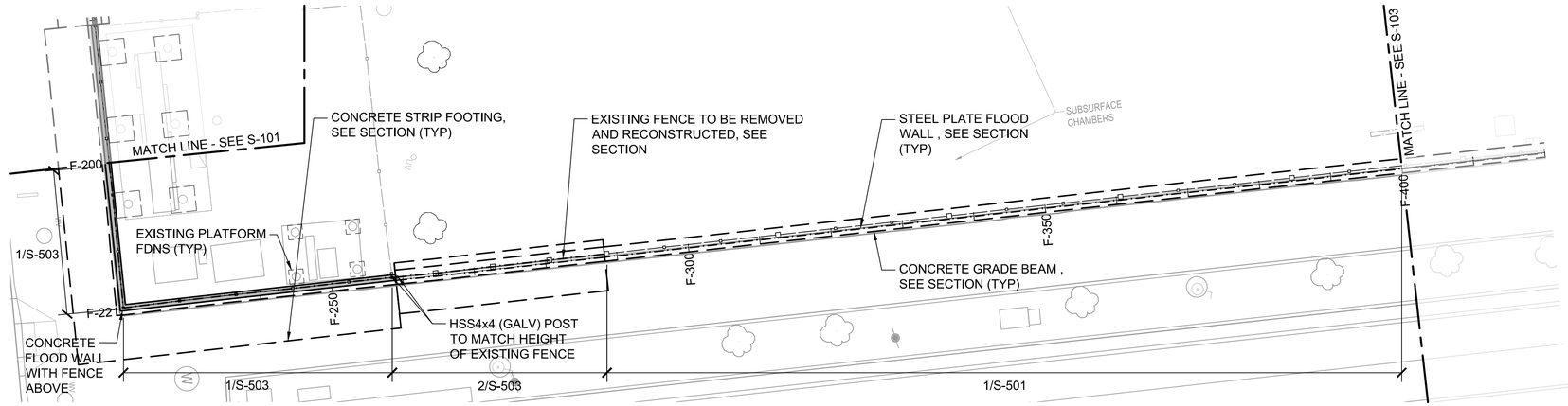
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PERIMETER PLAN SHEET 1 OF 4

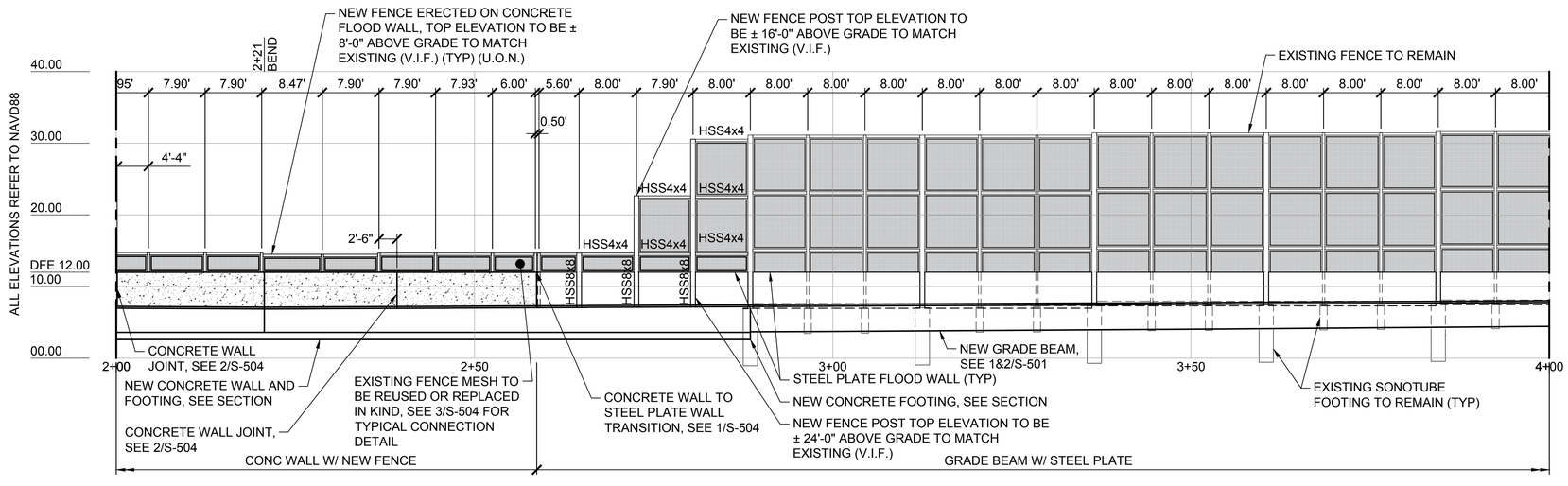
S-101



1 FENCE RING WALL PLAN - AREA 2

S-102 — 1"=10' — 10' 5' 0 10'

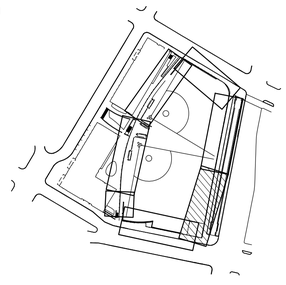
NOTES:
1. TOP OF CONCRETE GRADE BEAM IS TO BE LOCATED 3" ABOVE TOP OF GRADE AS SHOWN ON THE CIVIL DRAWINGS UNLESS OTHERWISE NOTED.
2. REFER TO 1/S-501 FOR REQUIRED DETAILING AT CONDITIONS WHERE TOP OF CONCRETE FALLS LESS THAN 4" ABOVE TOP OF FENCE POST BASE PLATE.



A ELEVATION

S-102 — 1"=10' — 10' 5' 0 10'

NOTES:
1. AT NEW FENCE CONSTRUCTION LOCATIONS, TOP OF STEEL POSTS AND HORIZONTAL MEMBERS SHALL MATCH EXISTING (V.I.F.)
2. CHANGES IN GEOMETRY OF THE EXISTING FENCE ALIGNMENT ARE DENOTED BY THEIR CORRESPONDING BASELINE STATION AND "BEND", SEE PLAN.
3. ALL TOP OF STEEL PLATE ELEVATIONS MUST BE AT A MINIMUM OF THE DESIGN FLOOD ELEVATION (EL. +12.0' NAVD88). ALL STEEL PLATE HEIGHTS SHALL MATCH DECORATIVE PANEL HEIGHTS SHOWN ON LANDSCAPE ARCHITECT DRAWINGS INSOFAR AS THE PANEL TOP ELEVATIONS ARE EQUAL TO OR ABOVE THE DESIGN FLOOD ELEVATION.



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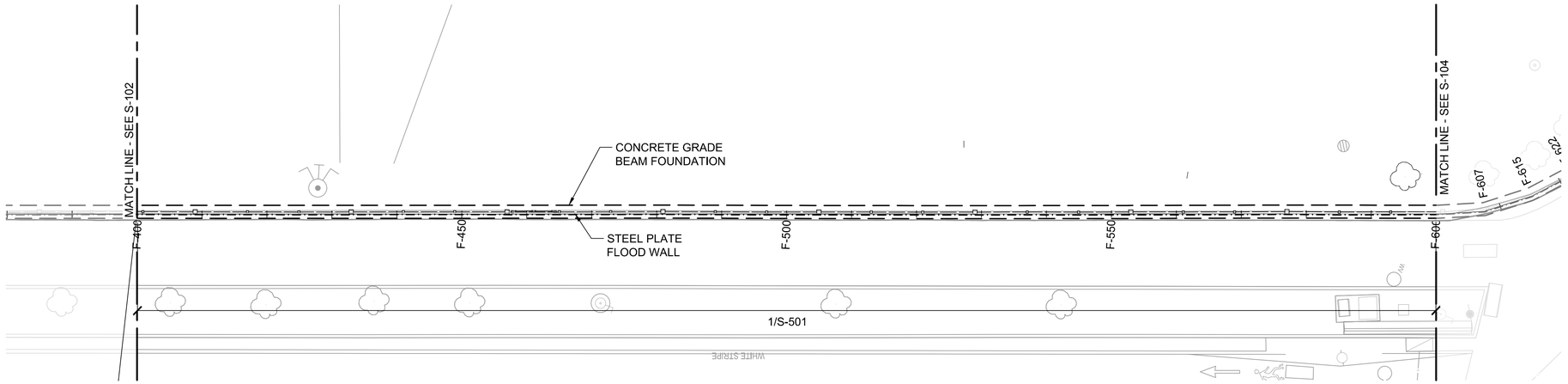
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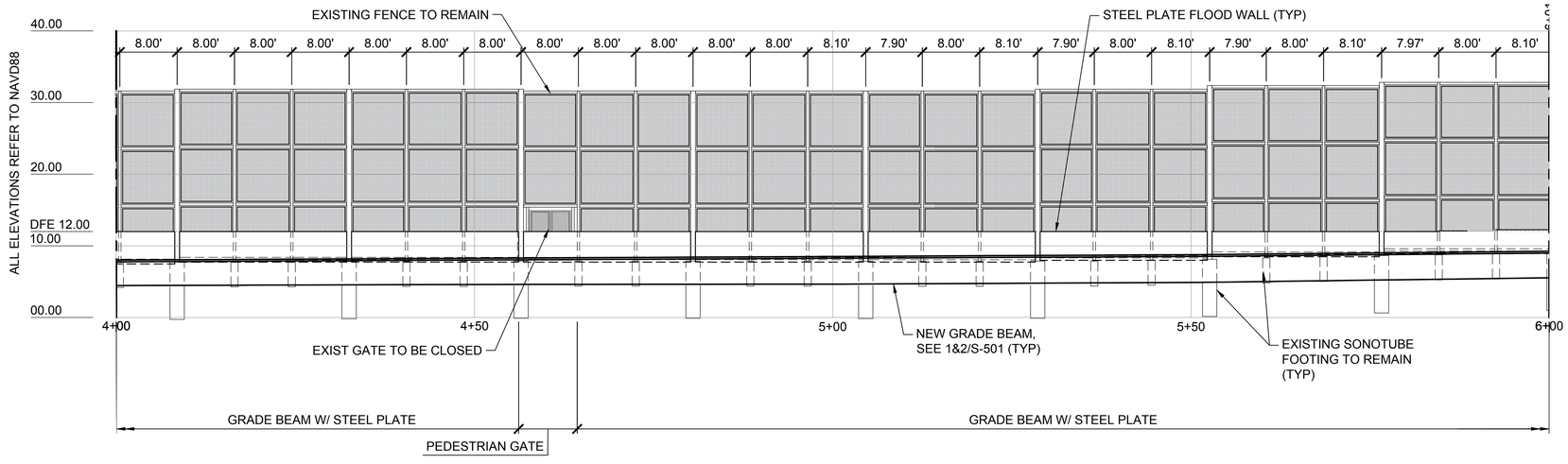
PERIMETER PLAN SHEET 2 OF 4

S-102



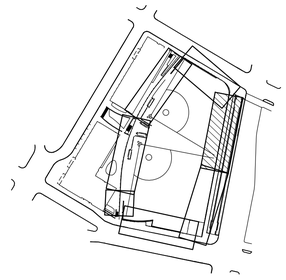
1 FENCE RING WALL PLAN - AREA 3
S-103 — 1"=10' — 10' 5' 0 10'

NOTES:
1. TOP OF CONCRETE GRADE BEAM IS TO BE LOCATED 3" ABOVE TOP OF GRADE AS SHOWN ON THE CIVIL DRAWINGS UNLESS OTHERWISE NOTED.
2. REFER TO 1/S-501 FOR REQUIRED DETAILING AT CONDITIONS WHERE TOP OF CONCRETE FALLS LESS THAN 4" ABOVE TOP OF FENCE POST BASE PLATE.



A ELEVATION
S-103 — 1"=10' — 10' 5' 0 10'

NOTES:
1. AT NEW FENCE CONSTRUCTION LOCATIONS, TOP OF STEEL POSTS AND HORIZONTAL MEMBERS SHALL MATCH EXISTING (V.I.F.)
2. CHANGES IN GEOMETRY OF THE EXISTING FENCE ALIGNMENT ARE DENOTED BY THEIR CORRESPONDING BASELINE STATION AND "BEND", SEE PLAN.
3. ALL TOP OF STEEL PLATE ELEVATIONS MUST BE AT A MINIMUM OF THE DESIGN FLOOD ELEVATION (EL. +12.0' NAVD88). ALL STEEL PLATE HEIGHTS SHALL MATCH DECORATIVE PANEL HEIGHTS SHOWN ON LANDSCAPE ARCHITECT DRAWINGS INSOFAR AS THE PANEL TOP ELEVATIONS ARE EQUAL TO OR ABOVE THE DESIGN FLOOD ELEVATION.



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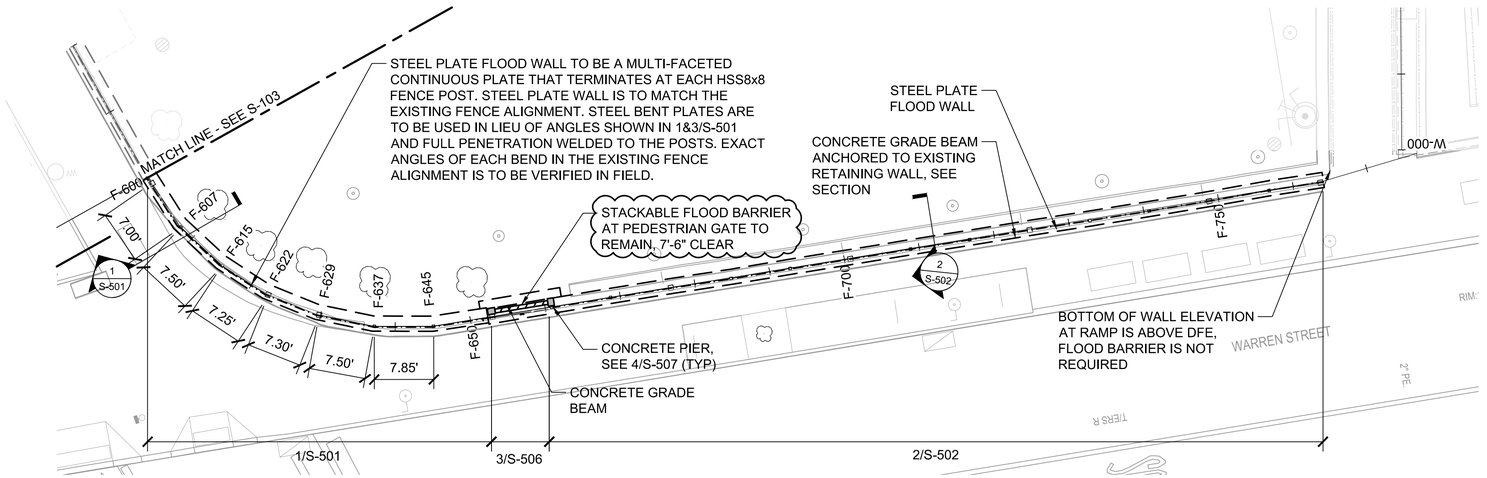
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PERIMETER PLAN SHEET 3 OF 4

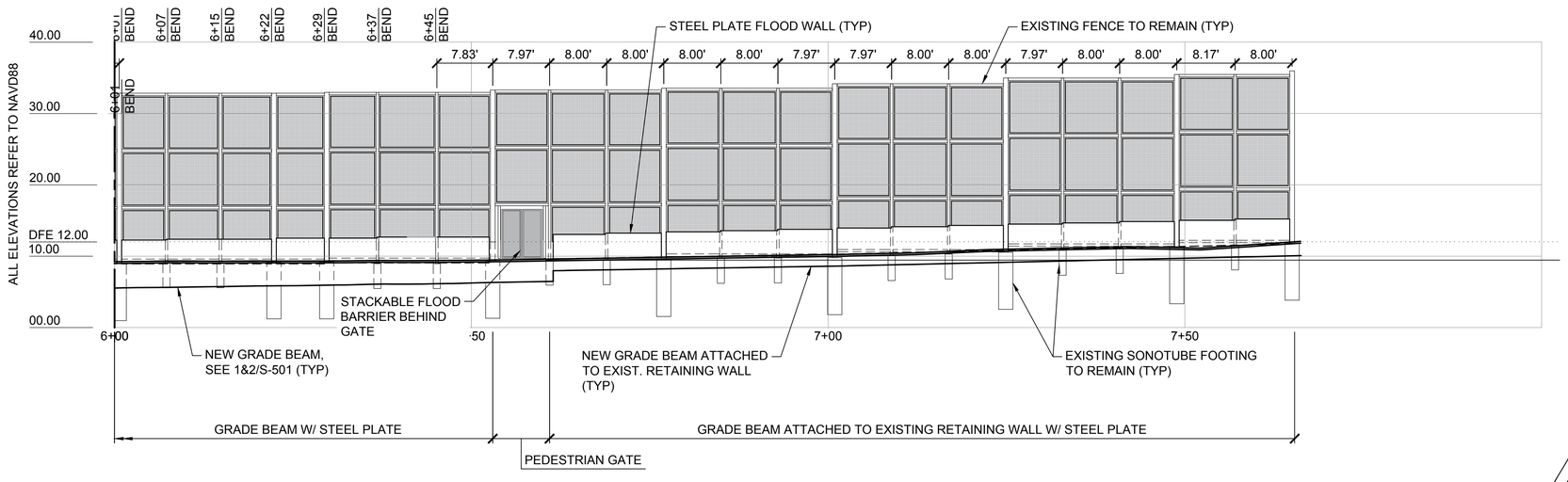
S-103



1 S-104 **FENCE RING WALL PLAN - AREA 4**

1"=10' 10' 5' 0 10'

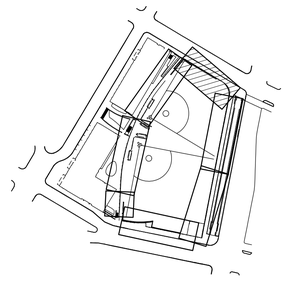
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2. REFER TO 1/S-501 FOR REQUIRED DETAILING AT CONDITIONS WHERE TOP OF CONCRETE FALLS LESS THAN 4" ABOVE TOP OF FENCE BASE PLATE.
3. PROJECT INTENT IS FOR THE EXISTING PEDESTRIAN GATE TO REMAIN IF POSSIBLE. THE GATE MAY BE REMOVED, STORED, AND REPLACED AT CONTRACTOR'S OPTION DURING CONSTRUCTION.



A S-104 **ELEVATION**

1"=10' 10' 5' 0 10'

NOTES:
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4. TOP AND BOTTOM OF GATE IN RELATION TO PROPOSED GRADE SHALL MATCH RELATION TO EXISTING GRADE (V.I.F.)



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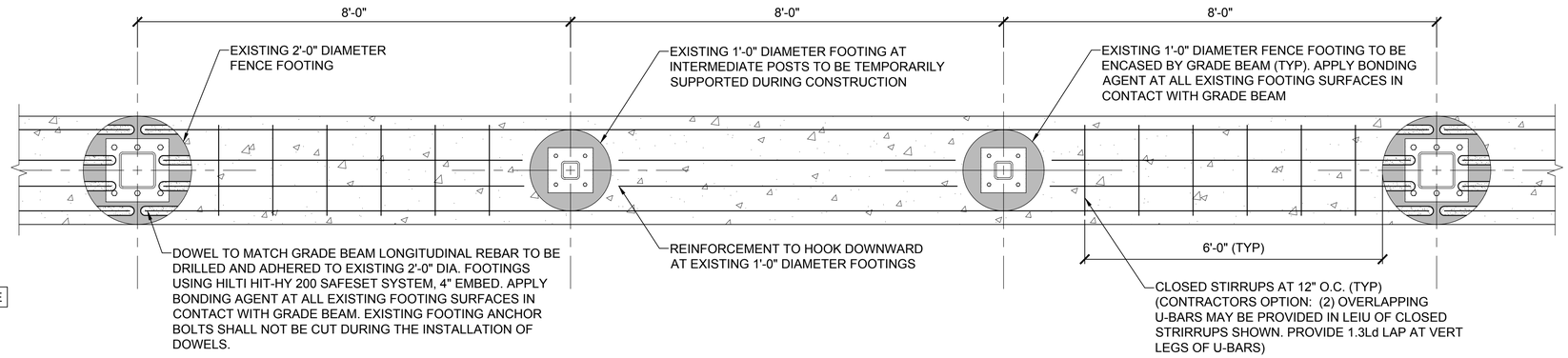
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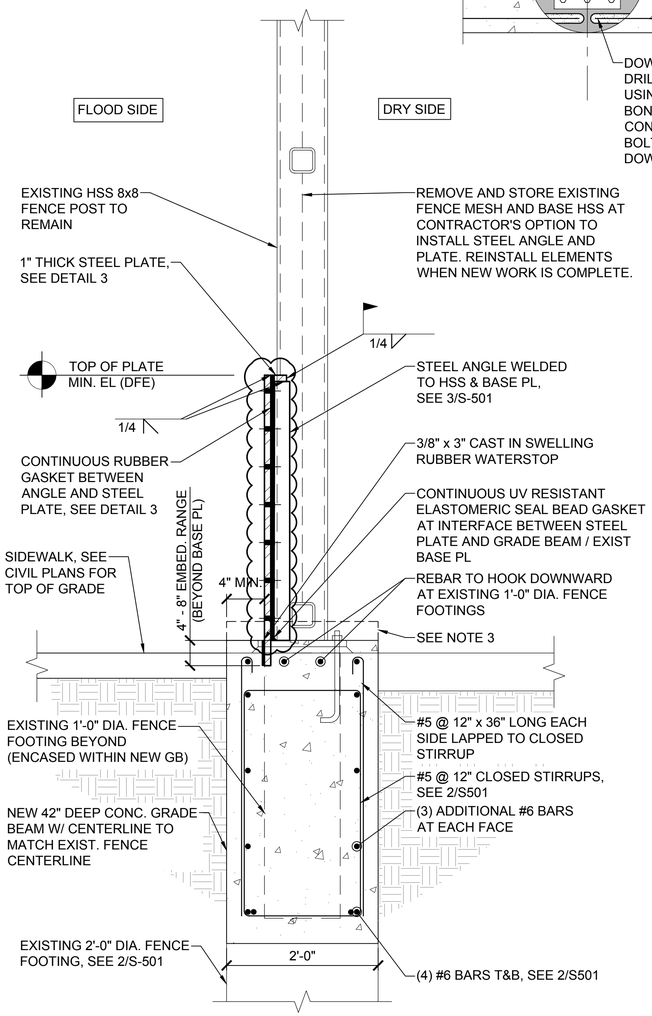
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S-104

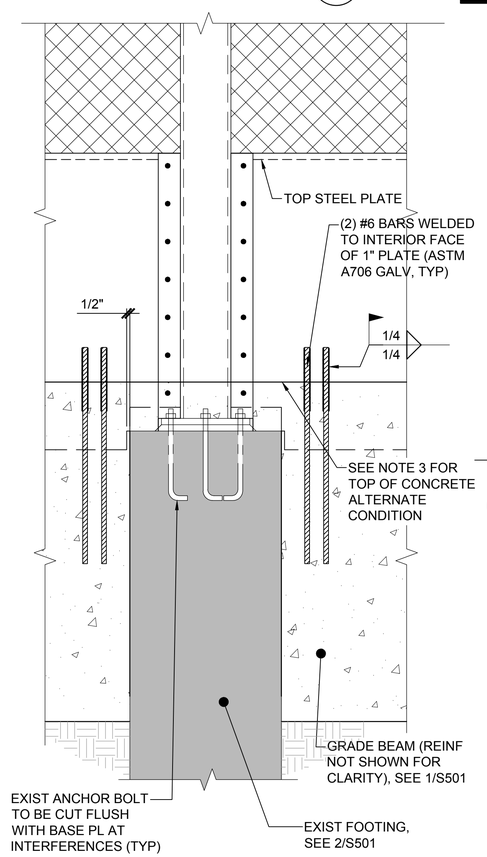


2 S-501 GRADE BEAM CONNECTION DETAIL AT EXISTING FENCE TO REMAIN

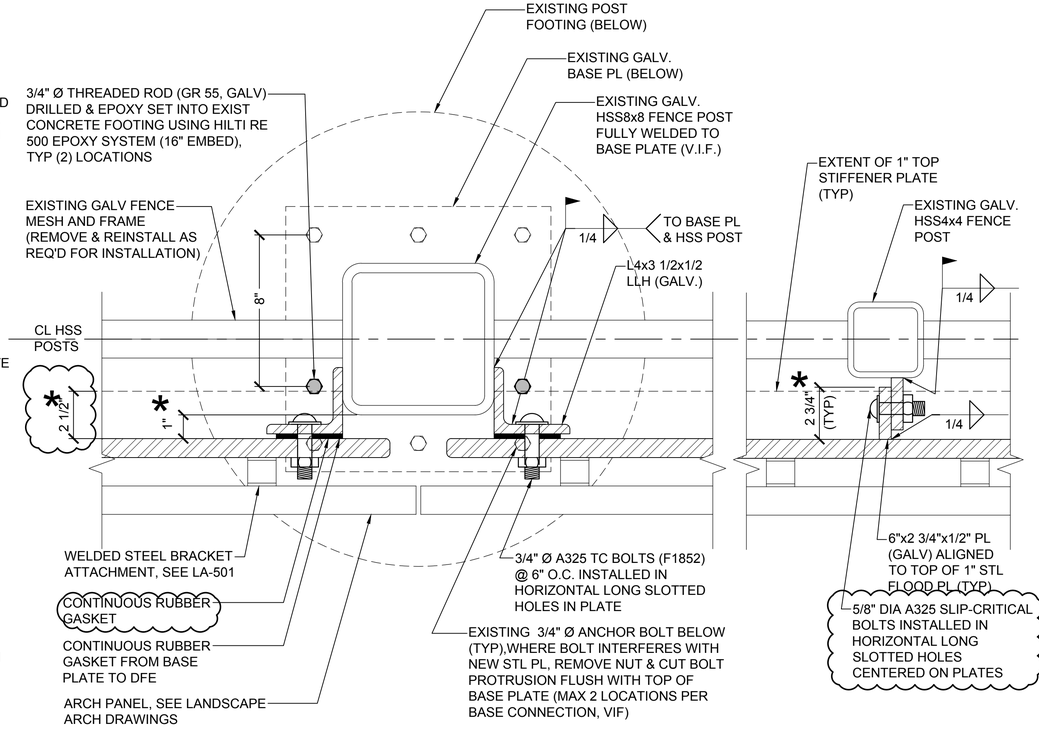
1 1/2"=1'-0" 0 1" 1' 6"



SECTION



ELEVATION



1 S-501 STEEL PLATE FLOOD WALL SECTION

1"=1'-0" 0 1' 2'

NOTES:

1. EXCAVATION DEPTH EXCEEDS DEPTH OF EXISTING HSS4x4 FENCE FOUNDATIONS. PROVIDE BRACING AS REQUIRED TO MAINTAIN STABILITY AND PLUMBNESS OF FENCE ELEMENTS DURING CONSTRUCTION. DESIGN OF BRACING ELEMENTS AND METHODOLOGY TO BE DETERMINED BY CONTRACTOR'S ENGINEER. SEE S-001 "SPECIAL CONSTRUCTION CONSIDERATIONS" NOTE 2.
2. WHERE STEEL PLATE FLOODWALL IS FACETED IN PLAN, PROVIDE BENT PLATES AT CONNECTION TO COLUMN IN LIEU OF ANGLES SHOWN.
3. IF TOP OF CONCRETE GRADE BEAM IS NOT A MINIMUM OF 4" ABOVE THE EXISTING FENCE BASE PLATE, PROVIDE LOCAL NOTCHING OF CONCRETE AS SHOWN IN DETAIL 1/S-508.
4. THE PROJECT INTENT IS FOR GRADE BEAM ALIGNMENT TO FOLLOW THE ALIGNMENT OF EXISTING HSS8x8 SONOTUBE FOOTINGS. THE MINIMUM COVER DIMENSION OF PLATE MUST BE MAINTAINED WHERE THERE ARE VARIATIONS IN EXISTING CONDITIONS.

3 S-501 STEEL PLATE TO EXISTING POST CONNECTION DETAIL

3"=1'-0" 0 3" 6" 9"

NOTES:

1. ALL STEEL PLATE SEGMENTS MUST SPAN BETWEEN AND TERMINATE AT EXISTING OR NEW HSS8x8 POSTS WHERE THE FLOOD WALL IS NOT CONCRETE.
2. * REPRESENTS THE DIMENSION AT THE OUTERMOST POST IN A GIVEN STREET SEGMENT. THIS DIMENSION CAN GROW BY AN ADDITIONAL INCH TO ACCOUNT FOR LOCATION VARIATIONS. SHOULD THE REQUIRED SURVEY REVEAL LOCATION WHERE A 1" VARIATION IS EXCEEDED, INCREASE THE ANGLE LEG SIMILARLY TO ENSURE A PROPER CONNECTION. THE PROJECT INTENT IS FOR THE STEEL PLATE TO BE AS STRAIGHT AS POSSIBLE ON EACH STREET REGARDLESS OF VARIATIONS IN THE EXISTING FENCE POST LOCATION.

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D	11/15/19	100% DESIGN SUBMITTAL	AC
C	11/01/19	ISSUED FOR BID- 95%	AC
B	10/18/19	75% DESIGN SUBMITTAL	AC
A	09/06/19	50% DESIGN SUBMITTAL	AC

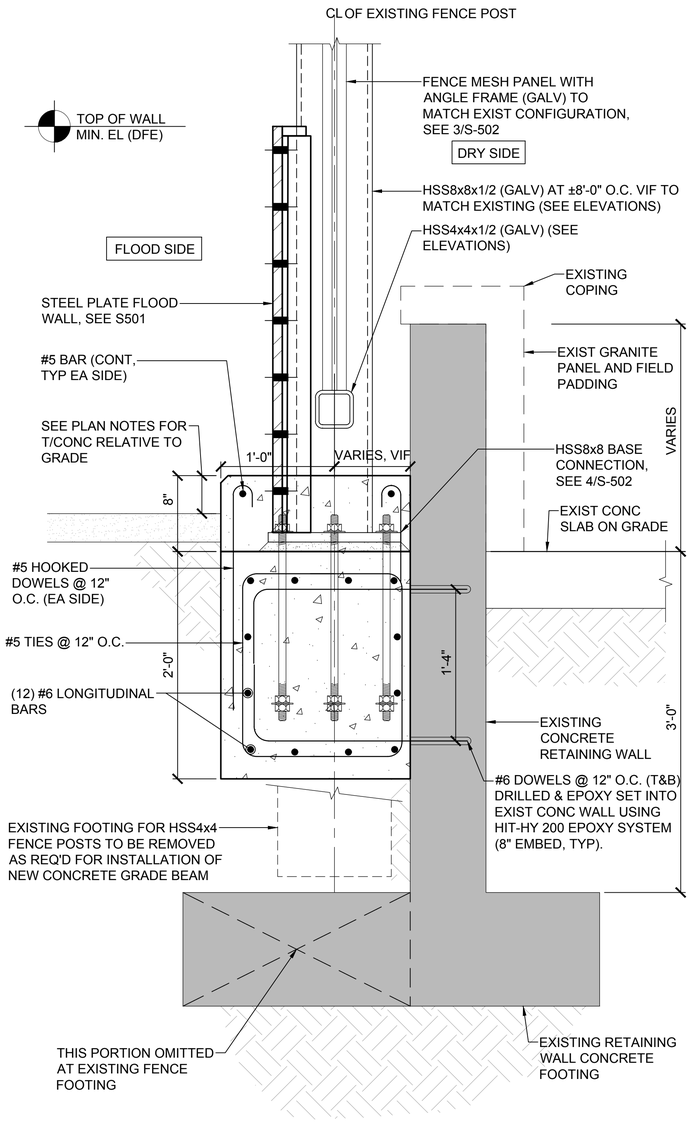
ISSUE BLOCK

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DRAWN BY:	N. TOLLI
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SHEET TITLE

STEEL PLATE WALL SECTIONS AND DETAILS

S-501

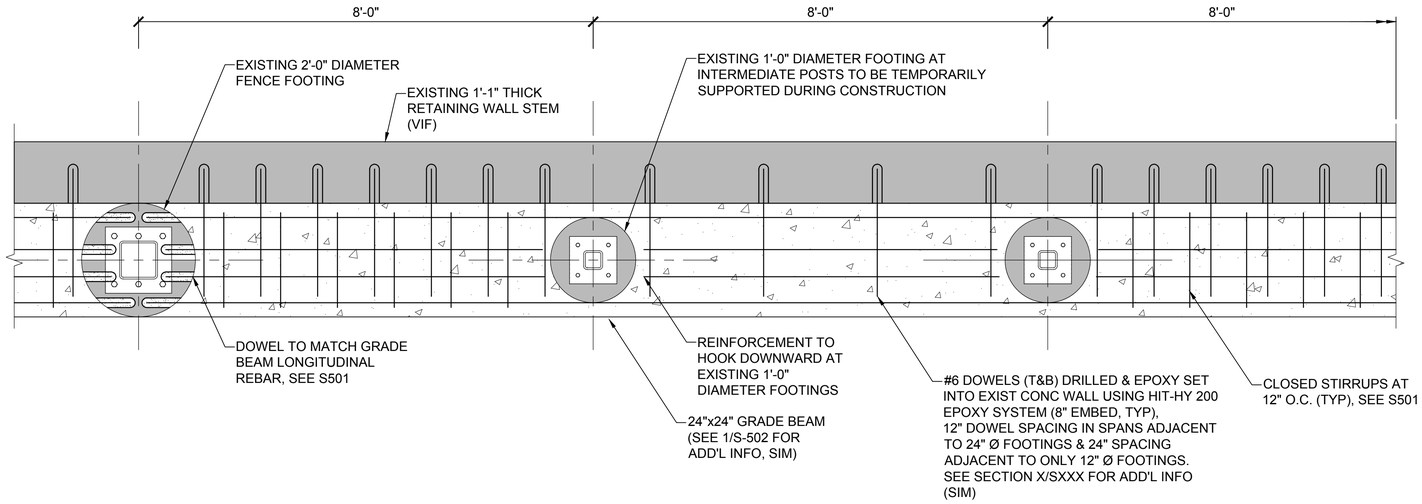


1 S-502 FLOODWALL DETAIL AT EXISTING 8'-0" FENCE

1 1/2"=1'-0" 0 1' 1' 6"

NOTES:

1. CONTRACTOR SHALL USE GROUND PENETRATING RADAR (GPR) TO IDENTIFY LOCATION OF EXISTING REINFORCEMENT IN ORDER TO AVOID CUTTING REINFORCEMENT DURING INSTALLATION OF NEW DOWELS.
2. DIMENSION FROM CENTERLINE OF POST TO FACE OF GRADE BEAM TO MATCH DIMENSION FROM CENTERLINE OF POST TO EXISTING FACE OF HSS8x8 SONOTUBE FOOTING AT RETAINING WALL WITH EXISTING 24'-0" FENCE PER EXISTING DRAWINGS.

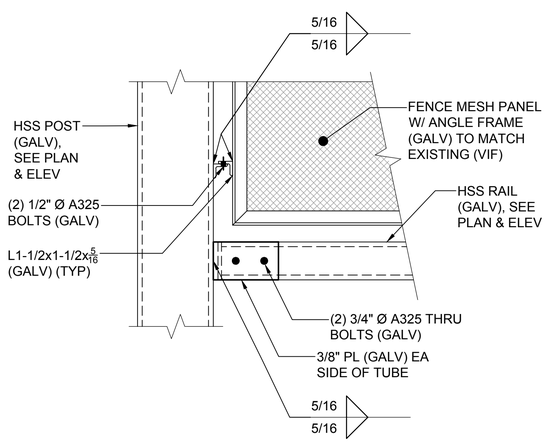


2 S-502 FOUNDATION REINFORCING DETAIL AT EXISTING RETAINING WALL AT 24'-0" FENCE

3/4"=1'-0" 0 1' 2' 3'

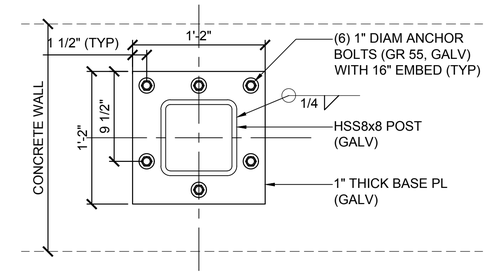
NOTES:

1. REFER TO DETAIL 2/S501 FOR ADD'L INFORMATION NOT SHOWN.
2. CONTRACTOR SHALL USE GROUND PENETRATING RADAR (GPR) TO IDENTIFY LOCATION OF EXISTING REINFORCEMENT IN ORDER TO AVOID CUTTING REINFORCEMENT DURING INSTALLATION OF NEW DOWELS.



3 S-502 FENCE MESH CONNECTION DETAIL

1"=1'-0" 0 1' 2'



4 S-502 HSS8x8 BASE PLATE DETAIL

1"=1'-0" 0 1' 2'

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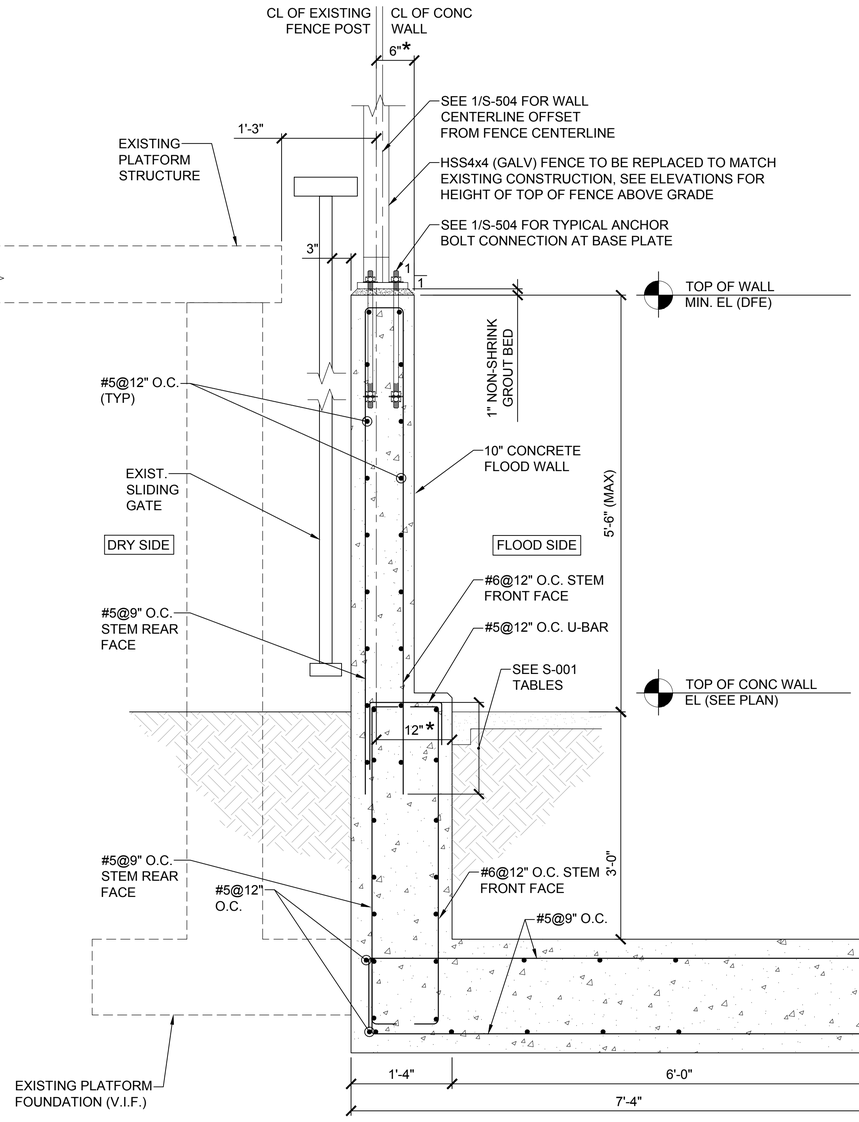
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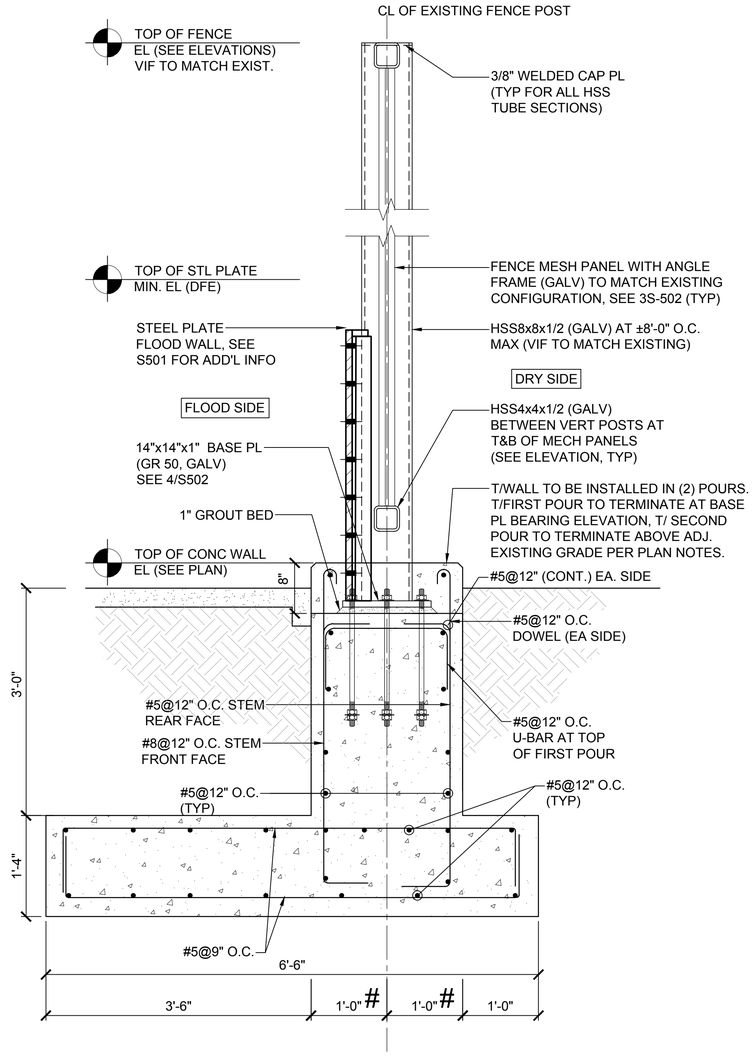
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RETAINING WALL SECTIONS AND DETAILS

S-502





1 CONCRETE WALL SECTION

S-503 — 1"=1'-0" — 0 1' 2'

NOTES:

1. PROJECT INTENT IS FOR NEW SECURITY FENCE ALIGNMENT TO MATCH EXISTING FENCE ALIGNMENT AND FOR CONCRETE WALL FACE TO MATCH STEEL PLATE FACE ON EACH STREET SIDE.
2. * DIMENSIONS REPRESENT THE DIMENSION AT THE OUTERMOST POST IN A GIVEN STREET SEGMENT. THIS DIMENSION CAN GROW BY AN ADDITIONAL INCH TO ACCOUNT FOR LOCATION VARIATIONS. SHOULD THE REQUIRED SURVEY REVEAL LOCATIONS WHERE A 1" VARIATION IS EXCEEDED, THE ALIGNMENT OF THE CONCRETE WALL AND FENCE ON TOP OF CONCRETE WALL SHALL BE ADJUSTED TO ENSURE THE FACE OF THE STEEL PLATE AND CONCRETE WALL MATCH.
3. VERIFY CLEARANCE BETWEEN EXISTING ELECTRICAL EQUIPMENT PLATFORM FOUNDATIONS, SLIDING GATE FOUNDATIONS AND NEW CONCRETE WALL FOUNDATIONS.

2 STEEL PLATE AT NEW FOUNDATION SECTION

S-503 — 1"=1'-0" — 0 1' 2'

NOTES:

1. PROJECT INTENT IS FOR NEW SECURITY FENCE ALIGNMENT TO MATCH EXISTING FENCE ALIGNMENT AND FOR CONCRETE WALL FACE TO MATCH STEEL PLATE FACE AT INTERFACE BETWEEN DETAILS. ALIGNMENT OF FOUNDATION CURB FACE SHOULD MATCH THE CURB FACE AT NEW GRADE BEAM AND NEW CONCRETE WALL SECTION.
2. # DIMENSIONS ASSUME THAT FOOTING LINES UP WITH A GRADE BEAM CENTERED ON THE EXISTING FENCE CENTERLINE. ALIGNMENT OF GRADE BEAM CAN VARY BASED ON WHETHER OR NOT THE EXISTING FENCE POSTS ARE CENTERED ON THEIR SONOTUBE FOUNDATIONS. SHOULD THE GRADE BEAM NOT BE CENTERED ON THE EXISTING FENCE CENTERLINE, THE ALIGNMENT OF THE FOOTING SHALL BE ADJUSTED TO HAVE FACE OF GRADE BEAM AND FACE OF FOOTING MATCH. SEE 1/S-501 FOR GRADE BEAM ALIGNMENT AND MINIMUM ALLOWABLE STEEL PLATE CONCRETE COVER.

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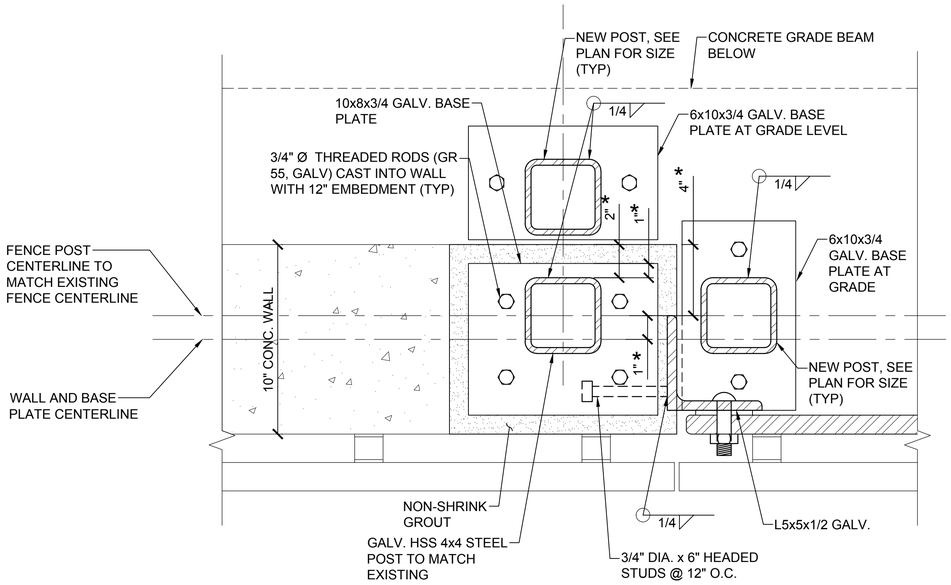
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CONCRETE WALL SECTIONS AND DETAILS

S-503

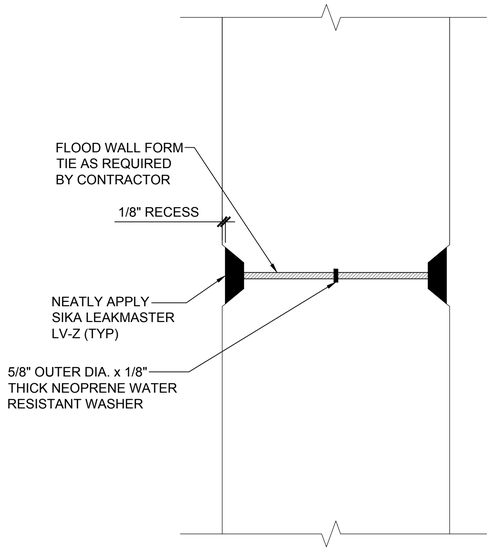


1 S-504 CONCRETE WALL TO STEEL PLATE TRANSITION DETAIL

1"=1'-0" 0 1' 2'

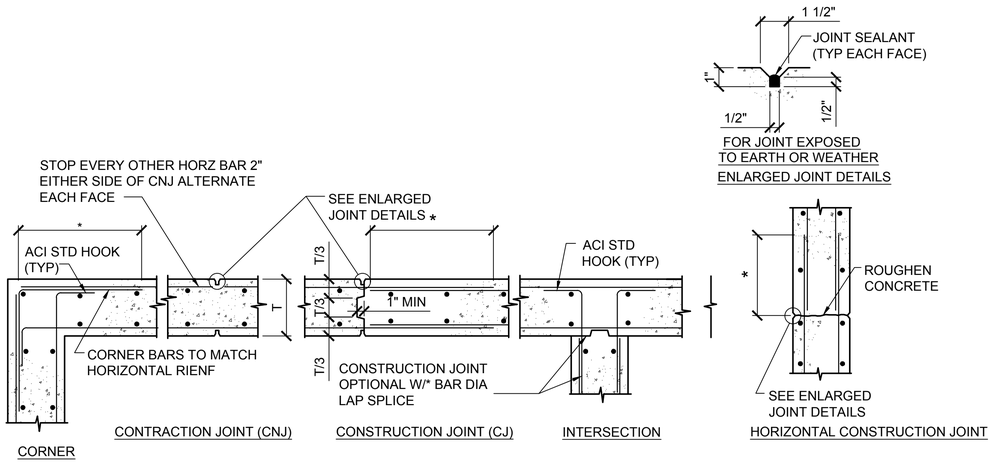
NOTES:

1. PROJECT INTENT IS FOR NEW SECURITY FENCE ALIGNMENT TO MATCH EXISTING FENCE ALIGNMENT AND FOR CONCRETE WALL FACE TO MATCH STEEL PLATE FACE ON EACH STREET SIDE.
2. * DIMENSIONS REPRESENTS THE DIMENSION AT THE OUTERMOST POST IN A GIVEN STREET SEGMENT. THIS DIMENSION CAN GROW BY AN ADDITIONAL INCH TO ACCOUNT FOR LOCATION VARIATIONS. SHOULD THE REQUIRED SURVEY REVEAL LOCATIONS WHERE A 1" VARIATION IS EXCEEDED, THE ALIGNMENT OF THE CONCRETE WALL AND FENCE ON TOP OF CONCRETE WALL SHALL BE ADJUSTED TO ENSURE THE FACE OF THE STEEL PLATE AND CONCRETE WALL MATCH.



2 S-504 TYPICAL FORM TIE DETAIL

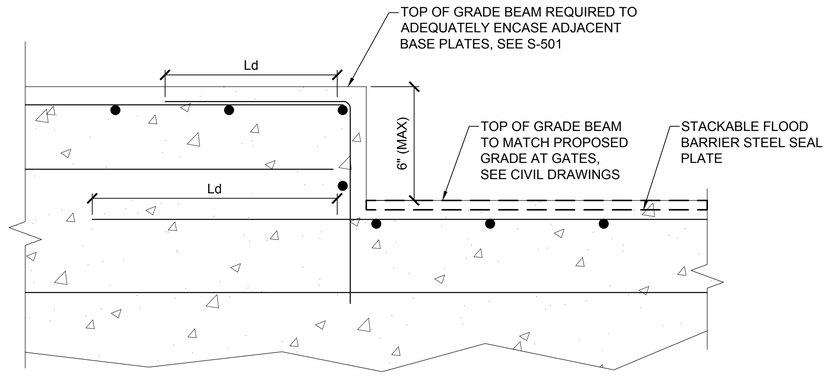
NOT TO SCALE



3 S-504 TYPICAL CONCRETE WALL JOINT DETAILS

NOT TO SCALE

-* REFER TO GENERAL NOTES FOR CONCRETE DEVELOPMENT LENGTH TABLE.
- PROVIDE V-GROOVE AT VERTICAL CONSTRUCTION JOINTS ONLY.
- T = WALL THICKNESS
- SEE ELEVATIONS FOR WALL JOINT LOCATIONS.



4 S-504 TYPICAL STEPPED FOUNDATION DETAIL AT GATES

NOT TO SCALE

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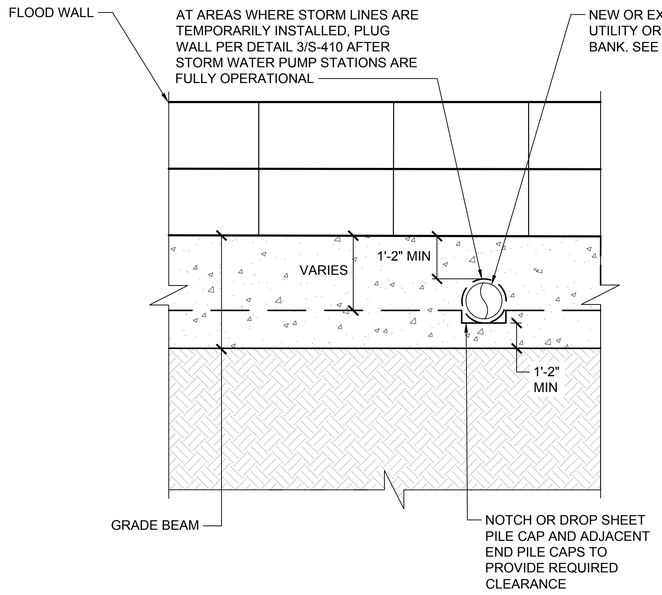
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CONCRETE DETAILS

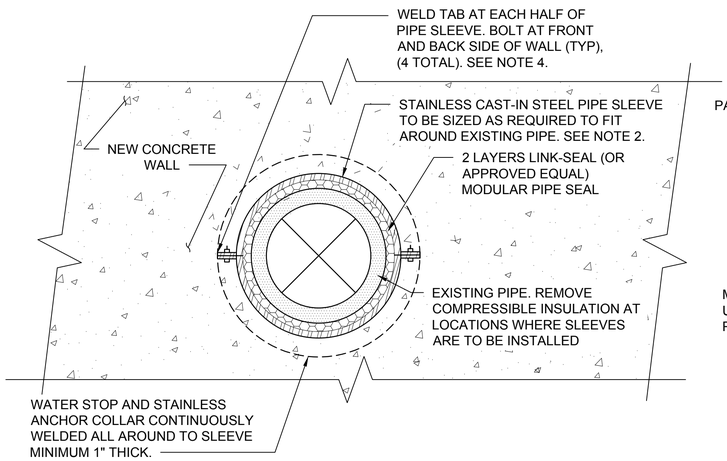
S-504



1 S-505 TYPICAL UTILITY SPAN THROUGH GRADE BEAM OR FOOTING

NOT TO SCALE

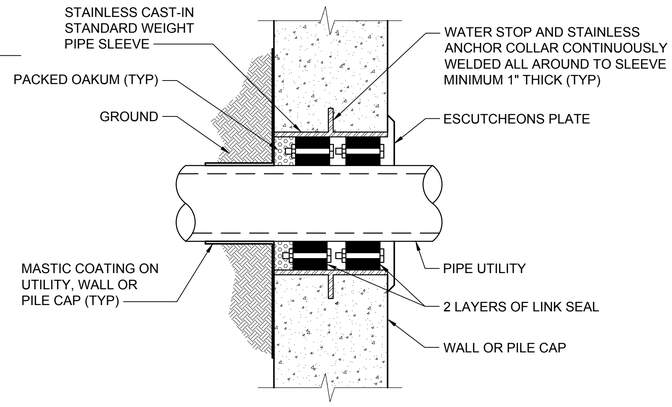
NOTES:
1. PROVIDE STANDARD WEIGHT PIPE SLEEVE AT EACH NEW AND EXISTING PIPE UTILITY. SEE PIPE SLEEVE DETAIL 2/S-505. FOR DETAIL AT DUCT BANK SEE 3/S-505.

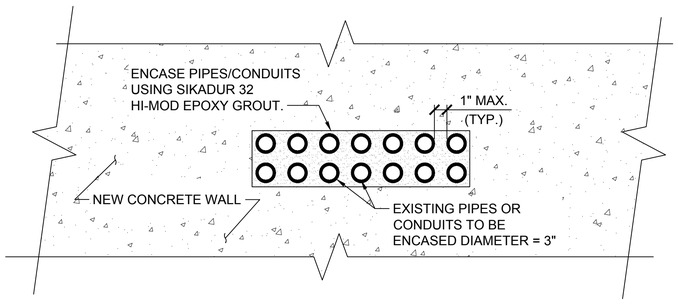


2 S-505 TYPICAL UTILITY SPAN THROUGH GRADE BEAM OR FOOTING

NOT TO SCALE

NOTES:
1. SLEEVE DETAIL SHALL APPLY FOR ALL PIPES LARGER THAN 2" IN DIAMETER AND HOT-OPERATING PIPES OF ALL SIZES. SMALLER COLD PIPES AND ALL CONDUITS SHALL BE ENCASED DIRECTLY IN CONCRETE.
2. SEE LINK-SEAL (OR APPROVED EQUAL) MANUFACTURER SPECIFICATIONS FOR REQUIRED PIPE SLEEVE SIZE & APPROPRIATE LINK-SEAL PRODUCT FOR SPECIFIC PIPE MATERIAL, DIAMETER, AND TYPE.
3. FOR UTILITY WIDTH LESS THAN 24", PROVIDE (1) ADDITIONAL FULL HEIGHT VERTICAL TENSION AND COMPRESSION BAR AT EACH SIDE OF UTILITY TO MATCH VERTICAL REINFORCEMENT. FOR UTILITY WIDTH UP TO 48", PROVIDE (2) VERTICAL TENSION AND COMPRESSION BARS EACH SIDE. PROVIDE (2) #6 BARS AT TOP AND BOTTOM OF UTILITY WITH FULL DEVELOPMENT LENGTH PAST EDGE OF UTILITY.
4. CAST-IN STEEL PIPE MAY BE WELDED IN PLACE IN LIEU OF BOLTING BUT IS NOT PERMITTED AT GAS LINES.
5. FOR UTILITIES LESS THAN 2" PENETRATING THROUGH FOUNDATION, PLACE OR BEND REINFORCEMENT TO AVOID UTILITY AND ENCASE UTILITY DIRECTLY IN CONCRETE.
6. FOR UTILITIES LARGER THAN 14" IN DIAMETER, THE ENGINEER SHALL BE NOTIFIED.





3 S-505 TYPICAL UTILITY GROUP PENETRATION DETAIL

NOT TO SCALE

NOTE:
1. FOR UTILITY GROUP WIDTH LESS THAN 24", PROVIDE (1) ADDITIONAL FULL HEIGHT VERTICAL TENSION AND COMPRESSION BAR AT EACH SIDE OF UTILITY GROUP TO MATCH VERTICAL WALL REINFORCEMENT. FOR UTILITY GROUP WIDTH UP TO 48", PROVIDE (2) VERTICAL TENSION AND COMPRESSION BARS EACH SIDE. PROVIDE (2) #6 BARS AT TOP AND BOTTOM OF UTILITY GROUP WITH FULL DEVELOPMENT LENGTH PAST EDGE OF UTILITY GROUP.

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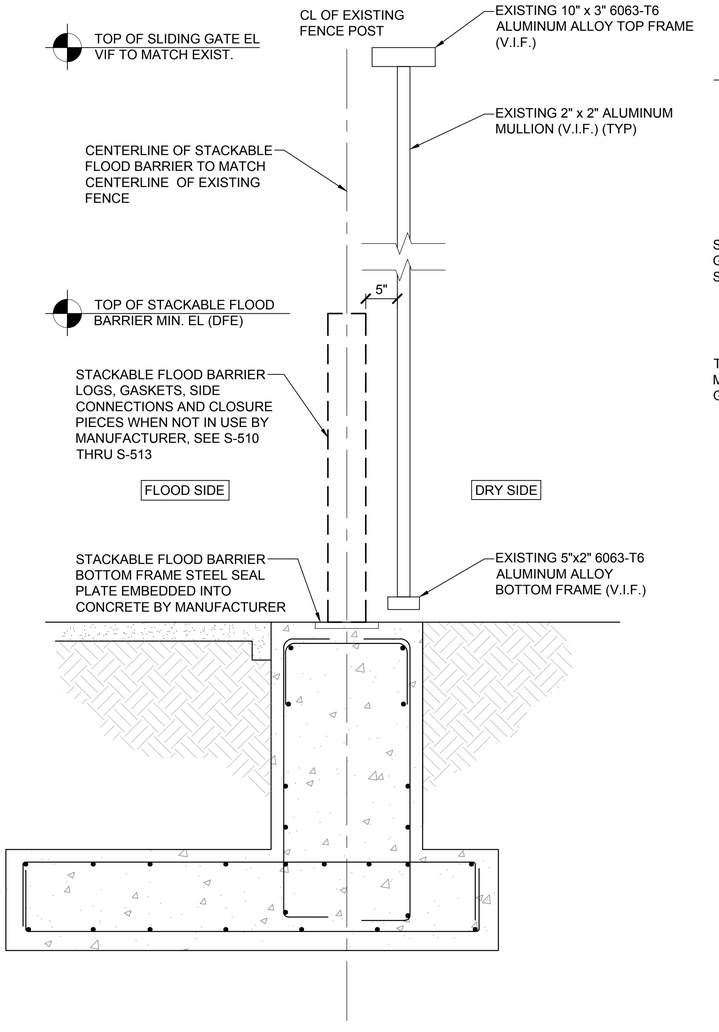
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TYPICAL UTILITY CROSSING DETAILS

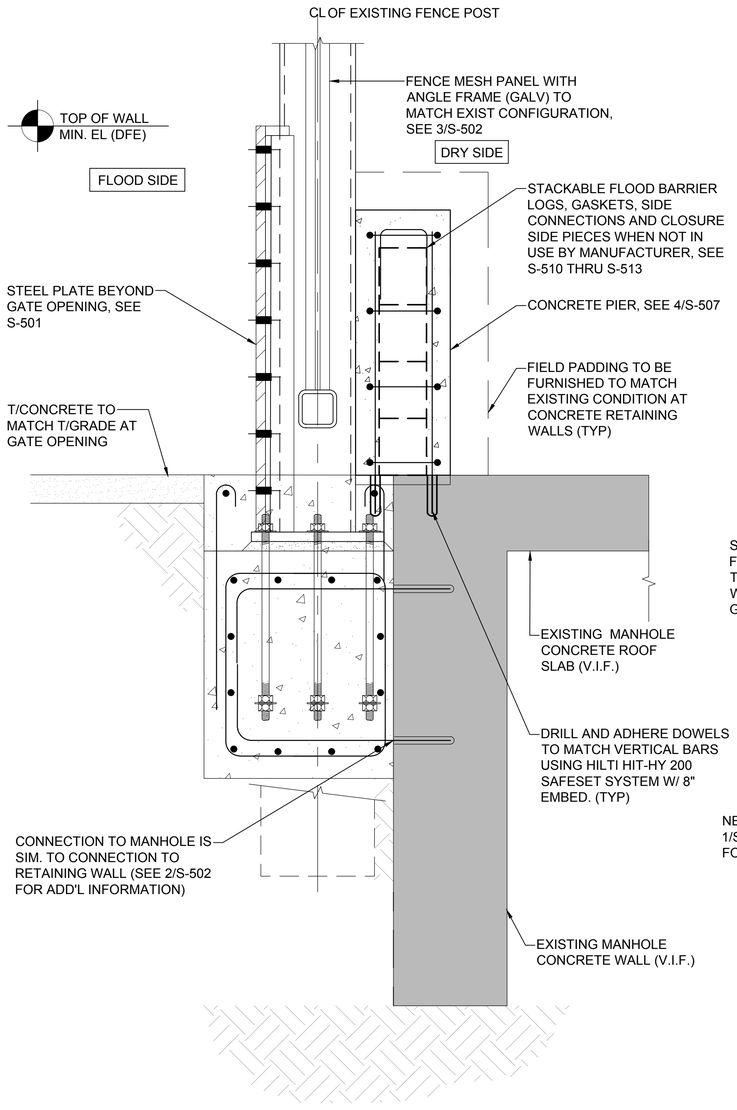
S-505



1 S-506 MURRAY STREET VEHICULAR GATE SECTION

1"=1'-0" 0 1' 2'

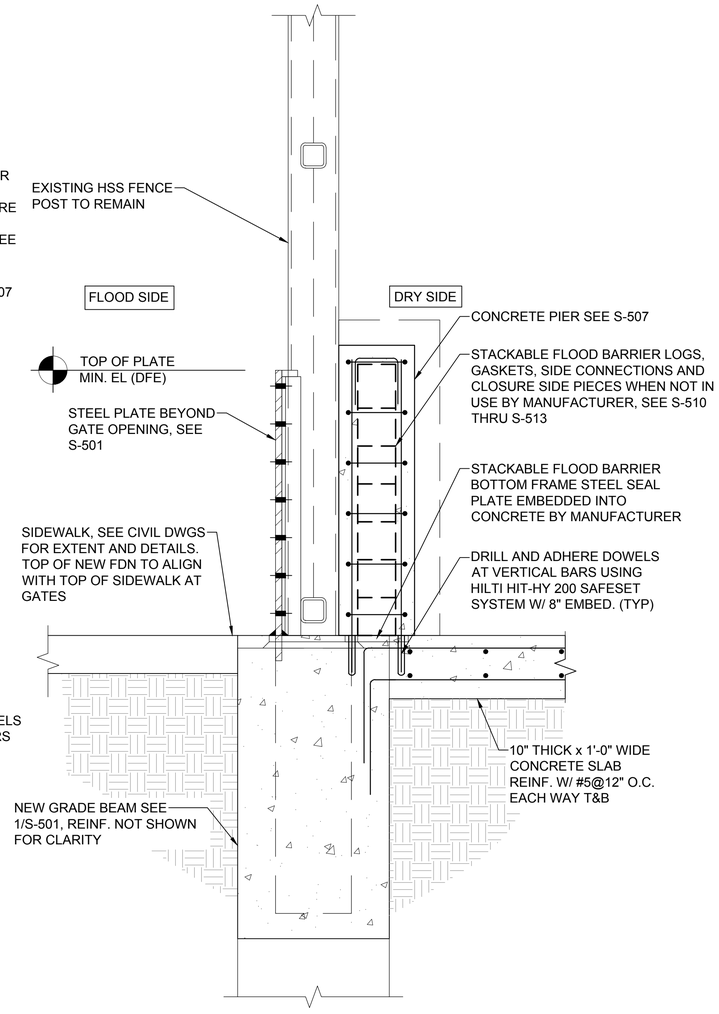
NOTES:
1. SEE 2/S-503 FOR ADDITIONAL INFORMATION NOT SHOWN.



2 S-506 MURRAY STREET PEDESTRIAN GATE SECTION

1 1/2"=1'-0" 0 1' 1' 6"

NOTES:
1. SEE 1/S-502 FOR ADDITIONAL FOUNDATION INFORMATION NOT SHOWN.



3 S-506 WARREN STREET PEDESTRIAN GATE SECTION

1"=1'-0" 0 1' 2'

NOTES:
1. SEE S-501 FOR ADDITIONAL INFORMATION NOT SHOWN.

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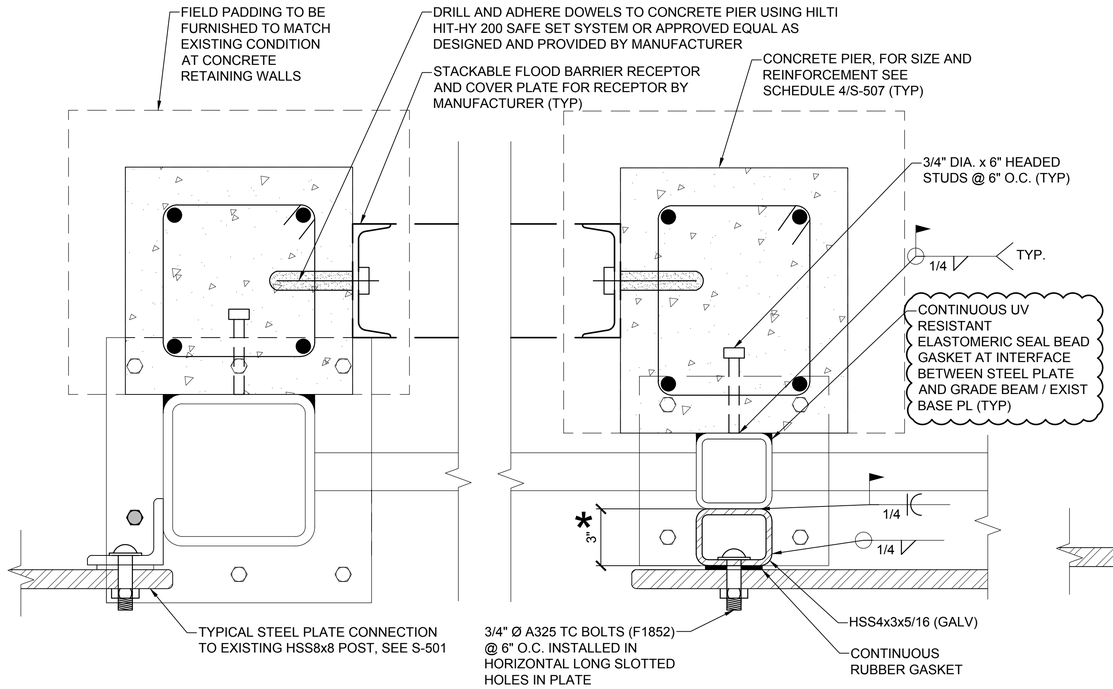
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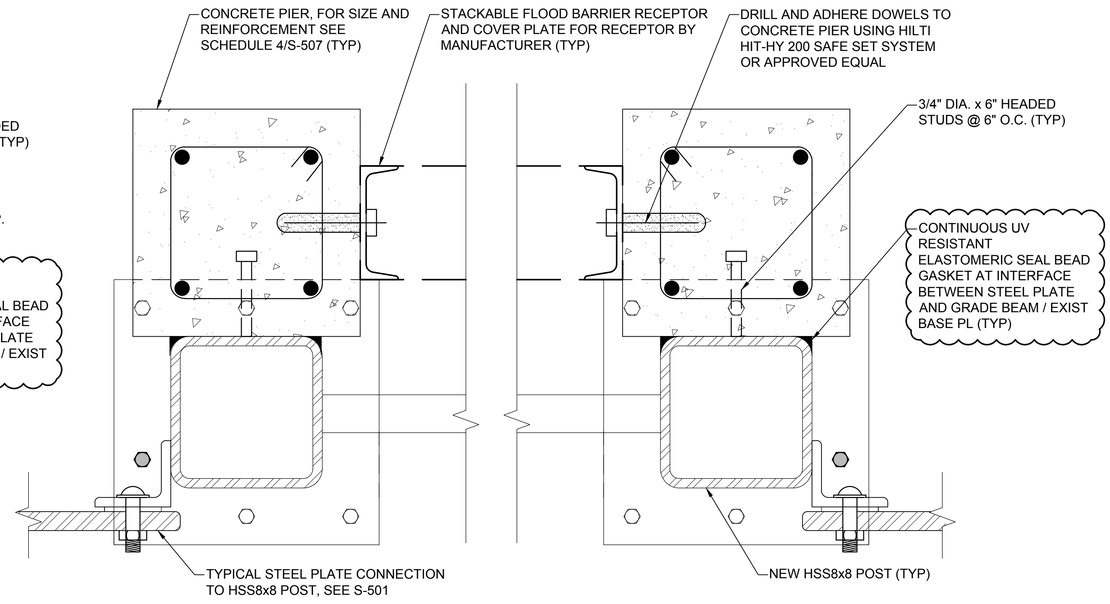
WALL SECTIONS AT GATES

S-506



1 S-507 WARREN STREET PEDESTRIAN GATE PLAN DETAIL

3"=1'-0" 0 3" 6" 9"

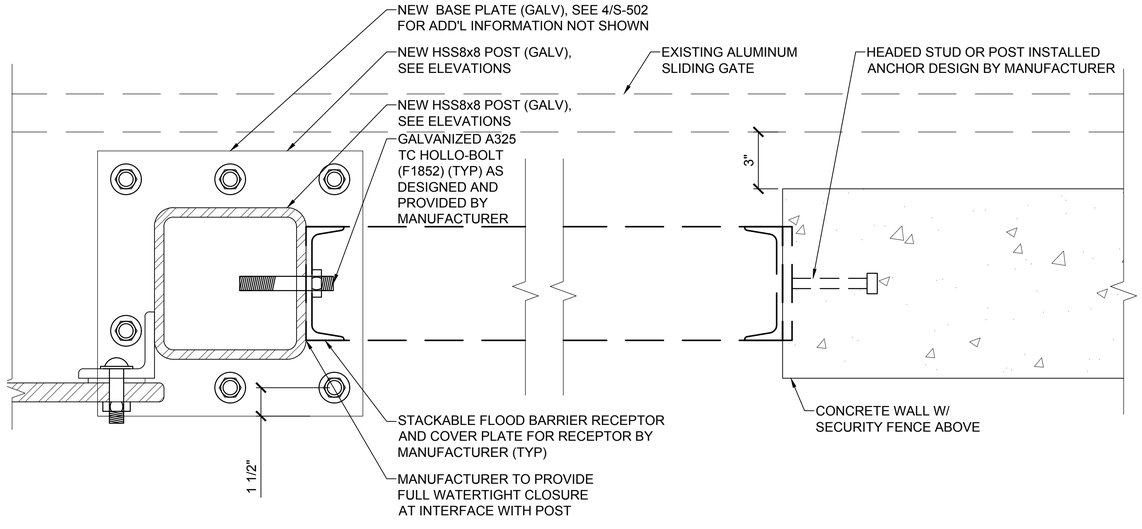


2 S-507 MURRAY STREET PEDESTRIAN GATE PLAN DETAIL

3"=1'-0" 0 3" 6" 9"

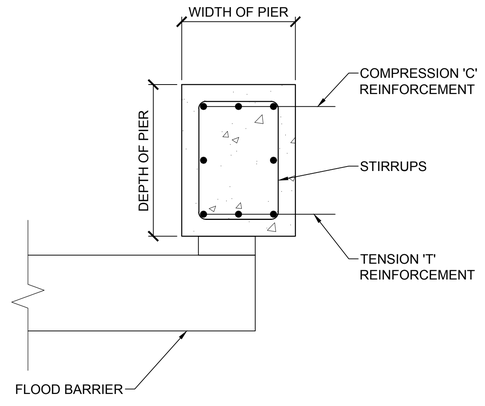
NOTES:

1. TOP OF NEW HSS POST TO MATCH TOP OF STEEL PLATE. NEW HSS POST TO BE SEALED WITH A 3/8" CAP PLATE.
2. * REPRESENTS THE DIMENSION AT THE OUTERMOST POST IN A GIVEN STREET SEGMENT. THIS DIMENSION CAN GROW BY AN ADDITIONAL INCH TO ACCOUNT FOR LOCATION VARIATIONS. SHOULD THE REQUIRED SURVEY REVEAL LOCATIONS WHERE A 1" VARIATION IS EXCEEDED, INCREASE THE STEEL TUBE SIZE SIMILAR TO ENSURE A PROPER CONNECTION. THE PROJECT INTENT IS FOR THE STEEL PLATE TO BE AS STRAIGHT AS POSSIBLE ON EACH STREET REGARDLESS OF VARIATIONS IN THE EXISTING FENCE POST LOCATION.



3 S-507 MURRAY STREET VEHICULAR GATE PLAN DETAIL

3"=1'-0" 0 3" 6" 9"



PIER SCHEDULE					
LOCATION	DIMENSIONS		REINFORCEMENT		
	WIDTH	DEPTH	REINF 'T'	REINF 'C'	STIRRUPS
MURRAY PEDESTRIAN EAST	8	8	2#5	2#5	2 LEGS #4@8"
MURRAY PEDESTRIAN WEST	8	8	2#5	2#5	2 LEGS #4@8"
WARREN PEDESTRIAN EAST	12	10	2#6	2#6	2 LEGS #4@8"
WARREN PEDESTRIAN WEST	12	12	2#6	2#6	2 LEGS #4@8"

4 S-507 CONCRETE PIER SCHEDULE

1 1/2"=1'-0" 0 1' 1' 6"

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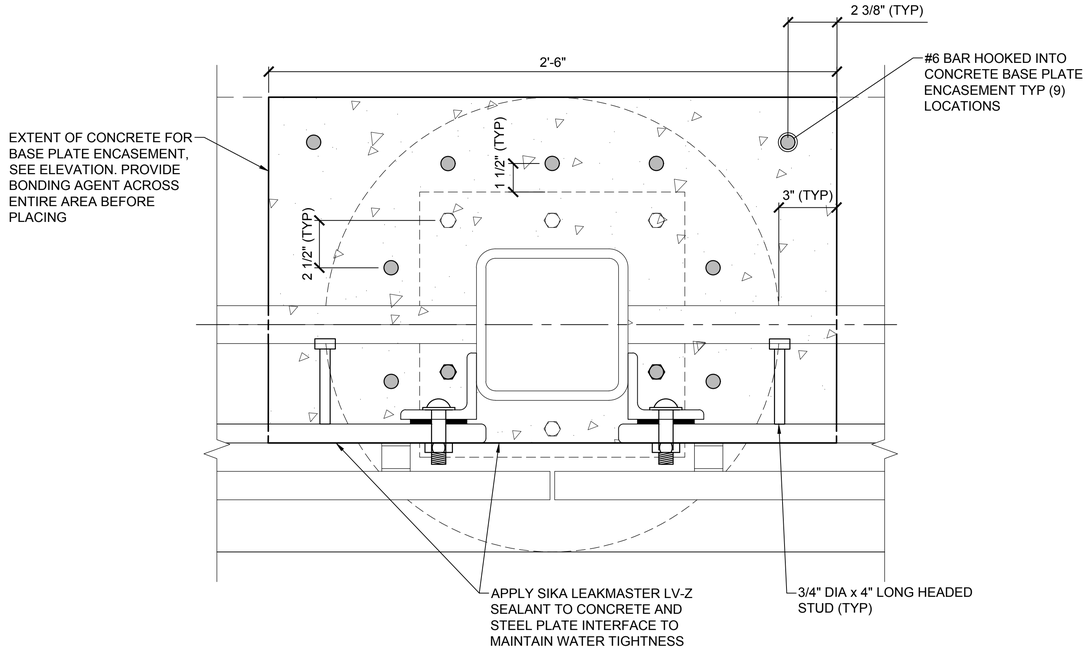
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PLAN DETAILS AT GATES

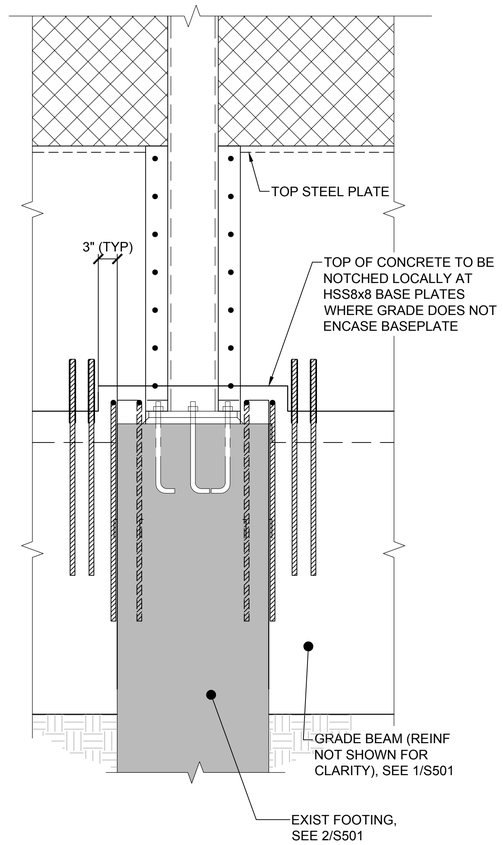
S-507



1 BASE PLATE ENCASEMENT PLAN DETAIL

S-508 — 3"=1'-0" — 0 3" 6" 9"

NOTES:
1. REFER TO S-501 FOR ALL ADDITIONAL INFORMATION NOT SHOWN.
2. DETAIL TO BE USED WHEN TOP OF GRADE BEAM DOES NOT PROVIDE A MINIMUM OF 4" OF CONCRETE ABOVE TOP OF EXISTING FENCE BASE PLATE.



2 BASE PLATE ENCASEMENT ELEVATION

S-508 — 1"=1'-0" — 0 1' 2'

NOTES:
1. REFER TO S-501 FOR ALL ADDITIONAL INFORMATION NOT SHOWN.
2. DETAIL TO BE USED WHEN TOP OF GRADE BEAM DOES NOT PROVIDE A MINIMUM OF 4" OF CONCRETE ABOVE TOP OF EXISTING FENCE BASE PLATE.

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CONSULTANTS

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SUITE 605
NEW YORK, NY 10001
www.siteworkscm.com

SEALS

PROJECT IDENTIFICATION

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BATTERY PARK CITY
BALLFIELD AND COMMUNITY CENTER

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A	11/01/19	ISSUED FOR BID- 95%	AC

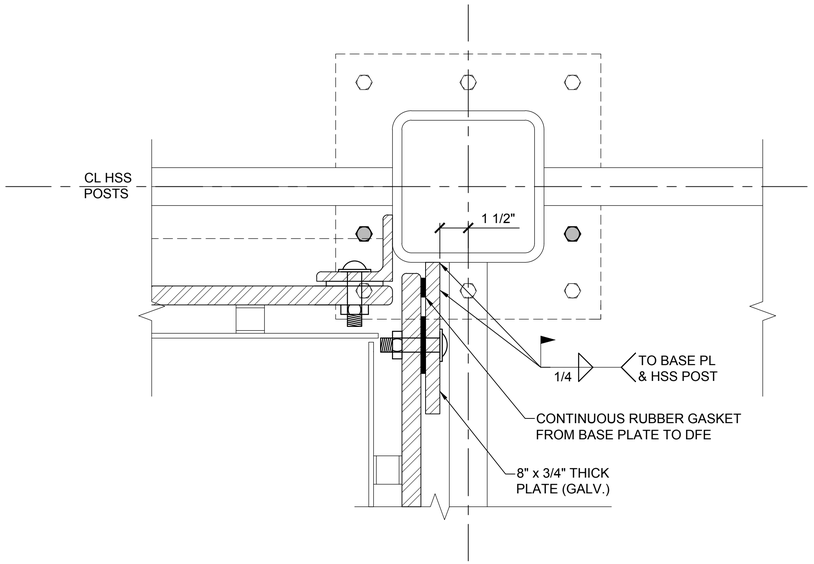
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CHECKED BY:	A. CERINO P.E.
APPROVED BY:	A. CERINO P.E.
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SHEET TITLE

BASE PLATE ENCASEMENT DETAILS

S-508



1
S-509

STEEL PLATE FLOOD WALL CORNER DETAIL

3"=1'-0" 0 3" 6" 9"

NOTES:

1. SEE S-501 FOR ADDITIONAL INFORMATION NOT SHOWN.

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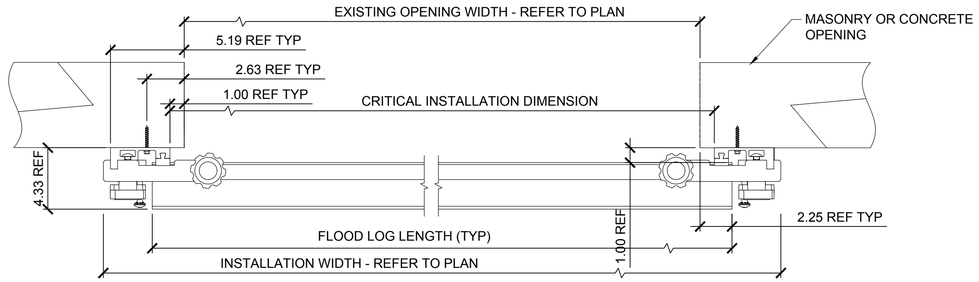
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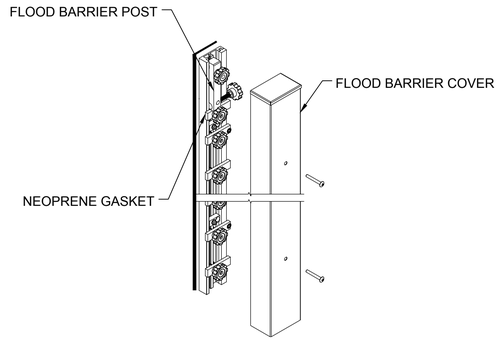
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FLOOD WALL
CORNER DETAIL

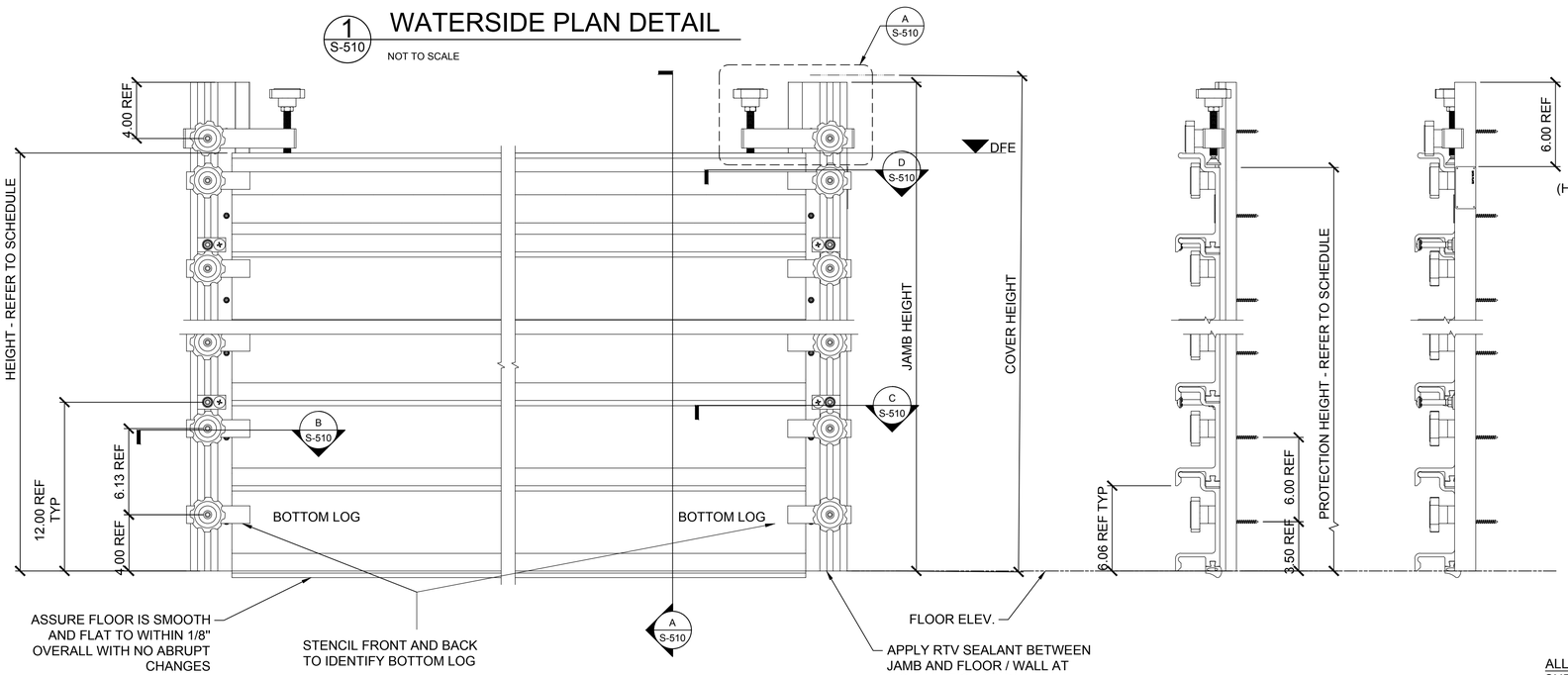
S-509





1 S-510 WATERSIDE PLAN DETAIL

NOT TO SCALE



3 S-510 ELEVATION DETAIL

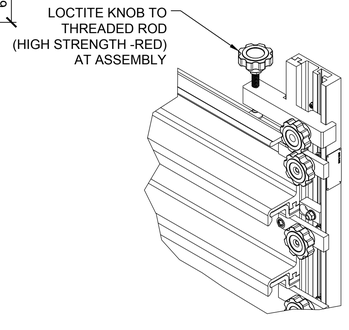
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4 S-510 SECTION B-B

NOT TO SCALE

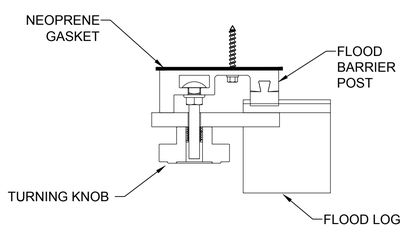
2 S-510 COVER DETAIL

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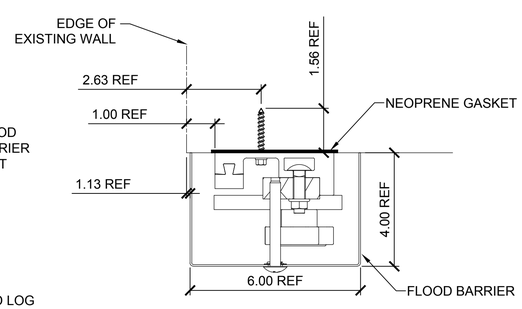
5 S-510 DETAIL A

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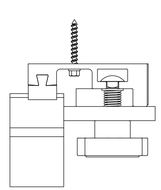
6 S-510 DETAIL D-D

NOT TO SCALE



7 S-510 DETAIL C-C

NOT TO SCALE



8 S-510 DETAIL E-E

NOT TO SCALE

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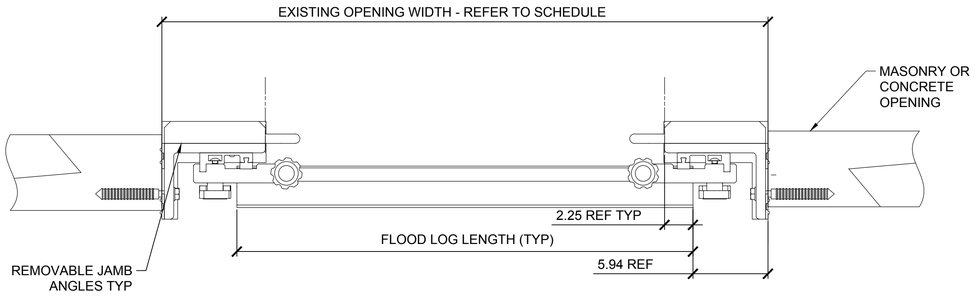
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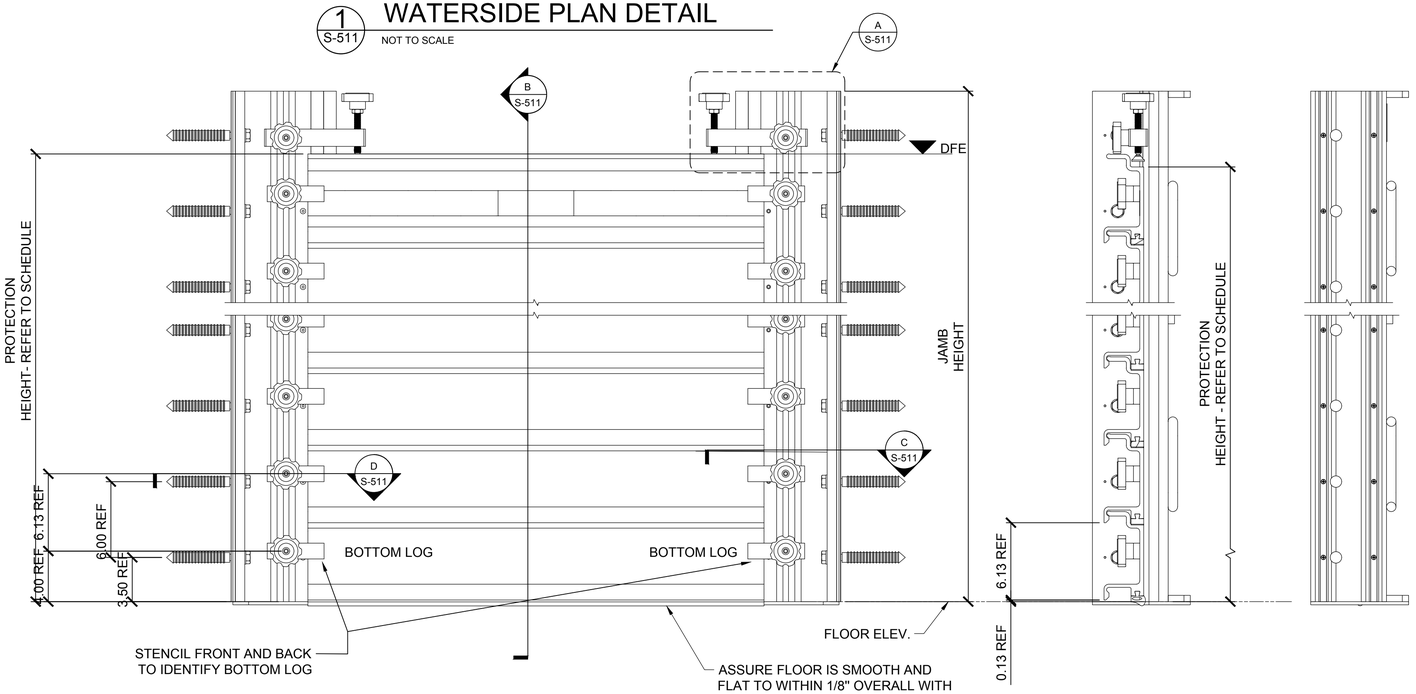
STACKABLE FLOOD BARRIER REFERENCE DETAILS SHEET 1 OF 4

S-510



1 S-511 WATERSIDE PLAN DETAIL

NOT TO SCALE



2 S-511 ELEVATION DETAIL

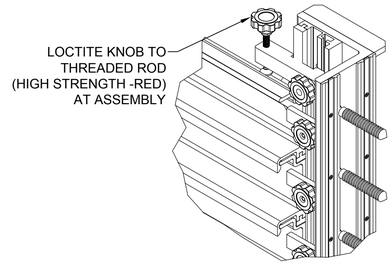
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3 S-511 SECTION B-B

NOT TO SCALE

NOTES:

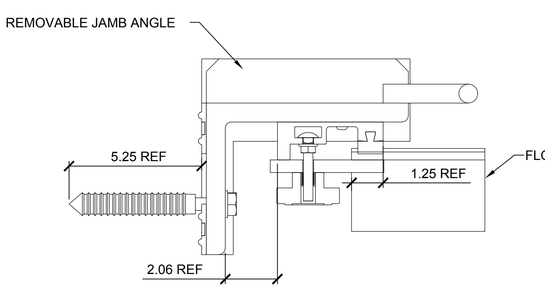
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4 S-511 DETAIL A

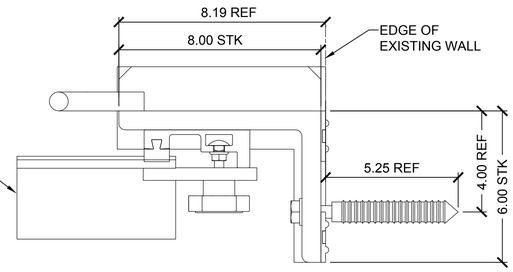
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5 S-511 SECTION D-D

NOT TO SCALE



6 S-511 SECTION C-C

NOT TO SCALE

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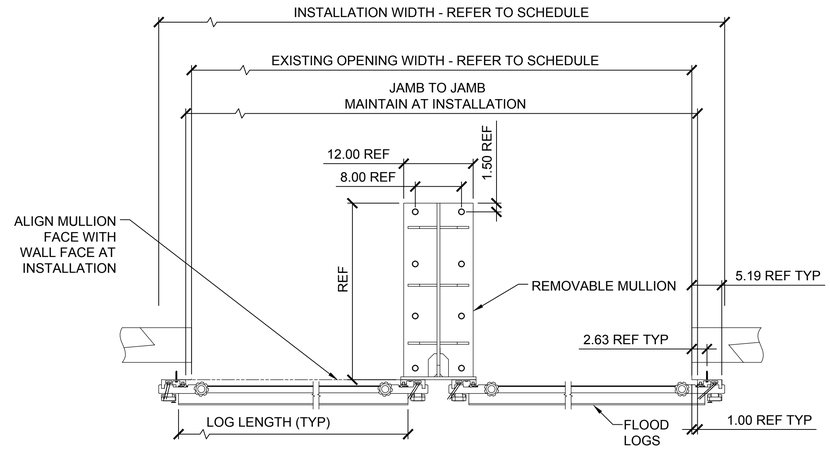
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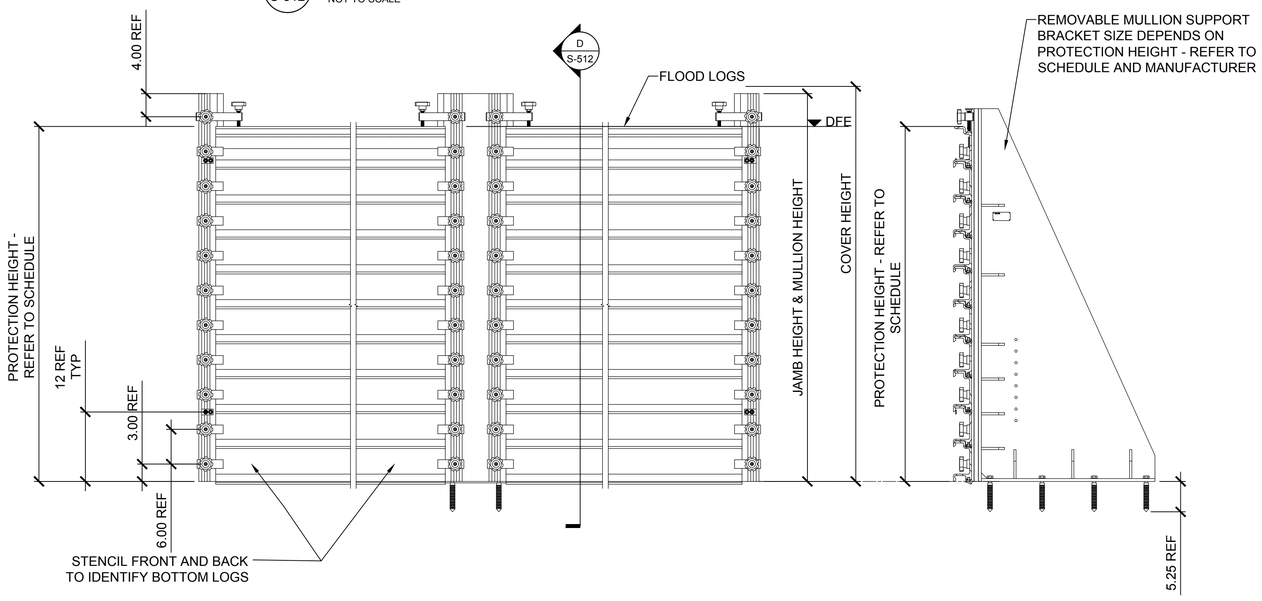
STACKABLE FLOOD BARRIER REFERENCE DETAILS SHEET 2 OF 4

S-511



1 S-512 WATERSIDE PLAN DETAIL

NOT TO SCALE



2 S-512 ELEVATION DETAIL

NOT TO SCALE

3 S-512 SECTION D-D

NOT TO SCALE

NOTES:

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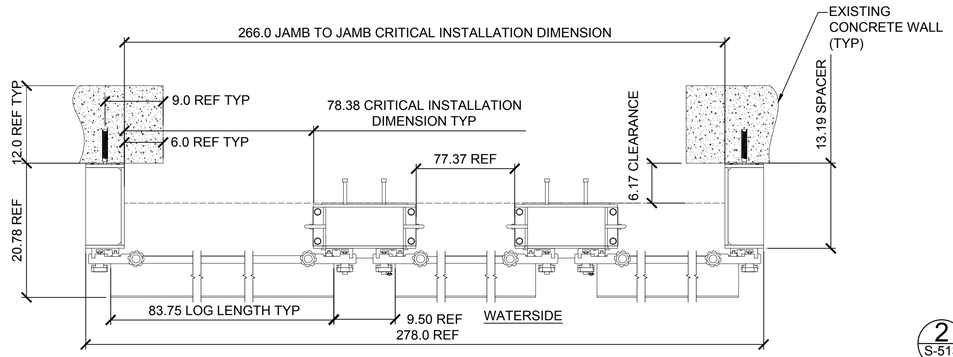
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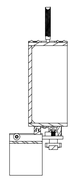
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STACKABLE FLOOD BARRIER REFERENCE DETAILS SHEET 3 OF 4

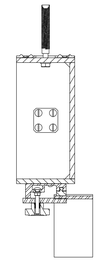
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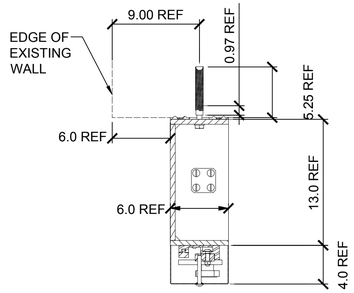
1 S-513 PLAN DETAIL
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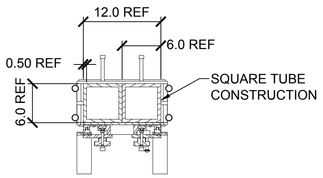
2 S-513 SECTION A-A
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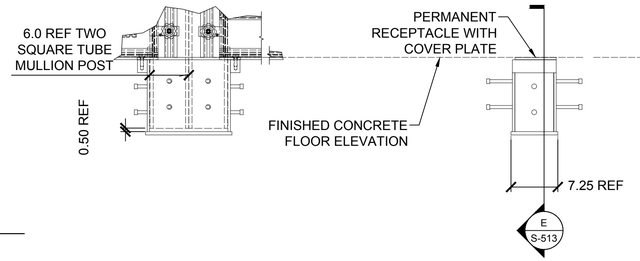
3 S-513 SECTION B-B
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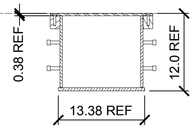


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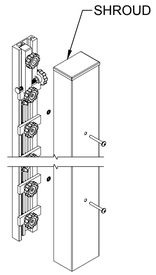


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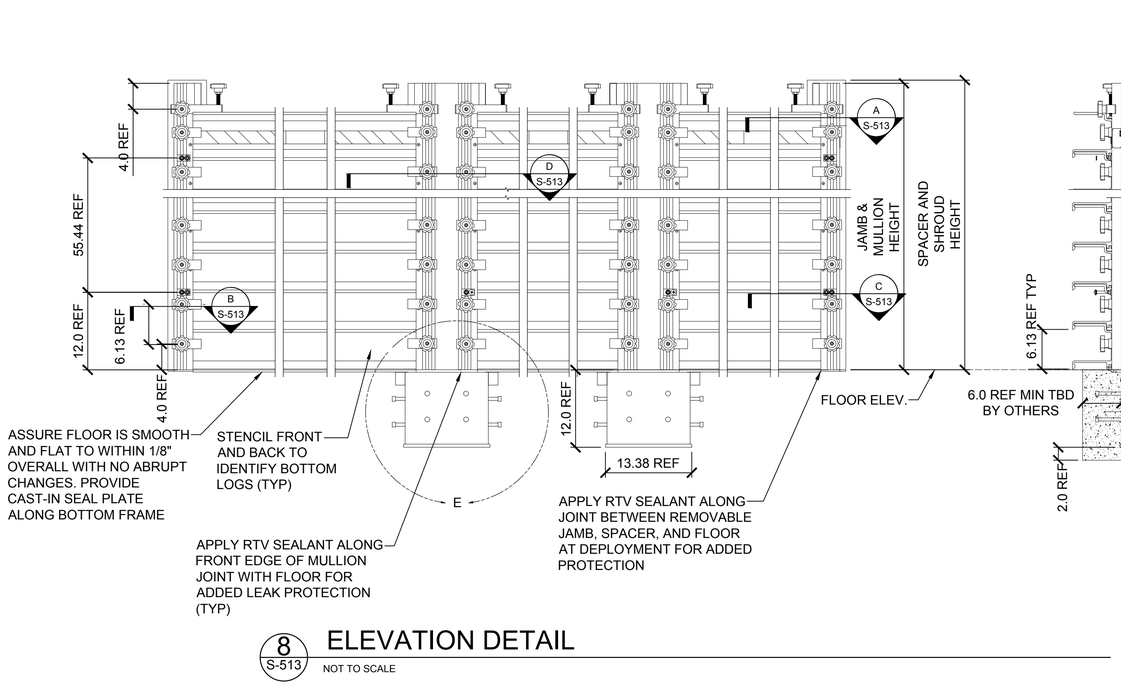




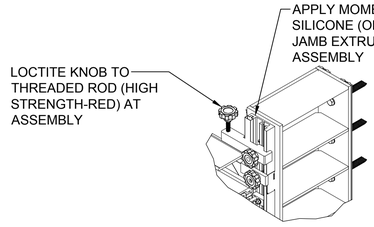
6 S-513 SECTION E-E
NOT TO SCALE



7 S-513 COVER DETAIL
NOT TO SCALE



8 S-513 ELEVATION DETAIL
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SHEET TITLE

STACKABLE FLOOD BARRIER REFERENCE DETAILS SHEET 4 OF 4

S-513

SECTION 00 0010 - TABLE OF CONTENTS

SECT. NO.	SECTION TITLE	REMARKS
00 0010	Table Of Contents	
DIVISION 01	GENERAL REQUIREMENTS	
015639	Temporary Tree And Plant Protection	
DIVISION 02	EXISTING CONDITIONS	
021000	General Demolition	
DIVISION 03	CONCRETE	
031000	Concrete Formwork	
032000	Concrete Reinforcement	
033000	Cast-in-Place Concrete	
DIVISION 05 - METALS		
051200	Structural Steel	
DIVISION 08	OPENINGS	
083919	Flood Panels And Barriers	
DIVISION 09	FINISHES	
099113	Exterior Painting	
DIVISION 31 - EARTHWORK		
311000	Site Clearing	
311500	Excavation Support And Protection	
312000	Earth Moving	
312319	Dewatering	
DIVISION 32	EXTERIOR IMPROVEMENTS	
323116	Welded Wire Fence Panels	

SECT. NO.	SECTION TITLE	REMARKS
323120	Architectural Metal Panels	
329113	Soil Preparation	
329300	Plants	

END OF SECTION 00 0010

SECTION 015639 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for temporary site fencing.
2. Section 311000 "Site Clearing" for removing existing trees and shrubs.
3. Section 329115 “Soil Preparation” for soil backfill.

1.3 DEFINITIONS

A. Caliper: Diameter of a trunk measured by a diameter tape or the average of the smallest and largest diameters at a height 6 inches above the ground for trees up to and including 4-inch size at this height and as measured at a height of 12 inches above the ground for trees larger than 4-inch size.

B. Caliper (DBH): Diameter breast height; diameter of a trunk as measured by a diameter tape or the average of the smallest and largest diameters at a height 54 inches above the ground line for trees with caliper of 8 inches or greater as measured at a height of 12 inches above the ground.

C. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

D. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and defined by a circle concentric with each tree with a radius 12 times the tree's caliper size and with a minimum radius of 96 inches unless otherwise indicated .

E. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site. Attendees to be Landscape Architect, Architect, Engineers, Contractor and BPCA.

1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:
    a. Tree-service firm's personnel, and equipment needed to make progress and avoid delays.
    b. Arborist's responsibilities.
    c. Quality-control program.
    d. Coordination of Work and equipment movement with the locations of protection zones.
    e. Trenching by hand or with air spade within protection zones.
    f. Field quality control.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include plans, elevations, sections, and locations of protection-zone fencing and signage, showing relation of equipment-movement routes and material storage locations with protection zones.
2. Detail fabrication and assembly of protection-zone fencing and signage.
3. Indicate extent of trenching by hand or with air spade within protection zones.

C. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.

1. Species and size of tree.
2. Location on site plan. Include unique identifier for each.
3. Reason for pruning.
4. Description of pruning to be performed.
5. Description of maintenance following pruning.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For arborist and tree service firm.

B. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

C. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

D. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1. Use sufficiently detailed photographs or video recordings.

2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

E. Quality-control program.

1.7 QUALITY ASSURANCE

A. Arborist Qualifications: Certified Arborist as certified by ISA .

B. Tree Service Firm Qualifications: An experienced tree service firm with a minimum of 5 years' experience that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.

C. Quality-Control Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work without damaging trees and plantings. Include dimensioned diagrams for placement of protection zone fencing and signage, the arborist's and tree-service firm's responsibilities, instructions given to workers on the use and care of protection zones, and enforcement of requirements for protection zones.

1.8 FIELD CONDITIONS

A. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Moving or parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

B. Do not direct vehicle or equipment exhaust toward protection zones.

C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Backfill Soil: Stockpiled soil mixed with planting soil or Planting soil of suitable moisture content and granular texture for placing around tree; free of stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.

1. Planting Soil: Planting soil as specified in Section 329115 "Soil Preparation (Performance Specification)."

B. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:

1. Type: Shredded hardwood or wood and bark chip .
2. Size Range: 3 inches maximum, 1/2 inch minimum .
3. Color: Natural.

C. Protection-Zone Fencing: Fencing fixed in position and meeting one of the following requirements:

1. Chain-Link Protection-Zone Fencing: Fencing fabricated from high-density polyethylene mesh; with 2 inch by 4 inch by 8 foot long wood posts and #4 rebar post supports with other accessories for a complete fence system.
   a. Height: 72 inches .
2. Gates: Single- swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; leaf width 36 inches .

D. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering and as follows:

1. Size and Text: 18 inches by 18 inches .
2. Lettering: 3-inch high minimum, black characters on red background.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

B. Prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

A. Locate and clearly identify trees, shrubs, and other vegetation to remain . Flagor Tie a 1-inch blue vinyl tape around each tree trunk at 54 inches above the ground.

B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated. Do not exceed indicated thickness of mulch.

1. Apply 4-inch uniform thickness of organic mulch unless otherwise indicated. Do not place mulch within 6 inches of tree trunks.

3.3 PROTECTION ZONES

A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people from easily entering protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.

1. Install to comply with NYCDPR standards.
2. Posts: Set or drive posts into ground as indicated in the NYCDPR Standard Details (2018), sheet 59. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect.
3. Access Gates: Install where indicated ; adjust to operate smoothly, easily, and quietly; free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Architect. Install one sign spaced approximately every 20 feet on protection-zone fencing, but no fewer than four signs with each facing a different direction.

C. Maintain protection zones free of weeds and trash.

D. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete, and equipment has been removed from the site.

1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.4 EXCAVATION

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 312000 "Earth Moving" unless otherwise indicated.

B. Trenching within Protection Zones: Arborist to be present for a trenching activity. Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with pneumatic excavation device, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.

C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction and as required for root pruning.

D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover and wrap with burlap. Keep burlap moist at all times until roots are covered with soil. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 ROOT PRUNING

A. Prune tree roots that are affected by temporary and permanent construction. Prune roots as follows:

1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
2. Cut Ends: Do not paint cut root ends .
3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
4. Cover exposed roots with burlap, keeping burlap moist.
5. Backfill as soon as possible according to requirements in Section 312000 "Earth Moving."

B. Root Pruning at Edge of Protection Zone: Prune tree roots 6 inches inside of the protection zone by cleanly cutting all roots to the depth of the required excavation.

C. Root Pruning within Protection Zone: Clear and excavate by hand or with air spade to the depth of the required excavation to minimize damage to tree root systems. If excavating by hand, use narrow-tine spading forks to comb soil to expose roots. Cleanly cut roots as close to excavation as possible, and cover with moist burlap until covered.

3.6 CROWN PRUNING

A. Prune branches that are affected by temporary and permanent construction. Prune branches as directed by arborist.

1. Prune to remove only injured, broken, dying, or dead branches unless otherwise indicated. Do not prune for shape unless otherwise indicated.
2. Do not remove or reduce living branches to compensate for root loss caused by damaging or cutting root system.
3. Pruning Standards: Prune trees according to ANSI A260.1.

B. Unless otherwise directed by arborist and acceptable to Architect, do not cut tree leaders.

C. Cut branches with sharp pruning instruments; do not break or chop.

D. Do not paint or apply sealants to wounds.

E. Provide subsequent maintenance pruning during Contract period as recommended by arborist.

F. Chip removed branches and stockpile in areas approved by Architect or dispose of off-site.

3.7 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.

1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.

C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

D. Minor Fill within Protection Zone: Where existing grade is 3 inches or less below elevation of finish grade, fill with backfill soil. Place backfill soil in a single uncompacted layer and hand grade to required finish elevations.

3.8 FIELD QUALITY CONTROL

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.9 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner approved by Architect.

1. Submit details of proposed pruning and repairs.
2. Perform repairs of damaged trunks, branches, and roots within 24 hours according to arborist's written instructions.
3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.

B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.

1. Replace trees in accordance with NYC Local Law 3, dated 2010.
   a. Species: As selected by Architect .

2. Plant and maintain new trees as specified in Section 329300 "Plants."

C. Excess Mulch: Rake mulched area within protection zones, being careful not to injure roots. Rake to loosen and remove mulch that exceeds a 4-inch uniform thickness to remain.

D. Soil Aeration: Where directed by Architect, aerate surface soil compacted during construction. Aerate 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch- diameter holes a minimum of 12 inches deep at 24 inches o.c. Backfill holes with an equal mix of augured soil and sand.

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove excess excavated material, displaced trees, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION 015639

SECTION 021000 - GENERAL DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, conditions of the Contract (including General, Supplementary, and Special Conditions), Division 01 Specification Sections and all other Contract Documents apply to work of this Section.

1.2 SUMMARY

A. Section Includes

1. The Contractor shall furnish all tools, equipment, materials, and supplies and shall perform all labor as required for the demolition, salvage, relocation, and removal of electrical and mechanical equipment, structures, bulkhead and facilities as indicated on the Contract Drawings and as specified herein.
2. The Work of this Section shall include, but shall not be limited to, the following items:

    a. Demolition of asphalt pavement, concrete, and other features as required to install new pavements, utilities, equipment and other structures (such as the Steel Sheet Pile bulkhead).
    b. Demolition, salvage, relocation, and removal of existing facilities, equip-ment, structures, pads and utilities as indicated on the Contract Drawings.
    c. Abandonment of existing structures and facilities as specified on the Con-tract Drawings.
    d. All items shown or specified to be demolished on Contract Documents.

B. Related Requirements

1. The following is a list of Specifications which may be related to this Section:

    a. Section 312000 - Earth Moving
    b. Section 311000 - Site Clearing

1.3 DEMOLITION COORDINATION

A. The Contractor shall carefully coordinate the extent of demolition in areas where existing utilities are to be reconnected to new facilities and where existing facilities are to remain operational.

B. While work is being performed, the Contractor shall provide adequate access to all operating equipment for routine operation and maintenance. The Contractor shall erect and maintain fences, warning signs, barricades, and other devices as required for the protection of the Contractor's employees, Battery Park City Authority's personnel and the general public. The Contractor shall remove all such protection when the work is completed or as directed by the Engineer.

C. The Contractor shall coordinate all demolition and construction work with the Engineer.

1.4 SUBMITTALS

A. Submittals for items specified herein shall be submitted by the Contractor and shall be in accordance with the Contract Documents.

1. A copy of this specification section, with any addendum updates included, and all referenced and applicable sections, with any addendum updates in-cluded, shall be submitted with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identi-fied paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. The submittal shall be accompanied by a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

B. Submittals shall be provided to confirm that materials to be used comply with in-formation specified herein.

C. Demolition and equipment removal procedures shall be submitted to the Engineer for review and approval at least fourteen (14) calendar days prior to beginning work. The procedures shall provide for safe conduct of the Work, careful removal and disposition of materials and equipment, protection of facilities property which are to remain undisturbed, coordination with existing facilities to remain in ser-vice, and timely disconnection of utility services. The procedures shall include a detailed description of the methods and equipment to be used for each operation, and the sequence of operation.

D. Deactivating Existing Facilities. The Contractor shall advise the Engineer in writing not less than fourteen (14) calendar days in advance of the time of any necessary deactivation of existing facilities or equipment which are to be removed, abandoned, modified, or connected to the new work.

1.5 REPAIR OF DAMAGE

A. Any damage to remaining equipment, structures to remain, and other existing fa-cilities to remain, as caused by the Contractor's operations shall be repaired at the Contractor's expense.

B. Damaged items shall be repaired or replaced with new materials as required to re-store damaged items or surfaces to a condition equal to and matching that existing prior to damage or start of work of this Contract.

1.6 PROTECTION OF EXISTING UTILITIES AND WORK

A. Before beginning any cutting, excavation/trenching or demolition work, the Con-tractor shall carefully survey the existing work and examine the Contract Draw-ings and Specifications to determine the extent of the Work. The Contractor shall take all necessary precautions to prevent damage to existing facilities which are to remain in place and in operation.

B. The Contractor shall be responsible for any damages to existing facilities, which are caused by the operations of the Contractor. Damages to such work shall be re-paired or replaced to its existing condition at no additional cost to the Battery Park City Authority.

C. The Contractor shall carefully coordinate the Work of this Section with all other work and construction and shall provide shoring, bracing, and supports, as required.

D. The Contractor shall protect all aboveground and subsurface utilities within the limits of the demolition; in particular, removal of subsurface soils and dewatering may affect the bearing soils of nearby utility structures – these work will be coordinated with the Engineer to assess and provide input on the effect of the excavation of soils or dewatering (where warranted) and measures to protect these structures, at no additional expense to Battery Park City Authority and the Client.

E. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under any part of this Contract.

F. The Contractor shall remove all temporary protection when the Work is complete or when so authorized by the Engineer.

G. The Contractor shall carefully consider all bearing loads and capacities for place-ment of equipment and material on site. In the event of any questions as to whether an area to be loaded has adequate bearing capacity, the Contractor shall consult with the Engineer prior to the placement of such equipment or material.

1.7 BURNING

A. The use of burning at the project site for the disposal of refuse, debris, and waste materials resulting from demolition and site clearing operations will not be permit-ted.

1.8 ELECTRICAL DEMOLITION

A. All electrical demolition work shall at all times be conducted by the Contractor in a safe and proper manner to avoid injury from electrical shock to the Battery Park City Authority's personnel and Contractor's personnel.

B. Intermediate and final electrical systems shall meet the requirements of the New York City Electrical Code. Electrical equipment to be shut off for a period of time shall be tagged and locked-out. At no time shall live electrical wiring or connec-tions or those which can become energized be accessible to Contractor, Battery Park City Authority, or other personnel without suitable protection and warning signs.

PART 2 - EXECUTION

2.1 DEMOLITION

A. The Contractor shall remove the existing bulkhead after installation of the new steel sheet pile bulkhead.

B. Disposal of all materials shall be performed in compliance with all applicable local, State, and Federal codes and requirements. No trace of these structures shall remain prior to placing of backfill in the areas from which structures were removed.

C. The Contractor shall note that the Contract Drawings used in this Contract to indicate demolition are based on Contract Drawings of the existing facilities. The Contract Drawings have been included to clarify the scope of work, although the Contractor must rely on his/her own inspection to determine the true arrangement and location of items.

D. Contract Drawings identify the major equipment, utilities and structures and facilities to be demolished. Auxiliary systems such as water, auxiliary equipment, drainage, electrical wiring, controls, and instrumentation are not necessarily shown. In association with the major electrical equipment demolition, the following work shall also be performed at no additional cost to the Battery Park City Authority.

1. All exposed electrical conduits, raceways, and conductors associated with demolished or relocated equipment, devices, and instruments shall ultimately be removed. Reuse of existing exposed conduits is not acceptable except where explicitly shown on the Contract Drawings. All resulting holes in structures from any demolition activity shall be repaired.
2. Connection to existing underground conduits, demolition, and repair of surfaces shall meet all of the applicable requirements of Division 16 - Electrical.
3. All electrical supports for demolished equipment including concrete pads, baseplates, mounting bolts, instrumentation supports and brackets, and support hangers shall be removed. Any damage to the existing structure shall be repaired as specified herein.
4. The area and equipment shall be thoroughly cleaned, repaired, and touched up such that little or no evidence of the previous equipment installation remains.

E. Wiring demolition shall be performed by licensed Electricians. Before removing or cutting wiring, check to be sure that it is wiring intended to be cut or removed, and label wiring which is to remain. Labels shall be fully documented on wiring diagrams, interconnection diagrams, elementary diagrams, and conduit and wire schedules. Wire bundles shall be rolled up and placed "out of the way" to the extent practicable.

F. Where existing materials and equipment are removed or relocated, remove all materials no longer used such as studs, straps, conduits, and wires. Remove or cut off concealed or embedded conduit, boxes, or other materials and equipment to a point at least 3/4 inch below the final finished surface.

G. Asphalt and/or concrete pavement shall be removed as necessary to perform the specified work. The limits of removal shall be neatly sawcut and dust mitigation shall be performed by the Contractor.

H. When the required improvements have been constructed, new concrete and/or asphalt pavement shall be constructed as specified.

I. Where cobblestones and/or decorative pavers are present within the limits of the excavation, these items shall be removed carefully and stored at the appropriate facility where it is not degraded or compromised. These items shall be installed similar to their original condition, style and orientation.

J. Where existing pipes and electrical conduits, supports, or hangers are removed from existing structures, the Contractor shall fill all resulting holes in the structures and repair any resulting damage such that the finished rehabilitated structure shall appear as a new homogeneous unit with little or no indication of where the new and old materials join.

K. The holes, gaps and or open joints in utility vaults or structures shall be sealed or filled with non-shrink grout to be watertight and reinforced as required, or as shown on the Contract Drawings.

L. At all locations where the surface of the seal or grout will be exposed to view, the seal or non-shrink grout shall be recessed to approximately 1/2-inch back of the exposed surface and the recessed area filled with cement mortar grout.

M. Perimeter work fence and gates shall be maintained at all times to ensure security.

2.2 SALVAGED MATERIA

A. Existing materials and equipment to be salvaged shall remain the property of the Battery Park City Authority. Salvage to be reinstalled in the Work shall be refurbished as shown or specified before reinstallation.

B. Salvaged material shall be carefully removed and handled in such a manner as to avoid damage and shall be cleaned prior to their delivery.

2.3 DISPOSAL

A. The Contractor shall be responsible for the removal from the job site and disposal of all demolition refuse and debris not specifically identified for salvage by the Battery Park City Authority. In addition, the Contractor shall be responsible for disposal of all items associated with equipment to be demolished such as fuel, antifreeze, oil etc. The Contractor shall in doing so comply with all applicable laws, codes, ordinances and regulations, and shall obtain and pay for all necessary permits. Demolition materials removed from the site for legal disposal and not specifically identified for salvage by the Battery Park City Authority shall be the property of the Contractor.

END OF SECTION 021000

SECTION 031000 - CONCRETE FORMWORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide design, supply, installation and removal of forms wherever necessary to confine concrete and shape it to required dimensions. Provide special formwork or form liners for concrete with smooth or special finishes. Provide all required bracing, shoring and reshoring.

1.2 RELATED SECTIONS

A. Concrete Reinforcement.....Section 032000

B. Cast-in-Place Concrete.....Section 033000

1.3 REFERENCES

A. References and industry standards listed in this Section are applicable to the Work. Unless more stringent criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

American Concrete Institute (ACI) standards, latest editions.

1. ACI 301 Specifications for Structural Concrete for Buildings.
2. ACI 347 Guide to Formwork for Concrete.

1.4 DESIGN REQUIREMENTS

A. The design and engineering of the formwork, as well as its construction, is the responsibility of the Contractor.

B. Design formwork in accordance with ACI 347 and Section BC 1906 of the 2014 NYC Building Code.

1.5 SUBMITTALS

A. Product Data - Submit manufacturers' information for the following:

1. Overlaid plyform formwork or form liners
2. Ties, each type and where to be used
3. Form-release agent. Form-release agent to be submitted for review only.

B. Samples

Submit 12” x 12” samples of the following items:

1. Overlaid plyform formwork or form liners

C. Shop Drawings

1. Prepare and submit formwork shop drawings and calculations prepared and sealed by a Professional Engineer licensed in the State of New York for review when required by Section BC 1906.3 of the 2014 NYC Building Code.

D. Quality Control Submittals

1. Contractor Qualifications: Provide proof of Formwork Installer qualifications specified under “Quality Assurance”.

1.6 QUALITY ASSURANCE

A. Qualifications

1. Company specializing in performing the Work of this Section shall have three years minimum experience.
2. Person responsible for inspection of formwork shall be a qualified person as defined in Section BC 3302.1 of the 2014 NYC Building Code.

B. Regulatory Requirements

1. Building Code: Work of this Section shall conform to all requirements of the NYC Building Code. Where more stringent requirements than those contained in the Building Code are given in this Section and ACI 347, the requirements of this Section and ACI 347 shall govern.
2. Industrial Code Rule #23 of the Department of Labor, paragraphs 23.10.1 to 23-10.5 inclusive.
3. ACI 347.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protection

1. Protect formwork materials before, during and after installation.
2. Protect installed work and materials of other trades.

B. Replacement

1. Repair or replace damaged formwork as approved by the Owner/Developer.
2. Repair overlaid plyform formwork as per manufacturer's instructions. Replace pieces when number of manufacturer recommended reuses is up or when finish deteriorates.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Rough Formwork Shall be Commercial Douglas Fir, DFPA: 5/8" thick minimum or modular metal units.

B. Overlaid Plyform Formwork
1. Plywood with thermosetting phenolic resin or urethane coating bonded to it to provide a flat matte finish. Shall be equal to B-Matte Formguard by Simpson Timber Company.

C. Smooth Form Finish Form liner

1. Shall be equal to #340 Smooth Face by Greenstreak.
2. Nails and staples used to attach form liner to formwork are to be Type 304 stainless steel.

D. Left-in-Place Forms: Galvanized per ASTM A653, coating designation G90, and not less than 20 gage.

E. Release Agent

1. VOC compliant material such as those of the Cresset Chemical Company for coating forms. Shall be compatible with material or finish to be subsequently applied and free of deleterious effects on final surfaces. Form oils shall not contain castor oil. Release agents shall not discolor concrete where concrete is to be exposed to view.

F. Form Sealers: Shall be guaranteed by manufacturer to be non-staining and to not impair the bond of paint, waterproofing or other required surface coatings.

1. Sealer for lumber surfaces and plywood edges shall be clear polyurethane.
2. Sealer for board forms shall be penetrating, non-staining and not leave a surface coating.

G. Form Ties

1. Form ties for exposed concrete shall be adjustable.
2. Form ties for exposed concrete and concrete to receive membranes shall be a break-off type and leave no metal closer than $1^{1}/_{2}$-inch to the surface.
3. Form ties for concrete stated in 2 above shall be free of devices which leave holes or depressions larger than 7/8"-inch back of exposed surface.
4. Wire ties not permitted.
5. Ties shall have a minimum capacity of 3000 pounds.

PART 3 - EXECUTION

3.1 PREPARATION OF FORMWORK SURFACES

A. Clean all surfaces of forms and embedded items of any accumulated mortar or grout from previous concreting and other foreign material before concrete is placed in them. Clean, repair and patch reused forms as required to return them to acceptable condition. Repair or replace any formwork as required.

B. Before placing either reinforcing steel or concrete, cover the surfaces of the rough or overlaid plyform formwork (when used) with an approved form release agent that will effectively prevent absorption of moisture, prevent bond with the concrete, and which will not stain the concrete surfaces. Coat steel forms with a non-staining, rust-preventative releasing agent. Material shall be carefully applied at the amount recommended by the release agent manufacturer to obtain the desired finish. Do not apply oil or release agents on formwork for concrete to receive coatings such as membrane waterproofing, plaster, or additional concrete (such as at construction joints). Follow manufacturer's recommendations for alternatives. For the overlaid plyform formwork, release agent should be a chemically reactive agent compatible with the factory treatment. Do not allow excess form coating material to stand in puddles in the forms nor allow coating to come in contact with hardened concrete against which fresh concrete is to be placed.

3.2 CONSTRUCTION AND DETAILS

A. Contractor shall be solely responsible for the design, construction, erection, removal, safety and adequacy of all concrete formwork, falsework, shoring, reshoring and the like. Design, erect, support, brace, and maintain formwork to support vertical and lateral, static and dynamic loads that might be applied, until such loads can be supported by the concrete structure. Design formwork to be readily removable without impact, shock, or damage to cast in place concrete surfaces and adjacent materials.

B. Adequately support and substantially brace formwork to hold lines, shape, alignment, plumbness and position.

C. Formwork shall be tight jointed to prevent leakage of mortar from the concrete.

D. Place chamfer strips in the corners of forms to produce beveled edges (chamfers) on permanently exposed surfaces (such as exposed columns). Do not provide beveled edge for interior corners of such surfaces and where members are flush with partitions or walls, unless required by Drawings or specified elsewhere.

E. Set slab-forms with camber of 1/4-inch per 10 feet of span to maintain tolerances. For two way slabs the lesser span dimension shall govern.

F. Provide positive means of adjustment (wedges or jacks) for shores and struts to take up all settlement during concrete placing operations. Fasten wedges used for final adjustment of forms prior to concrete placement in position after final check. Securely brace forms against lateral deflection.

G. Provide mud sills where shores rest on compressible materials.

H. Provide temporary openings to permit cleaning and inspection. Provide ample time for proper inspection before placement of concrete.

I. Provide "Rough Form Finish" for surfaces not exposed to view. Use plywood or metal forms coated with a release agent.

J. Provide "Smooth Form Finish" for surfaces exposed to view. Use dress, square-edged lumber with form liner or overlaid plyform forms with applicable release agent. Do not exceed manufacture's recommendations for number of re-uses for the form liner or overlaid plyform. Arrange the forms or form liner in an orderly and symmetrical fashion, keeping the number of seams to a practical minimum. Items indicated as “Architectural Concrete” or Architectural Finish” shall use specially designed formwork to attain the desired finish and shall have a CS 1 surface finish as developed by the Cresset Chemical Company, or other special finish specified. Other exposed concrete shall have CS3 or better surface finish.

K. Provide openings in formwork to accommodate work of other trades. Form holes for pipes, pipe sleeves, electric outlets, electric conduits, etc. as required. Construct wood forms for wall forms to facilitate loosening, if necessary, to counteract swelling of forms.

L. Provide runways for moving equipment with struts or legs, which shall be supported directly on the formwork or structural member without resting on the reinforcing steel.

M. Provide for rebates, offsets, sinkages, keyways, moldings, blocking, bulkheads, anchorages, embeds, reglets, grooves keys, pockets, ground nailers, projections and other built-in work prior to placement of concrete. Install reglets as per manufacturer's instructions.

N. Install dovetail slots, concrete inserts, and other metal fabrications. Secure to inside forms and space as shown on Drawings.

O. At construction joints, contact surface of the form sheathing for flush surfaces exposed to view shall overlap the hardened concrete in the previous placement by not more than 1". The forms shall be held against the hardened concrete to prevent offsets or loss of mortar at the construction joint and to maintain a true surface.

P. Form accessories to be partially or wholly embedded in the concrete, such as ties and hangers, shall be of a commercially manufactured type. Use of non-fabricated wire is not permitted. Construct form ties so that the ends or end fasteners can be removed without causing appreciable spalling at the faces of the concrete. After the ends or end fasteners of the form ties have been removed, terminate the embedded portion of the ties not less than 2 diameters or twice the minimum dimension of the tie from the formed faces of concrete to be permanently exposed to view, except that in no case shall this distance be less than 3/4". When the formed face of the concrete is not to be permanently exposed to view, form ties may be cut off flush with the formed surfaces.

Q. Carefully check all forms before placement of concrete.

R. Notify the Engineer of Record if openings are required but not shown on the Drawings, who will issue instructions accordingly.

S. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only.

T. Provide form ties at spacing as required to hold formwork readily and eliminate visible deflection and building of formwork surfaces as well as safely resist all applied loads. Ties shall be coated with an approved bond breaker.

U. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

V. For concrete exposed to view locate ties in level and plumb lines in an arrangement acceptable to the architect.

W. Provide square exposed corners and edges as indicated on architectural drawings, using wood, metal, or PVC strips fabricated to produce uniform smooth lines and tight edge joints.

3.3 REMOVAL OF FORMS AND SHORING

A. Remove forms in such a manner as to assure the complete safety of the structure as required by Section BC 1906.2 of the 2014 NYC Building Code. In no case remove forms or shoring supporting the weight of concrete in beams, slabs or structural members until the members have reached the minimum compressive strength specified on the Drawings or as permitted by the Engineer of Record.

B. Contractor shall be solely responsible for proper and safe removal of forms, shoring, and removal of reshoring. Contractor shall do cost of tests and/or calculations needed to determine such techniques, timing and sequences without expense to Owner, Architect or Engineer.

C. Formwork for columns, walls, sides of beams, and other parts not supporting the weight of the concrete may be removed as soon as the concrete has hardened sufficiently to resist damage from removal operations and as required by D below. For temperatures not less than 50 deg F this shall be a minimum of 36 hours after placement. Provide effective curing and protection.

D. Unless reshoring is used, formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than the time period specified in ACI 347, paragraph 3.7.2.3 unless concrete has attained 75 percent of specified compressive strength at an earlier time. Determine compressive strength of in place concrete by testing field cured cylinders representative of concrete location or members. The Contractor shall pay the cost of such testing.

E. When repair of surface defects or finishing is required at an early age, remove forms as soon as the concrete has hardened sufficiently to resist damage from removal operations.

F. Remove top forms on sloping surfaces of concrete as soon as the concrete has attained sufficient stiffness to prevent sagging. Perform any needed repairs or treatment required on such sloping surfaces at once and follow it with the specified curing.

G. Loosen wood forms for wall openings as soon as this can be accomplished without damage

H. Contractor shall replace or repair, at Engineer's direction, any and all work damaged by improper removal or reshoring operations.

3.4 TOLERANCES

A. Construct formwork so that concrete surfaces will conform to the tolerance limits listed in ACI 117.

B. Establish and maintain in an undisturbed condition and until final completion and acceptance of the project sufficient control points and bench marks to be used for reference purposes to check tolerances.

C. Regardless of the tolerances listed, do not extend any portion of the concrete work beyond the lot or street line.

3.5 INSPECTION

A. Under the requirements of Section BC 1906 of the 2014 NYC Building Code, formwork, including shores, braces, and other supports shall be inspected by a qualified person engaged by the Contractor. The qualified person shall make inspections prior to placement of steel to verify correct sizes of members formed and subsequently periodically after placement and during placement of concrete to detect incipient problems. Maintain a record of all inspections.

B. Under the requirements of Section 1704.4 of the Building Code, the Owner/Developer will assign a Special Inspector to inspect formwork for size of members and to verify in-situ concrete strengths prior to removal of formwork and shores from beams and slabs.

C. During and after concrete placement, check elevations, camber, and vertical alignment of formwork systems using tell-tale devices.

D. Keep a record of all inspections, the name of the persons making them, and the name of the foreman in charge of formwork at the site. Submit to the Owner/Developer's representative on the site a copy of the inspection records prior to each concrete placement.

END OF SECTION -031000

SECTION 032000 - CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide and install all reinforcement, stud rails, reinforcing supports and associated items required for cast-in-place.

1.2 RELATED SECTIONS

A. Concrete Formwork.....Section 031000

B. Cast-in-Place Concrete.....Section 033000

1.3 REFERENCES

References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

A. American Society of Testing and Materials (ASTM) standards, latest editions.

A82 Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

A185 Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete Reinforcement.

A1064 Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.

A615 Standard Specifications for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

A706 Standard Specifications for Low-Alloy Steel Deformed and Plain Bars for Concrete reinforcement

A767 Standard Specifications for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement

A775 Standard Specifications for Epoxy-Coated Reinforcing Steel Bars

A780 Standard Specifications for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

B. American Concrete Institute (ACI) standards, latest editions.

ACI 301 "Specification for Structural Concrete for Buildings."

ACI Detailing Manual SP66 (Includes ACI 315 & 315R)

ACI 318-11 "Building Code Requirements for Reinforced Concrete".

C. "Placing Reinforcing Bars - CRSI-WCRSI Recommended Practices", latest edition. Concrete Reinforcing Steel Institute.

D. "Structural Welding Code - Reinforcing Steel" D1.4 - American Welding Society (AWS).

1.4 DESIGN REQUIREMENTS

A. Detailing requirements for reinforced concrete structures shall meet the structural integrity requirements as set in Section BC 1916 of the 2014 NYC Building Code.

1.5 SUBMITTALS

A. Product Data

Submit manufacturers' information for the following:

1. Steel welded wire fabric
2. Steel welded wire reinforcement.
3. Supports
4. Mechanical connectors

B. Shop Drawings

1. Submit shop drawings to the Engineer for acceptance in accordance with the requirements of the Contract Documents. Engineer shall have ten business days to review submittal packages from day after submittal arrives in Engineer's office until day that submittal is sent returned by Engineer. Submit drawings gradually and not all at the same time so that sufficient time is allowed for checking and approval.
2. At least two weeks prior to the first shop drawing submittal Contractor shall provide Engineer with a comprehensive list of all shop drawing submittals, and a schedule indicating when all submittals are to be sent to Engineer. If Contractor deviates from this schedule, Engineer shall be allowed additional time to review shop drawings
3. Shop drawings shall conform to the highest standards of the construction industry. Include enough plans, elevations, sections and details at adequate scale to completely describe all work to be provided. All detailing work shall be in accordance with ACI 315 and shall be not less complete than examples given in ACI SP 04. Improperly prepared and incomplete shop drawings will be disapproved without review.
4. Submit shop drawings to Engineer in coordinated packages so that all required information is in hand at time of review. Prior to resubmission of shop drawings, all changes from prior issue shall be clearly circled and identified. Do not fabricate before shop drawings have been reviewed and returned to Contractor marked "No Exceptions Taken" or "Make Corrections Noted" only.
5. Contractor shall coordinate and cross check for accuracy, completeness and correct relationship to the work of other sections, each shop drawing prepared for the work of this Section, including each shop drawing prepared by accepted subcontractors. Show and dimension holes required for passage of work of other sections through

cast in place concrete. Engineer's review of shop drawings does not relieve Contractor from these responsibilities.

6. Prior to sending submittals to Engineer, Contractor and Construction Manager (if applicable) shall coordinate and cross-check for accuracy and completeness each shop drawing prepared for work of this Section with the approved Construction Documents and Specifications. Shop drawings shall bear the stamp of Contractor and Construction Manager indicating that this review has been performed. Engineer will not review submittals for which Contractor and Construction Manager have not performed this review.
7. Reinforcing detail drawings shall include, but not be limited to the following:

    a. Setting plans, wall elevations, detailed bending diagrams, cutting lists and other information so as to completely demonstrate the location, spacing, size, length, bending, shape of all reinforcing steel, and position and length of all splices.
    b. The yield strength and ASTM designation of all reinforcing.
    c. All control, expansion and construction joints including keys and waterstops.
    d. Cover for reinforcing, indicated and shown on every shop drawing.
    e. Wall reinforcing detailed on wall elevations, not on plans.
    f. All openings, depressions, trenches, sleeves, embedded inserts and any other project requirements affecting reinforcing details and placing.
    g. Type, size and location of all metal and plastic accessories required for the proper assembling, placing and support of the reinforcement.
8. Reinforcing steel shop drawings must provide all information, sections, details and marks so that reinforcing steel can be easily placed without the use of any other drawings or information. Reproduction of Structural Drawings, in entirety or part, for use as shop drawing is not permitted.
9. Detail reinforcing steel for curbs, pads, trenches, openings and the like from information given in Landscape Architectural, Civil, and other Contract Documents.
10. Provide all reinforcement shown or scheduled in the Drawings, including that required by typical details and general notes, but not less than required by ACI Code minimums.
11. Detailing of reinforcement shall consider the arrangement, shape and size of individual bars, including hooks and lap splices, so as to preclude interference between bars, and embedded items and to provide clear spacing and concrete cover as required by ACI 318. Provide placing sequence information when required to properly install reinforcement in the field. Provide enough sections and enlarged details, whether they are given on Structural Drawings or not, to fully illustrate placement locations.
12. Fieldwork drawings shall be submitted for review of and acceptance for all work required to accommodate field conditions.
13. Shop drawings will be checked for size of material and spacing by the Engineer of Record, which shall not render the Engineer responsible for any errors in construction dimensions, quantities, bends, etc. that have been made in preparation of the shop drawings. The Contractor shall assume full responsibility for the correctness of quantities, dimensions and fit.

C. Quality Control Submittals

1. Certificates

a. Submit to Testing Agency and Engineer certified copies of mill test reports for all steel reinforcement, including bars, welded wire fabric, stud rails, prestressing bars and strands.

2. Contractor Qualifications**:** Provide proof of Installer and Detailer qualifications specified under “Quality Assurance”.

1.6 QUALITY ASSURANCE

A. Qualifications

1. Rebar Installer: Company specializing in performing the Work of this Section shall have three years minimum experience on successful projects of similar size and type.
2. Rebar Detailer: Company shall be specialized in the detailing of reinforcing bar shop drawings with a minimum of three years of experience on successful projects of similar size and type.

B. Regulatory Requirements

1. Building Code

Work of this section shall conform to all requirements of the NYC Building Code. Deliveries will be rejected unless:

a. All reinforcing bars are identifiable as to point of origin, grade of steel, and size.
b. All bundles or rolls of cold drawn steel wire reinforcement are securely tagged to identify the manufacturer, the grade of steel, and the size.

Where more severe requirements than those contained in the Building Code are given in this Section and ACI 318, the requirements of this Section and ACI 318 shall govern.

2. Industry Standards

Details of Concrete reinforcement not covered herein shall be in accordance with "Building Code Requirements for Reinforced Concrete" (ACI 318) and "Details and Detailing of Concrete Reinforcement" (ACI 315), latest editions and the Concrete Reinforcing Steel Institute Manual on "Placing Reinforcing Bars" (CRSI).

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store in location to prevent rusting, etc.

B. Protect reinforcement before, during, and after installation.

C. Insure proper identification after bundles are broken.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Reinforcing Bars

1. All reinforcing bars, except those to be welded, shall be of deformed type of new billet steel conforming to current requirements of ASTM A615, and where not noted shall be Grade 60. No rail or re-rolled steel will be permitted. Reinforcement to be welded shall conform to the requirements of ASTM A706.
2. Grade or yield strength of reinforcing bars is indicated on Drawings.

B. Welded Steel Wire Fabric

1. Wire Fabric shall conform to the requirements of ASTM A185.
2. Required net area, placement details, and other requirements are indicated on Drawings.

C. Supports for Reinforcement

1. Supports for reinforcement supported by formwork or deck shall consist of metal bolsters and chairs of adequate strength, size, and number. Provide CRSI Class C supports (plastic tipped) for formed concrete surfaces and Class A (bright basic) for metal deck.
2. Support for reinforcement of footings/pile-caps shall consist of the above supports or precast concrete block, 4" square, having a compressive strength equal to that of the concrete being placed.

D. Mechanical Tension Splices for Reinforcing Bars: Cadweld Rebar Splices or Lenton Couplers by Erico Products, Inc., BarGrip by BarSplice Products Inc., or equivalent accepted by Engineer.

E. Mechanical Compression Splices for Reinforcing Bars: Speed-Sleeve Splices by Erico Products, Inc. or equivalent accepted by Engineer.

F. Shear Reinforcement: Studrails by Decon

G. Structural Macro Fibers: ASTM C 1116, minimum of 2 inches (50mm) length, aspect ratio of 50 to 90, minimum toughness rating of R10, 50 = 60 (approximate) according to ASTM C 1018. Manufacturer: The Euclid Chemical Company, “Tuf-Strand SF” or GCP Applied Technologies “Strux 90.40”.

2.2 FABRICATION

A. Fabricate reinforcing bars in accordance with fabricating allowances given in ACI 315 and accepted shop drawings.

1. Partially embedded reinforcement shall not be bent or re-bent without the express written acceptance of the engineer. Offset bars shall be bent before placing.

PART 3 - EXECUTION

3.1 PLACEMENT

A. General

1. Place reinforcement in accordance with CRSI "Placing Reinforcement Bars" and Section BC 1907.5 of the 2014 NYC Building Code.
2. Unless otherwise permitted, welding of crossing bars (tack welding) for assembly of reinforcement is prohibited.
3. Avoid cutting or puncturing vapor barrier during placement.
4. Clean reinforcement of loose rust and mill scale, earth, ice and other bond inhibiting materials.
5. Accurately position as shown on accepted shop drawings. Support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

B. Supports

1. Support and fasten together all reinforcement to prevent displacement by construction loads or placing of concrete. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces. Tie wire ends shall not fall within required clear concrete cover.
2. Provide supports specified in Article 2.01.
3. Provide Continuous High Chair Upper (CHCU) or Continuous Support (CS) for welded wire fabric in the metal deck and place every four feet (4') parallel to the supporting beams.
4. Lifting of bars and welded wire fabric into position during placement of concrete is not permitted.
5. Where the concrete surface will be exposed to the weather in the finished structure, the portions of all accessories within 1/2" of the concrete surface shall be non-corrosive or protected against corrosion.
6. Neither top nor bottom bars shall be allowed to sag below tolerances specified herein.
7. For #8 bars and smaller, separate adjacent layers of parallel bars with short length of #8 bars, securely tied to the layers. For #9 bars and larger, separator bar shall be of the largest bar size separated.

C. Cover

1. Provide minimum protective cover given in Section 1907.7 of the 2014 NYC Building Code if not indicated on Drawings.
2. Place reinforcement to obtain at least minimum coverages for concrete protection as required.

D. Splices

1. All splices not shown on the Project Drawings shall be shown on the shop drawings and approved by the Engineer of Record.

2. Provide welded splices where indicated on Drawings. All welding shall conform to AWS D1.4. At these locations, only reinforcement conforming to ASTM A706 shall be used.
3. Provide mechanical connectors where indicated on Drawings. Install in accordance with splice device manufacturer's recommendations.
4. For welded wire reinforcing in slabs on ground lap adjoining pieces at least one full mesh plus two inches and lace splices with wire.

E. Embedment Lengths

All embedment lengths not shown on the Project Drawings shall be shown on the shop drawings and approved by the Engineer of Record.

3.2 TOLERANCES

A. Fabricate bars in accordance with the fabricating tolerances given in ACI 315. Place reinforcing bars in accordance with the tolerances given in Section 1907.5.2 of the 2014 NYC Building Code, ACI 318 Chapter 7, or provided herein, whichever is more stringent.

1. Bars shall be placed to the following tolerances:

a. Clear distance to formed surfaces + ¼-inch
b. Minimum spacing between bars + ¼-inch
c. Top bars in slabs and beams:

1) Members < 8” deep + ¼-inch

2) 8” < Members < 24” deep + ½-inch

d. Crosswise of members: spaced evenly within 2-inch
e. Lengthwise of members: + 2-inch

B. Move bars as necessary to avoid interference with other reinforcement, conduits, or imbedded items. If bars are moved more than one bar diameter, or enough to exceed the above tolerances, the resulting arrangements are subject to approval by the Engineer of Record.

3.3 FIELD QUALITY CONTROL

A. Under the requirements of Section BC 1704.4 of the 2014 NYC Building Code, the Owner/Developer will assign a Special Inspector to inspect the size and placement of reinforcement. A record will be made of all inspection of reinforcement at the bending bench and in place.

B. Do not proceed with the completion of wall forms until all reinforcement has been approved and recorded by the Special Inspector.

C. Do not proceed with concreting until all reinforcing in place has been approved and recorded.

D. Promptly correct all reinforcement displaced during pouring of concrete.

E. Protect reinforcing steel and mesh from scaling, oil, grease and distortion. Reinforcing steel and mesh that has rusted to the extent of scaling will be rejected and may be placed in the work only after proper cleaning and approval by the Testing Agency. Damaged reinforcement shall not be used.

3.4 CLEANING

A. Steel reinforcement shall be free of all rust, scale, oil, paint, grease, loose mill scale, and all other foreign matter that will prevent bonding of concrete and steel just prior to pouring of concrete.

END OF SECTION 032000

LIST OF SUBMITTALS

SUBMITTAL	DATE SUBMITTED	DATE APPROVED
Product Data:		_____
1. Welded wire fabric		
2. Welded wire reinforcement		
3. Supports		
4. Mechanical connectors		
Shop Drawings:		_____
1. Reinforcement layout		
Certificates:		_____
1. Reinforcing bars		
2. Welded wire fabric		
3. Welded wire reinforcement		
Qualifications:		_____
1. Rebar Installer		
2. Rebar Detailer		
Sustainability:		_____
1. Contractor's Sustainable Materials Form (see Section S01352) with materials cost information.		

* * *

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Drawings, conditions of the Contract (including General, Supplementary and Special Conditions), Division 1 Specification Sections and all other Contract Documents apply to work of this section.

B. Extent of cast-in-place concrete is indicated on the Drawings, including layout and sizes of members, type and strength of concrete, reinforcing and accessories.

C. Furnish material, equipment, labor, and services required to provide for cast-in-place concrete.

D. Structural work includes but is not limited to footings, piers, pile caps, mats, pits, steel encasement, walls, beams, sleeves and openings, depressions and drops.

E. Additional work includes but is not limited to contraction and control joints, keys, sitework, and installation of miscellaneous inserts, waterstops, vapor barriers, and other items listed herein. Also included is finishing of concrete exposed to view, designing and testing of concrete mixes, and submittals as listed in 1.08.

F. All materials, equipment, labor and services required to complete the work. Allow ample time and facility for the Work of other Divisions to be installed.

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

Products to be installed include, but are not limited to, the following:

A. Anchor bolts and other anchors cast into concrete.....Section 051200

1.3 RELATED SECTIONS

A. Concrete Formwork.....Section 031000

B. Concrete Reinforcement.....Section 032000

1.4 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's sustainable requirements. The Contractor shall ensure that the requirements related to these goals, as defined in this Section, are implemented to the fullest extent. Substitutions or other changes to the work shall not be proposed by the Contractor or their sub-contractors if such changes compromise the stated Sustainable Design Performance Criteria.

B. Sustainability requirements included in the Section are as follows:

1. Meet established minimum recycled content for concrete.

2. Documentation of Recycled materials.

3. Documentation of Regional materials.

1.5 REFERENCES

References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

A. Conform to the requirements of the New York City Building Code.

B. American Society of Testing and Materials (ASTM) standards, latest editions.

C31 Standard Practice for Making and Curing Concrete Test Specimens in the Field.

C33 Standard Specifications for Concrete Aggregates.

C39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

C42 Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

C78 Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Three-point Loading)

C94 Standard Specification for Ready-Mixed Concrete.

C127 Standard Test Method for Density, Relative Density (Specific Gravity) and Absorption of Course Aggregate.

C131 Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angles Machine.

C138 Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.

C143 Standard Test Method for Slump of Hydraulic Cement Concrete.

C150 Standard Specification for Portland Cement.

C172 Standard Method of Sampling Freshly Mixed Concrete.

C173 Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

C192 Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.

C231 Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

C260 Standard Specifications for Air-Entraining Admixtures for Concrete.

C309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

C330 Standard Specification for Lightweight Aggregates for Structural Concrete.

C387 Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.

C494 Standard Specification for Chemical Admixture for Concrete.

C496 Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.

C567 Standard Test Method for Density of Structural Lightweight Concrete.

C685 Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.

C882 Standard Test Method for Bond Strength of Epoxy-Resin Systems used with Concrete by Slant Shear

C1315 Standard Specification for Liquid-Forming Compounds Having Special properties for Curing and Sealing Concrete

E96 Standard Test Methods for Water Vapor Transmission of Materials

E154 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs

E329 Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials used in Construction

E1643 Standard Practicew for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs

E1745 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs

C. American Concrete Institute (ACI) standards.

ACI 117 Standard Tolerances for Concrete Construction and Materials.

ACI 211.1 Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.

ACI 211.2	Standard Practice for Selecting Proportions for Structural Lightweight Concrete.
ACI 212.3R	Chemical Admixtures for Concrete.
ACI 214R	Evaluation of Results of Tests Used to Determine the Strength of Concrete.
ACI 301	Specifications for Structural Concrete for Buildings.
ACI 302.1R	Guide for Concrete Floor and Slab Construction.
ACI 304R	Guide for Measuring, Mixing, Transporting and Placing Concrete.
ACI 304.2R	Placing Concrete by Pumping Methods
ACI 304.5R	Batching, Mixing and Job Control of Lightweight Concrete
ACI 305R	Hot Weather Concreting.
ACI 306R	Cold Weather Concreting.
ACI 308	Standard Practice for Curing Concrete.
ACI 309R	Guide for Consolidation of Concrete.
ACI 311.4R	Guide for Concrete Inspection.
ACI 318-11	Building Code Requirements for Reinforced Concrete (With modifications per Section BC 1908 of the 2014 NYC Building Code).
SP-66(04)	ACI Detailing Manual

D. American Association of State Highway and Transportation Officials

T318 Water Content of Freshly Mixed Concrete Using Microwave Oven Testing

1.6 DEFINITIONS

A. Exposed to view

Situated so that it can be seen from eye level from a public location. A public location is that which is accessible to persons not responsible for operation or maintenance of the building.

B. Normal weight concrete

Concrete for which density is not a controlling attribute, made with aggregates of the types covered by ASTM C33 and usually having unit weights in the range of 135 to 160 lb/ft^3.

1.7 DESIGN REQUIREMENTS

A. Performance Characteristics:

1. All concrete shall adhere to the durability and minimum strength requirements set forth in Section BC 1904 of the Building Code.
2. Concrete strengths shall be as shown on the drawings and drawing notes.

1.8 SUBMITTALS

A. Product Data

Submit manufacturers' information for the following:
1. Admixtures
2. Curing compounds
3. Hardener
4. Bonding & Repair Agents
5. Beam clips
6. Vapor barrier
7. Vapor retarder
8. Waterstop
9. Joint Fillers

B. Samples

Submit samples of the following items:
1. Vapor Barrier
2. Vapor Retarder
3. Beam clips
4. Waterstop

C. Concrete Mix Design

Submit proposed concrete mix designs for each type of concrete as required in Part 2.03 of this Section for acceptance by the Engineer at least three weeks prior to the start of any concrete work. Reports shall be signed and sealed by a Professional Engineer licensed in the State of NY and experienced in the design and testing of concrete mixes. The reports shall be made on the mix design submittal form included at the end of this specification, or with a similar format.

1. Reports for each mix shall include:

a. Source and type of each cement, including results of chemical and physical tests, if requested by Engineer.
b. Complete identification of source of supply for each type of aggregate.
c. Results of tests of aggregates for compliance with specified requirements, if requested by Engineer.
d. Scale weight of each aggregate.
e. Absorbed water in each aggregate.
f. Brand, type and amount per cubic yard of each admixture used (including synthetic fiber reinforcement).

g. Amount of free water used per cubic yard.
h. Proportions of each material per cubic yard.
i. Gross weight per cubic foot.
j. Measured slump.
k. Water/cementitious materials ratio, by weight. Submit strength vs. water/cementitious materials ratio curve based upon compressive tests, and indicating water/cementitious materials ratio to be used.
l. Total air content, by percent.
m. Water soluble ion chloride content, percent by weight of cement, if maximum is specified in this Section.
n. Compressive strength at seven and 28 days, from not less than two cylinders at seven days and not less than four at 28 days, for at least four different water/cement ratios.
o. Complete standard deviation analysis or trial mix test data.
p. For mixes with a design strength of more than 4000 psi, results of at least 4 cement cube strength tests.

2. If requested by Engineer, submit manufacturer or supplier's certificates of conformance to applicable standards for each ingredient.

D. Deviations

Requests for deviations from the Drawings or Specifications shall be submitted on Contractor's letterhead. Acceptance of shop drawings including deviations not detected during shop drawing review will not relieve Contractor from responsibility to conform strictly to the Contract Documents. Deviations will be allowed only where permitted by Engineer in writing. Proposed deviations must be accompanied by documented and physical evidence, which will establish that its quality equals or exceeds the quality specified.

E. Protective Measures

Submit hot and cold weather concreting procedures prior to start of any work. Including cold weather heating systems, enclosures, insulation, curing procedures and the like. Procedures shall be reviewed at a preconstruction conference.

F. Quality Control Submittals

1. Certificates

a. Building Department form TR3, signed and sealed by the licensed concrete laboratory and concrete producer.
b. Admixture manufacturer's certificate stating that the chloride content of the admixture will not exceed 0.05% by weight.
c. Concrete laboratory license number and certification of meeting ASTM E329 standards.
d. Concrete producer's certificate stating the plant and trucks are NYSDOT approved.
e. Concrete producer's Computer Batch Ticket in accordance with Section BC 1905.8.2 of the 2014 NYC Building Code must be presented at site before concrete is placed for every load of concrete delivered.

2. Manufactures' Instructions:
   Waterstop manufacturer's instructions for proper installation of waterstop, including manner in which splices are to be made.

3. Contractor Qualifications:
   Provide proof of Installer and Producer qualifications specified under “Quality Assurance”.

H. Survey

Submit signed and sealed copies of surveys conducted by a Licensed Land Surveyor showing elevations of all finished slab surfaces.

I. Mock-up

Provide mock-up as indicated under Quality Assurance.

J. Sustainable Submittals:

1. Submit Contractor’s Sustainable Materials Form with complete information on recycled content for cementitious materials provided under the work of this section. Include cost of cementitious materials and percentage, by weight, of cementitious materials that have post-consumer or pre-consumer recycled content.
2. Submit documentation of recycled content in cementitious materials – product data, mix design information, or manufacturer’s statement.
3. Submit Contractor’s Sustainable Materials Form with complete information on regional content for concrete provided under the work of this section. Include cost of all concrete materials and distance in miles to point of materials extraction and manufacture.
4. Submit documentation of regional materials – product data, mix design information, or manufacturer’s statement.

1.9 QUALITY ASSURANCE

A. General

Contractor shall examine all Contract Documents and note any discrepancies or items requiring close coordination or time schedules; assume responsibility of same and administer action such that the proper solution will result.

1. Contractor's material control procedures shall be effective and shall assure that all work fulfills the requirements of applicable provisions of the Contract Documents.
2. Contractor shall maintain sufficient staff to assure that all data and drawings for work of other sections is transmitted to detailers to allow proper detailing of holes, penetrations and the like and to assure proper execution of the work in the field.
3. Perform quality control functions required to achieve and to document that work conforms to the Contract Documents. Proved a reasonable number of copies of quality control reports and make all documents available up on request to the Architect, Owner and Engineer.
4. Contractor and Construction Manager shall coordinate and schedule the work of this section with the work of other sections of this specification in order to optimize quality and to avoid delay in job progress.
5. Prior to starting work the contractor shall cooperate and coordinate with each trade affected by the work of this section. Contractor shall report unsatisfactory or nonconforming conditions to the Engineer in writing prior to the start of work.
6. Construction loads shall not exceed the superimposed load which the member, with necessary supplemental support, is capable of carrying safely and without damage. The amount, method of distribution, and proposed supplemental support is the sole responsibility of the contractor.

B. Qualifications

1. General: Provide at least one person who shall be thoroughly familiar with the Construction Documents and other applicable requirements, trained and experienced in the necessary skills, and who shall be present at the site and direct all work performed under this section. Use an adequate number of skilled workmen to ensure installation in strict accordance with the approved design.
2. Concrete Installer: Company specializing in performing the Work of this Section shall have three years minimum experience on successful projects of similar size.
3. Concrete Producer: Company specializing in the production of concrete shall be certified by the National Ready Mixed Concrete Association (NRMCA) and shall have certification by either a New York City Agency or the NYS Department of Transportation. The plant shall use NYSDOT approved trucks and drivers shall be certified by the NRMCA.
4. Concrete Laboratory: Concrete laboratory providing design mixes shall be New York City licensed and shall meet the requirements of ASTM E329.

C. Regulatory Requirements

1. Building Code: Work of this Section shall conform to all requirements of the NYC Building Code and all applicable regulations of governmental authorities having jurisdiction including safety, health, noise, and anti-pollution regulations. Where

more severe requirements than those contained in the Building Code are given in this Section, the requirements of this Section shall govern.

2. Industry Standards: The ACI Standards listed under references apply to Work of this Section. Where more severe requirements then those contained in the Standards are given in this Section or the Building Code, requirements of this Section or the Building Code shall govern. The Contractor shall keep a copy of ACI SP-15 - "Field Reference Manual" at the site.
3. Recommendations or suggestions in the codes and references listed in this Article and under “References” shall be deemed to be mandatory unless they are in violation of the Building Code.

D. Certifications

1. Cast-in-Place Concrete shall conform to the material acceptance, certification, and inspection requirements of Sections BC 1704.4 and BC 1905 of the 2014 NYC Building Code.
2. Cement and aggregate shall be acquired from the same source for all work. If a change in suppliers is required, a new mix submittal must be produced with the new material and submitted for approval.

E. Cold Weather

When casting concrete in cold weather, plans to protect the concrete shall be made in advance and in accordance with ACI306.1 and all necessary material and equipment shall be on site well in advance of concrete placement. The contractor is responsible for ensuring the proper planning for cold weather concreting.

F. Pre-Concrete Conference

At least 35 days prior to the start of the concrete construction schedule, conduct a meeting to review the proposed mix designs and to discuss the required methods and procedures to achieve the required concrete quality. The contractor shall send a pre-concrete conference agenda to all attendees 20 days prior to the scheduled date of the conference.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Materials and products shall be delivered to the site in the manufacturer's original and unopened containers and packaging bearing labels as to type of material, brand name and manufacturer's name. Delivered materials shall be identical to accepted samples.

B. Materials and products shall be handled in a workmanship like manner per manufacturer's specifications. Storage shall be under cover in dry, weathertight, ventilated and clean locations off the ground.

C. Storage of ingredients for concrete:

1. Cement shall be stored in weathertight containers.
2. Aggregate stockpiles shall be arranged and used in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of like aggregates. To ensure that this condition is met, any test for determining conformance to requirements for cleanliness and grading shall be performed on

samples secured from the aggregates at the point of batching. Frozen or partially frozen aggregates shall not be used.

3. Stockpiles of natural or manufactured sand shall be allowed to drain to ensure a relatively uniform moisture content throughout the stockpile.
4. Unless predampening is not considered desirable by the manufacturer or is considered impractical by the Engineer, dry lightweight aggregates shall be predampened as necessary. To prevent excessive variations in moisture content, predampened aggregates shall be allowed to remain in the stockpiles for a minimum of 12 hours before use.
5. Admixtures shall be stored in a manner that will avoid contamination, evaporation, or damage. For admixtures used in the form of suspensions or nonstable solutions, agitating equipment shall be provided to ensure thorough distribution of the ingredients. Liquid admixtures shall be protected from freezing and from temperature changes which would adversely affect their characteristics.

D. Delivered materials which are damaged or otherwise not suitable for installation, shall be removed from the jobsite and replaced with acceptable materials.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Adequately protect concrete placed during rain, sleet, or snow, or when the mean daily temperature falls below 40°F or rises above 90°F as provided in Article 3.05.

1.12 PROJECT SITE CONDITIONS

A. The Contractor shall report in writing to the Engineer any discrepancies between the design drawings and the existing site conditions.

B. The Contractor shall field verify all information related to existing conditions such as: Surrounding structures, underground utilities and any other conditions that may exist.

C. The Contractor shall survey surrounding structures to obtain information such as: Elevation of existing footings, bearing walls, water supply, sewage, utility piping and other utilities installations which may interfere with the construction.

D. The Contractor shall obtain the pertaining information described above before starting a particular phase of work.

E. Examine the substrata and the conditions under which the concrete is to be installed, and notify the Engineer in writing of unsatisfactory conditions. Do not proceed with the work until the unsatisfactory conditions have been corrected.

F. All concrete work shall be properly protected during casting against freezing, excessive heat, acid rain or any other environmental destructive agent. Completed work shall be covered temporarily, permanently or as required. Protect adjacent finish materials against spatter during concrete placing.

G. The Contractor shall comply with any and all federal, state and local environmental code requirements.

H. Descriptions of, or limitations on, sequences of construction given in the Contract Documents are intended to assist the Contractor. Descriptions or limitations given are not by any means intended to fully describe construction limitations, sequence or techniques, nor preclude use of other methods if accepted by Engineer in writing. Whether or not Contractor follows the limitations and descriptions given herein, Contractor remains fully responsible for both the stability and the safety of the work; adherence to the limitations described herein does not relieve the Contractor from that responsibility.

1.13 DEFICIENT WORK

A. Deficient work or any work failing to strictly conform to the Contract Documents shall be removed and replaced, or repaired if accepted by Engineer, at no cost to the Owner, Architect or Engineer.

1. Contractor shall prepare appropriate details and procedures to bring such work into conformance with the Contract Documents and submit to Engineer for review and acceptance. Contractor shall, through the Owner, reimburse the Engineer for time and expense incurred reviewing proposal procedures and details in accordance with the Engineer's current fee schedule.
2. Nonconforming work may be rejected by Owner, Architect or Engineer at any time, regardless of prior acceptance in shop drawings, prior inspection, inclusion in inspection or test reports, or inclusions in certificates of payments.

B. Deficient work shall include, but not be limited to:

1. Low cylinder strength, as defined by this Specification.
2. Excessive or deficient air content.
3. Slump not in accordance with this Specification.
4. Spalling, honeycombing, surface defects, cracking, improper consolidation or the like.
5. Unauthorized cutting, construction joints, cold joints and so forth.
6. Workmanship not in accordance with the Drawings, with this Specification, with accepted samples, or with referenced codes or standards.
7. Incorrect forming, finishing or treating of concrete surfaces.
8. Exceedance of tolerances.
9. Evidence of improper curing and the like.
10. Higher than specified water content and/or w/cm ratio as determined by Microwave testing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Lightweight Aggregate

1. Northeast Solite Corporation,
2. Norlite Corporation,

B. Admixtures

1. Euclid Chemical Company, Cleveland, OH 44110
2. Master Builders,
3. Sika Chemical Corporation,
4. Anti Hydro Company,
5. Chem Masters,
6. GCP Applied Technologies
7. St. Lawrence Cement Company,
8. BASF

C. Curing Compounds

1. Euclid Chemical Company, Cleveland, OH 44110
2. Master Builders,

D. Waterstops

1. BBZ USA-Greenstreak, St. Louis, MO 63122
2. Sika Corp, Lyndhurst NJ 07071
3. DeNeef Construction Chemicals, Waller, TX 77484

E. Vapor Barrier

1. Stego Industries, San Juan Capistrano, CA 92675
2. Reef Industries, Houston, TX 77075
3. W.R. Meadows, Hampshire, IL 60140-0338

F. Vapor Retarder

1. Stego Industries, San Juan Capistrano, CA 92675
2. Reef Industries, Houston, TX 77075
3. W.R. Meadows, Hampshire, IL 60140-0338

G. Bonding Agent

1. Sto Concrete Restoration Division, Atlanta GA
2. Sika Corp, Lyndhurst NJ
3. Euclid Chemical Company, Cleveland, OH 44110

H. Densifier/Sealer

1. Euclid Chemical Company, Cleveland, OH 44110
2. Curecrete Chemical Company, Inc., Springville, UT 84663

2.2 MATERIALS

A. Cement

Shall conform to ASTM C150 and shall be of the non air-entrained types, from a single supplier:

1. Unless otherwise specified or approved by the Engineer of Record, cement shall be Type I or II.
2. Type II shall be used for exterior pavements.
3. Cement shall not contain ingredients that would result in more than two percent air being entrained in the concrete.
4. For concrete mixes with a design strength of more than 4ksi, cement shall have a minimum 28 day cube strength of 4000 psi when tested in accordance with ASTM C109.

B. Admixtures

1. General
   a. The use of admixtures shall comply with the requirements of Section BC 1903.6 of the 2014 NYC Building Code.
   b. The final soluble chloride content in concrete, percent by weight of cement, due to the addition of admixtures and other ingredients shall not exceed 0.05 at 28 days. All admixtures shall be non-corrosive.
   c. The amount of cement required by the Building Code may be reduced by 40% as per the code with the use of slag cement that has been reviewed and approved by the Owner.
   d. All admixtures shall be added at separate intervals of the mix cycle.
2. Air-entraining admixture: Shall conform to ASTM C260.

3. Water-reducing admixture: Shall conform to ASTM C494, Type A or D, and contain no more chloride ions than found in drinking water.

4. High range, water-reducing admixture (super- plasticizer): Shall conform to ASTM C494, Type F or G, and contain no more chloride ions than found in drinking water.
5. Water reducing, accelerating admixture: Shall conform to ASTM 494, Type C or E, and contain no more chloride ions than found in drinking water.
6. Water reducing, retarding admixture: Shall conform to ASTM C494, Type D, and contain no more chloride ions than found in drinking water.
7. Slag cement: ASTM C989, Grade 100 or 120. Shall be GranCem slag cement as manufactured by the St. Lawrence Cement Company.
8. Fly Ash: ASTM C618, Class F except that maximum carbon content shall not exceed three percent and maximum percentage retained on the #325 screen shall not exceed 25 percent. Fly ash shall be from a single, domestic source.
9. Corrosion inhibiting, calcium nitrite based compound; "Eucon CIA" by the Euclid Chemical Company, "DCI Corrosion Inhibitor" by GCP Applied Technologies, "Rheocrete CNI" by BASF Admixture Systems.
10. Microsilica; "MSA" by the Euclid Chemical Company, "Force 10,000" by GCP Applied Technologies, or "Rheomac SF" by BASF Admixture Systems.

C. Water: Shall be clean potable water free of injurious foreign matter conforming to the requirements of Section BC 1903.4 of the Building Code.

D. Aggregates:
Fine and coarse aggregates shall be regarded as separate ingredients. Each size of coarse aggregate, as well as the combination of sizes when two or more are used, shall conform to the appropriate grading requirements of the applicable ASTM specifications. Maximum size of coarse aggregate shall conform to paragraph 3.3.2 of ACI 318.

1. Aggregates for normal weight concrete shall conform to ASTM C33 and be of Size No.67 and/or No.8.
2. Aggregates for lightweight concrete shall conform to ASTM C330 and be of sizes 3/4" to No.4, 1/2" to No.4, and/or 3/8" to No.8. Lightweight coarse aggregate shall be rotary kiln product of expanded shale or slate and conforming to the requirements for normal weight coarse aggregates.
3. Fine aggregate shall be clean, hard, light colored sand.
4. Pea gravel aggregate shall be as given above except course aggregate shall be ASTM C33 size #8.
5. Aggregates for slab on grade shall conform to the recommendations of ACI 302.1R Chapter 4.

E. Curing Compounds

1. Non-strippable

a. Clear Curing and Sealing Compound (A.I.M. Regulations - VOC Compliant, 350 g/l): Liquid type membrane-forming curing compound, clear styrene acrylate type, complying with ASTM C1315, Type I, Class A, 25% solids content minimum. Moisture loss shall be not more than 0.40 Kg/m^2 when applied at 300 sq. ft./gal. Manufacturer's certification is required.
b. Curing Compounds shall be "Super Diamond Clear VOX" by The Euclid Chemical Company or "Masterkure 100W" by Master Builders.

2. Strippable

a. Clear Curing Compound: Liquid type membrane-forming curing compound, complying with ASTM C309.
b. Curing Compounds shall be "Kurez DR Vox, Kurez W Vox by The Euclid Chemical Company or "Masterkure N-Seal VOC" by Master Builders.

F. Curing Materials

1. Sheet materials shall conform to ASTM C171 and be non-bleeding and non-staining. Burlap cloth shall be made from jute or kraft and conform to AASHTO M182, using at least 2 layers.

G. Bonding Agent

1. Epoxy/acrylic resin that will not form a vapor barrier with the concrete with the following properties:

a. Bond strength of 1800 psi in 2 hours when tested in accordance with ASTM C882.
b. Flexural strength of 2000 psi in 28 days when tested in accordance with ASTM C78.
c. Tensile strength of 600 psi in 28 days when tested in accordance with ASTM C496.

2. Bonding agent shall be "CR246 Sto Bonding and Anti-corrosion Agent" by Sto Concrete Restoration Division, Armatec 110 by Sika Corp, Corr-bond by Euclid Chemical Company, SBR Latex by Euclid Chemical Company, Daraweld-C by GCP Applied Technologies or equivalent accepted by Engineer.

H. Densifier/Sealer

1. The densifier/sealer compound shall be a VOC compliant, non-yellowing, siliconate-based sealer that penetrates concrete surfaces and increases abrasion resistance and provides a “low-sheen” surface that is easy to clean. The compound shall contain a minimum solids content of 20%, of which 50% is siliconate.
2. Densifiier/Sealer shall be “Euco Diamond Hard” by The Euclid Chemical Co. or “Ashford Formula” by Curecrete Chemical Co.

I. Vapor Barrier

1. Vapor Barrier shall meet the following properties:

a. Minimum 15-mil polyolefin geomembrane.
b. Water Vapor Barrier – ASTM E1745, Class A
c. Permeance Rating – ASTM E1745/E96 or E1249/E96: 0.018 perms or lower
d. Puncture Resistance by ASTM E1745: Class A, minimum 2300 grams

e. Tensile Strength by ASTM E1745: Class A, minimum 45 lbf/in

2. Accessories

a. High density polyethylene tape with pressure sensitive adhesive
b. Pipe boot for piping and conduits constructed from vapor barrier and tape

3. Shall be:

a. Stego Wrap 15 mil Vapor Barrier by Stego Industries
b. Griffolyn 15 mil Green by Reef Industries
c. Perminator 15 mil by W.R. Meadows

J. Vapor Retarder

1. Vapor retarder shall be polyolefin type material, 10-mil thick minimum, with a perm rating of less than 0.1 when tested in accordance with ASTM E1745/E96, procedure A, and shall be resistant to decay when tested in accordance with ASTM E154 and meet ASTM E1745 Class A.

2. Shall be:

1. Griffolyn 10 mil Green by Reef Industries
2. Stego Wrap 10 mil Vapor Retarder by Stego Industries
3. Perminator 15 mil by W.R. Meadows

K. Waterstops

1. Concrete Joints

a. Water-swelling acrylate ester resin, hydrophilic rubber, or polyurethane type capable of expanding and contracting over multiple number of wet-dry cycles without reduction in its expansion ratio. If concrete surface is very uneven, provide paste type indicated in 2 below.
b. Shall be Duroseal Gasket Waterstop by BBZ USA-Greenstreak, Swellseal 8 by DeNeef, SikaSwell Profile by Sika Corp., or Waterstop-RX by Volclay Provide approximately 1" x 3/4" chemical resistant type. Attach to concrete and membranes with manufacturer's recommended adhesive or paste type waterproofing.
c. PVC type shall be 6" wide dumbell or serrated type made from virgin PVC; Style 748 or 679 by Greenstreak, Type R6-316 by Vinylex, or equivalent accepted by Engineer.

2. Steel, pipe and metal penetrations
a. Water-swelling acrylate ester or polyurethane paste type capable of expanding and contracting over multiple number of wet-dry cycles without reduction in it expansion ratio. Paste is a thixotropic grade material capable of being placed on uneven surfaces.
b. Shall be Duroseal Paste by BBZ USA, Swellseal Mastic by DeNeef, or SikaSwell S by Sika Corp. Provide chemical resistant type. Provide a minimum of 3/8" by 1/2" bead of material.

L. Reed Clips for Concrete Encased Structural Steel
   1. Expansible reed clips shall consist of 12-gage longitudinal wires and 12-gage clips 9" on center, which place the wires 3/4" to 1" from the flanges.
   2. Provide the following types, depending on member sizes:

      a. 4" wide, expansible to 8"
      b. 8" wide, expansible to 12"
      c. 12" wide, expansible to 16"
      d. 16" wide, expansible to 24"

   3. Shall be Expansible Reed Clips by Equipment Distributing Corporation.

M. Granular Fill: Under slabs on grade shall be well a graded run of bank sand and gravel with maximum size of 1-1/2", between 30% and 50% passing a #4 sieve, between 10% and 25% passing a #50 sieve and not more than 5% of particles by weight passing a #200 sieve. Imported material, if required, shall consist of a well graded mixture of sand and durable, hard limestone. The Contractor shall provide laboratory gradation tests (i.e., before and after laboratory compaction tests) and compaction tests (ASTM D 1557) prior to delivery for evaluation and approval by the geotechnical engineer.

N. Gravel or Crushed Stone: Under slabs on grade shall be hard, clean, natural rock, free of dust or other contaminants, and graded to requirements of ASTM C33, size #67.

O. Bond Breaker: Under fill and topping slabs shall be 4 mil thick polyethylene sheet.

P. Styrofoam: Shall conform to ASTM C578, Type VI; Styrofoam 40 High Load by the Dow Chemical Company or equivalent approved by the engineer.

Q. Expansion Dowels
ASTM A36 bars, hot-dipped galvanized and provided with a suitable expansion shield securely positioned and end filled with a readily compressible material assuring adequate expansion space beyond.

R. Neoprene Pads
Shall conform to AASHTO Standard Specification, Division II, Chapter 18 ASTM D2240, grade 50 Durometer hardness.

S. Premolded Joint Filler
Non-extruding bituminous-type preformed expansion joint filler conforming to ASTM D1751.

U. Semi Rigid Joint Filler
For contraction and construction joints in slabs on grade a two (2) component 100% solids compound, with a minimum shore A hardness of 80. Provide “Euco 700” or “QWIKjoint 200” by The Euclid Chemical Company or Masterfill CJ by BASF Admixture Systems.

V. Penetrating Sealer

Clear solvent based or water based silane or siloxane penetrating sealer; Euco-Guard 100, 200 or Vox by the Euclid Chemical Company, Sikaguard 701W by Sika, Masterseal SL by BASF Admixture Systems, or equivalent accepted by Engineer.

W. Polymer Repair Mortar
Polymer and microsilica modified cementitious based compound; “Thin Top Supreme, Concrete Top Supreme” (Horizontal repairs) by the Euclid Chemical or “Sikatop 121 or 122” (Horizontal repairs) by Sika Chemical, or “Verticoat/Verticoat Supreme by The Euclid Chemical Company (Vertical or Overhead) or “Sika 123” by Sika Chemical (Vertical or Overhead) by Sika Chemical. These patching mortars may be used when color match of the adjacent concrete is not required. Prior approval by the Engineer is required.

X. High Strength Repair Mortar
A flowable high strength, microsilica modified repair mortar for large horizontal placements or form and pour applications; Eucocrete by Euclid Chemical.

Y. Underlayment Compound
Free flowing, self-leveling, pumpable cementitious base compound, Flo-Top or Super Flo-Top by The Euclid Chemical Company, Ardex by Ardex Company, or Underlayment 110, by BASF Admixture Systems.

Grade

2.3 MIXES

A. General

1. Contractor shall employ a consultant , acceptable to the Engineer, hereinafter called the "Concrete Consultant", to prepare concrete mix designs from representative samples of the materials to be used to produce the concrete for each "type" of concrete required. A new “type” of concrete exists whenever there are changes to source or type of ingredient, source or type of cement, design strength, proportioning, or placing methods.
2. The Concrete Consultant shall design or verify mixes for each "type" of concrete in accordance with the trial mixture method or field experience method of ACI 318 Article 5.3. Test results of trial mixes shall be submitted to Engineer for acceptance prior to concreting. Each mix shall clearly state the location where mix is to be used.
3. The proportion of ingredients shall be selected by the Concrete Consultant to produce proper placeability, durability, strength, and to produce a mixture which will work readily into the corners and angles of forms and around reinforcement by methods of placement and consolidation employed on the work, but without permitting materials to segregate or permitting excessive free water to collect on surface. Comply with recommendations of ACI 211.1, 211.2 and 302.1R.
4. When a source, type, kind or brand of each constituent has been established and approved for the project mixes, it shall not be changed throughout the duration of the concreting. Batch all constituents including admixtures at the central batch plant.

B. Method of Proportioning

1. Proportion, batch, and mix concrete in accordance with Section BC 1905. The licensed concrete laboratory is responsible running the mix and signing the TR3 for filing with the Building Department. Proportion concrete mix in accordance with Section BC 1905.3.
2. Mix designs are specific to material used, concrete producer, and method of placement. Each mix design must be reviewed by the Engineer of Record and accepted prior to placement along with accompanying TR3 signed by the lab and concrete producer.
3. The recycled content in the concrete mix shall be 40% of the cementitious content or a minimum of 6% of the dry weight.

C. General Mix Requirements

1. Concrete mixes shall be designed to provide for all of the requirements given in this Specification and on the Drawings even if strength or any other criteria must be exceeded to meet another criteria.
2. Strength requirements given on the Drawings shall be based on 28-day compressive strength (56 days for concrete containing 40% alternate cementitious material - slag) for Type I and II cement and 7-day for Type III, unless a different test age is specified.
3. Concrete to be exposed to deicing salts, to brackish water, or to salt laden air in service shall have a maximum water-to-cement ratio, by weight, of 0.40, a minimum strength of 5000 psi, a minimum cement content of 650 pounds per cubic yard, air entrainment, Type II cement, and a maximum water soluble chloride ion content of 0.15 percent by weight of cement.
4. All concrete required to be watertight shall have a maximum water-to-cement ratio, by weight, of 0.40 and a minimum strength of 5000 psi.
5. Provide pea gravel aggregate concrete for all sections thinner than 6 inches, and where required due to congestion of reinforcing steel.
6. Concrete mixes to be exposed to earth or weather shall have a maximum water soluble chloride ion content of 0.30 percent by weight of cement.
7. All normal weight concrete subject to freezing and thawing shall contain 4½% minimum to 6 1/2% maximum total air content. The allowable tolerance shall be plus or minus 1 ½% of the air content indicated in the mix design.

D. Normal Weight Concrete

1. Unless otherwise specified, proportion and produce normal weight concrete to have a maximum slump of 4” or less. A tolerance of up to 1" above the indicated maximum shall be allowed for individual batches provided the average for all batches or the most recent 10 batches tested, whichever is fewer, does not exceed the maximum limit. The slump shall be determined by ASTM C143. Concrete containing High Range Water Reducer shall have a slump not exceeding 9”, unless other wise approved by the Engineer of Record. The concrete shall arrive at the job site at a slump of 2" to 3", be verified, and the HRWR admixture added to increase the slump to the approved level.

2. All normal weight concrete subject to freezing and thawing shall be air-entrained, provide the following air content for the grading size of coarse aggregate as follows:

   a. No.8.....$7^{1}/_{2}$%
   b. No.67.....6%

   Tolerance on air content as delivered shall be +1.5%.

3. Normal weight concrete shall have a maximum water-to-cement ratio, by weight, of 0.40 and a minimum strength of 5,000 psi unless otherwise noted.

E. Admixtures

1. Concrete mixes with admixture dosages exceeding 64 ounces per cubic yard of concrete shall have free water content of concrete mix reduced by aqueous portion of admixtures in order to adhere to water to cementitious ratio requirements.
2. A water reducing admixture or high-range water reducing admixture shall be used in all mix designs.
3. A high range, water reducing admixture shall be used when any of the conditions below apply. Self-Consolidating concrete shall have a slump/flow of 20” to 30”.

   a. Water to cementitious ratio is 0.45 or less, architectural concrete, self-consolidating concrete, and synthetic fiber concrete.
   b. Concrete is to be pumped.
   c. When requested by the Contractor and accepted by the Engineer in concrete mix design.

4. An air-entraining admixture shall be used in all mix designs for concrete subject to freezing and thawing.
5. A water reducing, retarding admixture shall be used when concrete is to be placed during hot weather as defined by ACI 305R.
6. Fly ash shall be used as an admixture for all lightweight concrete to be pumped.
7. A non-corrosive accelerator shall be used when concrete is to be placed during cold weather as defined by ACI 306.1.
8. Synthetic macro fiber reinforcement shall be used where called for on the Drawings and when requested by Contractor and accepted by the Engineer. Unless noted otherwise on the Drawings, or otherwise recommended by the manufacturer, dosage rate shall be 1-1/4 pounds per cubic yard.

2.4 SOURCE QUALITY CONTROL

A. Tests

1. The Owner Testing Laboratory will review and/or check test proposed materials for compliance with the Specifications prior to construction.
2. The Testing Laboratory will perform field tests as work progresses as listed in "Field Quality Control".

B. Inspection

1. Testing Laboratory

a. The Owner will engage a Licensed Concrete Testing Laboratory, meeting the requirements of ASTM C1077 and ASTM E329, to inspect batching of the concrete, at the Authorities discretion, and perform all field tests. The Laboratory will perform the following services:

1) Review and/or check-test the Contractor's proposed materials for compliance with the Specifications.
2) Review and/or check-test the Contractor's proposed mix design.
3) Secure production samples of materials at plants or stock-piles during the course of the Work and test for compliance with the Specifications.
4) Perform tests during construction as required by Section BC 1905.6.2 of the 2014 NYC Building Code. The Laboratory will obtain samples at the mixer and when directed by the Engineer at the point of placement by the following methods:

a) Secure composite samples in accordance with ASTM C172. Each sample shall be obtained from a different batch of concrete on a random basis, avoiding any selection of the test batch other than by a number selected at random before commencement of concrete placement.
b) Mold and cure specimens from each sample in accordance with ASTM C31 and perform strength tests.

b. The Owner may assign a qualified concrete technician to be stationed at the batch plant depending on the size of the project or evidence of poor concrete breaks. At least one qualified concrete technician will be stationed at the site to obtain the test specimens.
c. The Laboratory will be responsible to and under the supervision of the Special Inspector.

2. Special Inspector

a. The Owner will assign, under the requirements of Section BC 1704.4 a Special Inspector who will supervise the testing of the materials and the inspection of concrete construction. The Special Inspector is responsible for any required filing with the Building Department, as well as maintaining a log book of the concrete work.
b. The Special Inspector will check that all required tests are made and the results submitted and shall have the right to order the Contractor to make such changes of the mix of concrete as required to produce concrete of the necessary strength provided that it satisfies the drawings, specifications and building code. Any changes to the mix shall be submitted to the engineer for approval. The Special Inspector will also report to the Building Department Superintendent any deviation from the requirements of the Code, as indicated by records of inspection and reports of tests.

3. Notifications

   a. Notify the Owner in writing at least forty-eight hours in advance of each concrete placement. The Owner will notify the Testing Laboratory immediately to order out the necessary concrete technicians to cover the work.
   b. Once the concrete technicians are ordered out and a cancellation follows, the Contractor will be charged Four Hundred Fifty Dollars for each technician so ordered to appear, unless a cancellation order is issued to the Laboratory by 3 PM the day before the concrete placement.
   c. During the placement of the concrete, notify the Owner immediately of any delay at the concrete plant or at the job site. Where the Owner decides to provide a technician at the plant, do not mix concrete or add admixtures unless the Technician is present. Do not add admixtures to be added at the site unless the Technician is present.
   d. The Testing Agency shall report directly to the Owner and Engineer the results of all testing and inspection by means of daily written reports. When any test or inspection reveals deficient or nonconforming work the Testing Agency shall notify the Owner and Engineer immediately by means of a written report specially and clearly marked and identified to show deficient areas of work.

4. Contractors Responsibility for Quality Control

   a. The Contractor will receive a copy of all reports prepared by the Laboratory and/or Special Inspector. Copies of the daily concrete reports prepared by the Special Inspector will be available for reference.
   b. The Contractor will therefore be afforded an opportunity to review all reports and mix data and submit to the Special Inspector and Engineer any recommendations in changing the mixes provided they conform to the Code and Specifications. Any testing required because of changes in materials or proportions of the mix requested by the Contractor, as well as any extra testing of concrete or materials occasioned by the failure to meet Specification requirements shall be at the Contractor's expense. The Contractor, at any time, can arrange to have independent tests made at own expense by an approved laboratory and submit the reports and recommendations to the Special Inspector and Engineer of Record.
   c. The tests and inspections or waiving of tests and inspections by testing agency, as provided in the Code, do not in any way relieve the Contractor of responsibility to construct the Work in accordance with the Drawings and Specifications and to use safe, standard methods of construction at all times, safeguarding the public, workmen, and structure. The Contractor shall be solely responsible for the physical control of the materials and concrete mixes, and shall see that such mix designs, tests, and controls are in accordance with the Code and Specifications.
   d. It shall be the Contractor's complete responsibility to adjust, alter, and/or correct any controls necessary in materials and/or concrete operation based upon tests and inspections made by the Owner or the Contractor's independent tests. If, during the course of the concrete operations, a lower water content or more cement is needed per cubic yard above that used in the approved design mix, provide same at no additional cost to the Owner.

e. If the Contractor requests any deviation from the Specifications and Drawings, or makes or causes to be made any change of construction from Drawings and Specifications, and such request requires the time and investigation of the Engineer of Record, pay all costs incurred by the Owner relating to such time and investigation.

f. Where additional tests are deemed necessary by Engineer due to failure to pass tests, the cost of additional testing will be deducted from payments to Contractor.

g. If, due to errors by the contractor or failure to perform his work in accordance with the Contract Documents, the Engineer must perform additional design or drafting work or review proposed solutions, the Contractor shall, through the Owner, reimburse the Engineer in accordance with the Engineer's current fee schedule, plus out of pocket expenses incurred.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to placement of concrete, verify that the concrete cover over the reinforcement is that specified on Drawings.

B. Verify that anchor bolts, reinforcement, and all other embedded items are provided and held securely, positioned accurately, and will not be a detriment to concrete placement.

C. Examine all adjoining work on which this Work is in anyway dependent for proper installation and workmanship. Report to the Engineer and Owner any condition that prevents the performance of this Work.

3.2 PROTECTION

A. Protect concrete members on grade and the subgrade from freezing before and after installation. Provide blankets and other items necessary.

B. Protect adjacent finish materials and previously poured concrete against spatter during concrete placement.

C. Provide and maintain barricades and safeguards around openings, etc. to protect workmen from injury and to comply with all Building Code, OSHA, and other authorities having jurisdiction regulations.

3.3 PREPARATION

A. Remove ice, excess water, trash, and rubbish from forms.

B. Remove hardened concrete from inner surfaces of conveying equipment and all formwork, reinforcement, and dowels.

C. Prepare previously placed concrete to be in contact with new concrete in the manner described under "Construction Joints".

D. Prepare existing concrete to be in contact with new concrete by roughening and cleaning the surface and applying a bonding agent. Surface must be free of laitance. Concrete must be placed after agent cures and within 20 hours of applying bonding agent. If time elapses, apply a new application in accordance with the directions of the manufacturer.

E. In case a conflict arises between concrete as poured and other Work that requires cutting into concrete beams, columns, walls, or slabs, submit requests to the Engineer of Record, who will issue instructions accordingly. Cutting of concrete is otherwise prohibited.

F. Do not place concrete on frozen ground.

G. Contractor is solely responsible for the protection, shoring, bracing, stability and underpinning of existing structures either on or adjacent to the site. Details and extent of such work shown on the Drawings are suggestions only; Contractor is to determine requirements and methods. All of the above operations shall be done under the supervision of a qualified Professional Engineer licensed in the state of NY.

H. Contractor shall examine all existing surfaces, structures and the like which the work must attach to, clear or abut. Notify Engineer in writing of any conditions, which will delay or be detrimental to work. Start of work shall represent acceptance by Contractor of existing conditions as suitable for completing work as specified.

I. Contractor shall verify, by measurements at the site, all existing dimensions, which affect the work of this Section. Field dimensions varying from those on the design drawings or accepted shop drawings shall be brought to the Architect's and Engineer's attention in writing.

3.4 JOINTS AND EMBEDDED ITEMS

A. Construction Joints

1. Shall be made and located only as shown or indicated on the Drawings or accepted shop drawings. Conform to ACI 318, Article 6.4. All construction joints not shown or indicated on the Drawings shall be submitted in writing for acceptance.
2. Place construction joints perpendicular to main reinforcement and continue reinforcement across joints. Provide longitudinal keys at least $1^1/_2$" deep in walls, slabs and between walls and footings. Accepted bulkhead designs for this purpose may be used for slabs. Drawings indicate keys or roughened surface at interface of walls and footings.
3. Use butt joints for unreinforced slabs on grade with Diamond Dowels for proper load transfer.
4. Thoroughly clean concrete surface of oil, grease, and other contaminants and remove all laitance prior to placement of adjoining concrete. Roughen surface of the concrete in an approved manner that will expose the aggregate uniformly to a 1/4" amplitude and will not leave laitance, loosened particles of aggregate, or damaged concrete at the surface. Dampen surface immediately prior to placement.
5. Provide waterstops in construction joints as indicated on drawings and specifications. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during the progress of work. Fabricate field joints in waterstops in accordance with manufacturer's instructions.

6. Where overlay finishes, such as pavers or terrazzo, are to be provided, locate construction joints accurately below or behind expansion joints in the finish material.
7. Do not exceed maximum distance between construction joints noted in the Drawings or this Specification. If no criteria is given, do not space greater than 40 feet for walls, 100 feet in any direction for formed slabs, or 40 feet for slabs on grade.
8. Construction joints designated to be specially roughened, or joints of new concrete connecting to existing concrete, shall be bush hammered to 1/4-inch minimum roughness amplitude and thoroughly cleaned. Apply specified bonding agent where noted or specified.
9. Joints in slabs on grade, subjected to hard wheeled traffic shall be filled with the specified semi-rigid joint filler. The installation shall be made in strict accordance with the instructions from the manufacturer. The surface must be level with the concrete shoulders.
10. Properly install all embedded items where required.
11. Construction joints shall be made in accordance with Section BC 1906.8 of the Building Code.

B. Contraction (Control) Joints in Slabs-On-Ground

1. Construct in pattern as shown or noted on Drawings.
2. Inserts shall be laid into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of inserts. After concrete has cured, remove inserts and clean groove of loose debris.
3. Saw cuts shall be made as soon as possible after slab finishing and may be done without dislodging aggregate.

    a. Maximum joint spacing shall be 36 times the slab thickness unless otherwise noted on the drawings. The Soff-Cut saw shall be used immediately after final finishing and to a depth of 1-1/4-inch. A conventional saw shall be used as soon as possible without dislodging aggregate and to a depth of 1/4 slab thickness.
    b. Use load plate baskets under saw cuts where designated on the plans for load transfer.

4. Joints, in slabs on grade, subjected to hard wheeled traffic shall be filled with the specified semi-rigid joint filler. The installation shall be made in strict accordance with the instructions from the manufacturer. The surface must be level with the concrete shoulders.

C. Isolation Joints in Slabs On Grade

1. Provide at points of contact between slabs on grade and vertical surfaces where shown or called for on drawings. Provide joint filler and sealant as specified.

D. Waterstops

1. Provide waterstops at all joints and all penetrations of type indicated in Part 2 of this Section. All surfaces onto which material is placed shall be clean and smooth. Do not let materials come in contact with water by covering waterstop, forms, or other means necessary. Provide minimum clearance from edge of concrete as per manufacturer's recommendations, typically 3".
2. Provide maximum practical lengths for each piece so that the number of end joints will be held to a minimum.
3. Make joints in such a manner that they develop effective watertightness fully equal to that of the continuous material. All joints to be lapped as per manufacturer's instructions.
4. Use manufacturer's adhesive or swelling paste type for applying gasket type to previously poured concrete and/or waterproofing membrane. Surface onto which waterstop is placed shall be smooth.
5. Provide swelling paste type at all pipe penetrations, conduits, drains, steel members, and other areas where items penetrate the concrete foundation system and at uneven concrete surfaces.
6. If water penetrates joints in which waterstops are placed at contract locations or at cracks and cold joints, the Contractor shall remediate the crack with injection material recommended by the Owner and approved by the Engineer that will provide a 5-year labor and material guarantee against water seepage at no cost to the Owner.

E. Other embedded items

1. Place all fence sleeves and shoes, pipe sleeves, inserts, anchors, anchor bolts, and other embedded items required for the Work of other Divisions or for their support prior to concreting. Install Link-seal Watertight Sleeves by Thunderline Corp. through foundation walls and other locations where watertight construction is required and where indicated on Drawings as per manufacturer's instructions. Coordinate with other trades, all Drawings, and manufacturer for sizes, location, and quantity.
2. Provide ample notice and opportunity for items of other Division to be introduced and/or furnished for installation before concrete is placed. Coordinate the Work of the other Divisions so all items are placed in their proper location.
3. Set metal pipe sleeves, sockets, shoes, etc. into concrete to receive fence posts or any other items, all as indicated on details.

F. Placement of Embedded Items

Position expansion joint material, waterstops, and other embedded items accurately and support against displacement. Fill voids in sleeves, anchor slots, and inserts temporarily with readily removable material to prevent the entry of concrete into the voids.

3.5 MIXING AND PLACING CONCRETE

A. General

1. Notify Owner at least 48 hours in advance of each concrete placement. Do not place concrete without approval of the Special Inspector.

2. Do not allow rainwater to increase mixing water nor damage surface finish.
3. When placing concrete in cold weather (air temperature below 40°F), concrete shall contain either an accelerating admixture or use Type III cement.

B. Mixing

1. Batch, mix, and transport ready-mixed concrete in accordance with the appropriate sections of ASTM C94 and Section BC 1905.8.2 of the 2014 NYC Building Code. Truck mixers and agitators shall meet the requirements of the Truck Mixers Manufacturer's Bureau or shall comply with Section 8.1.2 of ASTM C94 and shall be NYSDOT approved. All trucks shall have working revolution counters and site gages. Batch all other concretes in accordance with subsection 4.3.1 of ACI 301 only if permitted by the Engineer of Record and Special Inspector.
2. Batch ready-mixed concrete only in plants that are are NRMCA certified and NYSDOT approved. Only plants that are NYSDOT approved with current certification meeting the requirements for certification of the NRMCA for automatic batching and automatic recording will be permitted. Concrete shall be batched by the use of automation.
3. Unless otherwise approved by the Engineer of Record, concrete shall be deposited within $1^1/_2$ hours or 300 revolutions of the mixing drum, whichever comes first, after introduction of water to the cement or cement to the aggregate. When the ambient temperature rises above 90°F, the time shall be decreased to 1 hour.
4. Batch lightweight concrete using the saturated weight of aggregate, which shall take into account the internal and surface moisture content.
5. Tempering and control of mixing water

    a. Mix concrete only in quantities for immediate use. Concrete that has started to set shall not be retempered, but shall be discarded. After the introduction of initial mixing water for the batch, no additional water shall be added at the site.
    b. For concrete containing HRWR (Superplasticizer), if loss of slump occurs, HRWR may be redosed at the site as long as a "flash set" has not occurred. Redosage procedures must be discussed and approved by the Engineer and the admixture manufacturer at the Pre-Concrete Conference.

6. Weather Conditions

    a. Cold weather (Air Temperatures below 40°F)

        1) Concrete shall have either an accelerating admixture or use Type III cement. Do not use calcium chloride, salt, materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.
        2) The temperature of concrete delivered at the site shall conform to the temperature limitations given in Section 5 of ACI 301.
        3) If water or aggregate is heated above 100°F, combine the water with the aggregate in the mixer before cement is added. Cement shall not be mixed with water or with mixtures of water and aggregate having a temperature greater than 100°F.
        4) Detailed requirements are given in ACI 306R.

b. Hot Weather (Air Temperatures above 90°F)

1) Cool the ingredients before mixing, or substitute flake ice or well-crushed ice of a size that will melt completely during mixing for all or part of the mixing water if, due to high temperature, low slump, flash set, or cold joints are encountered. Water equivalent of ice must be calculated to total amount of mixing water.
2) Detailed requirements are given in ACI 305.

7. Admixtures - General

a. Add all admixtures prior to mixing unless otherwise specified or directed.
b. Air-entraining admixtures and other chemical admixtures shall be charged into the mixer as solutions and shall be measured by means of an approved mechanical dispensing device. The liquid shall be considered a part of the mixing water. Admixtures that cannot be added in solution may be weighed or may be measured by volume if so recommended by the manufacturer. The accuracy of measurement of any admixture shall be within +3 percent.
c. If two or more admixtures are used in the concrete, add them separately to avoid possible interaction that might interfere with the efficiency of either admixture or adversely affect the concrete. Do not charge admixtures into the mixer in such a manner that they will come in direct contact with the cement.
d. Use of accelerating admixtures or Type III cement shall not relax cold weather placement requirements.
e. Use of retarding admixtures in hot weather must be approved by the Special Inspector. Use of such admixtures will not relax hot weather placement requirements.
f. Where using high-range, water-reducing admixture shall be added at the jobsite or at the initial batching, in accordance with the manufacturer's instructions.
g. Where synthetic macro fiber reinforcement is used, fibers shall be added when concrete is batched. Follow manufacturer's instructions and standard ASTM C94 practices.

8. Hand-Mixed concrete shall not be used without written acceptance by Engineer. When permitted, such concrete shall be mixed only in watertight containers. Each ingredient shall be measured dry and sand and cement shall be mixed prior to adding coarse aggregate. Water shall be added slowly so as to provide an even mixture

C. Placing

1. General: Place concrete in accordance with ACI 304R, ACI309R ACI 318, and Sections BC 1905.9 and BC 1905.10 of the 2014 NYC Building Code.

a. Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work; cooperate in setting such work.

Moisten wood forms immediately before placing concrete where form coatings are not used.

b. Forms and other surfaces to receive fresh concrete shall be clean and free of frost, dirt and any other debris immediately prior to and during concrete placing.

c. Apply temporary protective covering to lower 2 feet of finished walls adjacent to poured floor slabs and similar conditions, and guard against spattering during placement.

2. Conveying

a. Handle concrete from the mixer to place of final deposit as rapidly as practicable by methods that will prevent separation or loss of ingredients and in a manner that will assure that the required quality of concrete is obtained.

b. Conveying equipment shall be approved and shall be of a size and design such that detectable setting of concrete shall not occur before adjacent concrete is placed. Conveying equipment shall be cleaned at the end of each operation or workday. Conveying equipment and operations shall conform to the following additional requirements:

1) Truck mixers, agitators, and non-agitating units and their manner of operation shall conform to the applicable requirements of ASTM C94.

2) Belt conveyors shall be horizontal or at a slope which will not cause excessive segregation or loss of ingredients. Concrete shall be protected against undue drying or rise in temperature. An approved arrangement shall be used at the discharge end to prevent apparent segregation. Mortar shall not be allowed to adhere to the return length of the belt. Long runs shall be discharged into a hopper or through a baffle.

3) Chutes shall be metal or metal-lined and shall have a slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20' long and chutes not meeting the slope requirements may be used provided they discharge into a hopper before distribution.

4) Pumping or pneumatic conveying equipment shall be of suitable kind with adequate pumping capacity. Pneumatic placement shall be controlled so that segregation is not apparent in the discharged concrete. The loss of slump in pumping or pneumatic conveying equipment shall not exceed 2". Pumping is permitted only if a pump mix is approved. Concrete shall not be conveyed through pipe made of aluminum or aluminum alloy.

3. Depositing: Detailed recommendations are given in ACI 304R.

   a. General

      1) Deposit concrete continuously, or in layers of such thickness that no concrete will be deposited on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, locate construction joints at points as provided for in the Drawings, shop drawings, or as approved. Should cold joints form, cease operations. Submit detailed drawings showing remedial measures for acceptance. Drilled dowels or anchors or chipped keyways may be required by the Engineer.
      2) Carry out placement at such a rate that the concrete that is being integrated with fresh concrete is still plastic. Do not deposit concrete that has partially hardened or has been contaminated by foreign material.
      3) Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
      4) Place concrete on metal deck in a manner that uniformly distributes the material over the metal deck in order to avoid overloading the deck joints.
      5) Remove temporary spreaders in forms when the concrete placing has reached an elevation rendering their service unnecessary. They may remain embedded in the concrete only if made of metal or concrete and if prior approval has been obtained.
      6) Placing of concrete in supported elements shall not be started until the concrete previously placed in columns and walls is no longer plastic.
      7) Deposit concrete as near as practical to its final location. Minimize lateral movement of fresh concrete. Placement procedures shall not allow concrete to drop thru successive reinforcing grids, nor strike cages in columns or layers in walls.

   b. Segregation: Deposit concrete as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. Do not subject concrete to any procedure that will cause segregation. Free drop of concrete shall not exceed 8 feet for columns or 4 feet for other elements. Self-Consolidating Concrete may be dropped further when approved by the engineer. Canvas or rubber elephant trunks may be used to limit free drop.

   c. Consolidation

      1) Consolidation of concrete and the use and type of concrete shall be in accordance with ACI 309R.
      2) Where a surface mortar is to be the basis of the finish, the coarse aggregate shall be worked back from the forms with a suitable tool so as to bring a full surface of mortar against the form, without the formation of excessive surface voids.

3) Consolidate all concrete by vibration so that the concrete is thoroughly worked around the reinforcement, around embedded items and into corners of forms, eliminating all air or stone pocket or weakness. Internal vibrators shall be the largest size and most powerful that can be used in the Work, as described in Table 5.1.5 of ACI 309R, with a minimum frequency of 7000 revolutions per minute and shall be operated by competent workmen. Overvibrating and use of vibrators to transport concrete within forms is not permitted. Insert and withdraw vibrators at many points, from 18" to 30" apart. At each insertion, the duration shall be sufficient to consol-idate the concrete but not sufficient to cause segregation, generally from 5 to 15 sec duration, and shall reach the bottom of the pour. Keep a spare vibrator on the job site during all concrete placing operations.

4) Self-Consolidating Concrete may not require vibration if successful placement is demonstrated on site.

4. Cold Weather Concrete Placement and Protection: Detailed requirements are given in ACI 306.

When the mean daily temperature of the atmosphere is less than 40°F during concreting, or within 72 hours there after (or the air temperature is not greater than 50°F for more than one-half of any 24-hr period for a period of 3 consecutive days), follow the procedures outlined in ACI 306R to protect the concrete. Provide a cold weather concreting plan as well as list of equipment and material (e.g. thermometers, blankets) to be used to the Special Inspector. Temperature of the plastic concrete shall be no lower than 55°F and not more than 80 ^{o}F at point of placement. Heat all forms, reinforcing steel, subgrades and surfaces to receive concrete above the freezing point and keep them completely free of frost, snow, and ice. Protection shall consist of insulating boards, blankets, or heated enclosures. Underside of slabs shall be heated during placement and protection period. Initial protection period shall be as indicated in tables 5.1 and 5.3 of ACI 306R. Maximum temperature drop of concrete surface after protection is removed shall follow table 5.5 of ACI 306R. Protect concrete work from physical damage or reduced strength, which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306.1 and as herein specified.

5. Hot Weather Placement and Protection: When the mean daily temperature of the atmosphere is over 90°F during concreting, follow the procedures outlined in ACI 305R to protect the concrete.

a. All concrete, at the time it is actually deposited in the forms, shall have a temperature not lower than 50°F but never above 90°F.

b. Reduce concrete mixing time as required and specified herein to avoid quick stiffening of the concrete.

c. Cover reinforcement with water-soaked burlap to cool steel so its temperature will not exceed the ambient air temperature immediately before concrete placement.

d. Dry surfaces that are to receive concrete should be wet down with fog spray before commencing placement of concrete and the temperature of such surfaces should not exceed the temperature of the concrete being placed.

6. Concrete shall not be placed during rain, sleet or snow, nor shall rain, sleet or snow be permitted to fall upon uncured surfaces.

3.6 FINISHING OF SURFACES AND REPAIR OF SURFACE DEFECTS

A. General

1. Remove forms as soon as practicable. Refer to Section 031000 and Section BC 1906.2 of the 2014 NYC Building Code.
2. Repair surface defects, including tie holes and cracks, immediately after form removal. Patches shall be of quality to match the specified finish.
3. Remove oil, grease, compounds, and other contaminants from surfaces and areas to be repaired, those receiving coatings (ie. plaster, waterproofing, paint, and membranes of any kind).
4. Provide finishes specified below immediately after form removal.
5. Provide curing and protection.

B. Repair of Surface Defects

1. Remove all honeycombed and other defective concrete down to sound concrete. If chipping is necessary, the edges shall be perpendicular to the surface or slightly undercut. Undercut all cracks a minimum of 1" x 1". No featheredges will be permitted. Dampen the area to be patched and an area at least 6" wide surrounding it to prevent absorption of water from the patching mortar. A bonding grout shall be prepared using a mix of approximately 1 part cement to 1 part fine sand passing a No. 30 mesh sieve, mixed to the consistency of thick cream, and then well brushed into the surface.
2. The patching mortar shall be made of the same materials and of approximately the same proportions as used for the concrete, except that the coarse aggregate shall be omitted and the mortar shall consist of not more than 1 part cement to $2^1/_2$ parts sand by damp loose volume. Substitute white Portland cement for a part of the gray portland cement on exposed concrete in order to produce a color matching the color of the surrounding concrete, as determined by a trial patch. If the material color cannot be matched properly, the Contractor shall use a specialty repair mortar of the Engineer of Record's choice at the Engineer's discretion. The quantity of mixing water shall be no more than necessary for handling and placing. Mix the patching mortar in advance and allowed to stand with frequent manipulation with a trowel, without addition of water, until it has reached the stiffest consistency that will permit placing.
3. After surface water has evaporated from the area to be patched, brush the bond coat well into the surface. When the bond coat begins to lose the water sheen, apply the premixed patching mortar. The mortar shall be thoroughly consolidated into place and struck off so as to leave the patch slightly higher than the surrounding surface. To permit initial shrinkage, leave it undisturbed for at least 1 hr before final finishing. Keep the patched area damp for 7 days. Do not use metal tools for finishing a patch in a formed wall that will be exposed.

C. Repair of Tie Holes and Formed Surfaces

1. Remove ties, nails, and other form accessories below the concrete surface when the surface is exposed to view, the elements, or for surfaces to receive waterproofing or dampproofing. For surfaces not exposed to view or the above-mentioned conditions, remove metal to the surface. Refer to Section 031000.
2. Undercut surfaces of holes. After cleaning and thoroughly dampening the holes, fill them solid with the patching mortar. The mortar shall match the color of the existing concrete for concrete exposed to view as specified in paragraph B.2 above.
3. Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect or Engineer. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discoloration that cannot be removed by cleaning. Flush out form tie holes, fill with dry pack mortar, or precast cement cone plugs secured in place with bonding agent.
4. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.

D. Repair of Unformed Surfaces

1. Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness using a template having required slope.
2. Repair finished unformed surfaces that contain defects, which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate to reinforcement, spalling, pop outs, honeycomb, rock pockets, and other objectionable conditions.
3. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days, but without exposing the reinforcing.
4. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Use the specified underlayment or repair topping.
5. Repair defective areas, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4" clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
6. Repair isolated random cracks and single holes not over 1" in diameter by dry pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry pack, consisting of one part Portland cement to 2 1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry pack after bonding compound has dried. Compact dry pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.

E. Formed Finishes

1. Rough Form Finish

a. Provide for concrete not exposed to view and not covered with a material applied directly to the concrete, unless otherwise indicated under "Finishing" below.
b. Formwork material given in Section 031000.
c. Repair surface as indicated in B. and C. above.
d. Chip or rub off fins exceeding 1/4" in height.

2. Smooth Form Finish

a. Provide for concrete exposed to view, concrete receiving sheet membrane waterproofing or other covering material applied directly to the concrete, or as indicated under "Finishing" below. Areas exposed to view shall have a CS 3 or better finish as developed by the Cresset Chemical Company.
b. Formwork material is given in Section 031000.
c. Repair surfaces as indicated in B. and C. above.
d. Chip or rub off fins completely and grind smooth.
e. Provide smooth rubbed finish unless otherwise indicated below.

E. Unformed Finishes

At top of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

F. Finishing

1. Smooth Rubbed Finish

a. Provide for smooth form finish except for those items listed in 2 below.
b. Produce on newly hardened concrete no later than the day following form removal.
c. Wet the surfaces and rub with a No. 16 carborundum brick or other equal abrasive to obtain a smooth, even surface of uniform appearance without applying any cement or other coating.
d. Obtain the final finish by thoroughly rubbing with a No. 30 carborundum brick. The surface shall be wet for a period of 3 days. The Owner shall be the sole judge of whether the finish is proper.

G. Acceptance of Concrete Finish

If the finish produced is not acceptable to the Owner, the Contractor shall be responsible for all costs incurred to produce an acceptable finish by whatever means determined by the Owner.

3.7 SLABS

A. Placement

1. Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints (if required), until the placing of a panel or section is completed. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners. To obtain good surfaces and avoid cold joints, the size of finishing crews shall be planned with due regard for the effects of concrete temperature and atmospheric conditions on the rate of hardening of the concrete.
2. Mixing and placing shall be carefully coordinated with finishing. Do not place concrete on the subgrade or forms more rapidly than it can be spread, straightedged, and darbied or bull floated. Provide leveling, floating, troweling, etc. at the correct time interval after poring to prevent dusting and a non-durable surface as specified in ACI 302.1R. These operations must be performed before bleeding water has an opportunity to collect on the surface.

B. Leveling and Finishing

1. General

   a. Carefully provide slab depressions as required for the finishes indicated on the Drawings.
   b. Where floor drains or floor slopes are indicated, slope slabs uniformly to provide even fall for drainage.
   c. Follow detailed recommendations for finishing given in ACI 301, Section 5, and ACI 302.1R.
   d. Protect finishes from contamination from time of placing until time of acceptance, placement of topping, etc.
   e. Remove defects of sufficient magnitude to show through floor coverings or that do not meet tolerances by grinding.

2. Finishes

   a. Surfaces which receive bonded applied cementitious applications such as full-set vitreous ceramic tile, concrete fills and toppings, cementitious membrane waterproofing: Strike off and level to the proper elevation, plane surface to tolerances for floor flatness (F_F) of 15 and floor levelness (F_L) of 13. Slope surfaces uniformly to drains where required. After the topping has stiffened sufficiently to permit the operation, float the surface to a uniform sandy texture. The surface shall then be broomed to a texture as approved by the Architect.
   b. Surfaces that are exposed or painted finishes such as at auditorium floors and stairs, unless specified otherwise: After floating, begin first trowel finish operation using a power driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surfaces by final hand troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled

to tolerances of FF 20 FL 17. Grind smooth surface defects, which would telegraph through applied floor covering system. Apply densifier/sealer to slabs exposed or painted, except for those specified below to have no finish. Apply two coats in accordance with the manufacturer's instructions at the proper time.

c. Surfaces that are to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand bed terrazzo, and as otherwise indicated: After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power driven floats, or both. Consolidate surface with power driven floats, or by hand floating if area is small or inaccessible to power units. Check and level surface plane to tolerances of FF 18 FL 15. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

d. Surfaces with no finishes: Areaways, pipe and duct, and crawl spaces; Level and wood float surface level or toward drains if required.

e. Pavements: Finish surface to a true smooth plane and texture with a toothed roller or float with a wood float. Score concrete pavement in squares of approximately 5'-0" and/or as shown on Drawings. Each rectangular slab shall have all edges neatly rounded with proper tools and be bounded on all sides by a troweled border about 1" in width.

f. Concrete ramps, sloped walks, and elsewhere as indicated: After completion of float finishing, and before starting trowel finish, uniformly spread 25 lbs. of dampened non slip aggregate per 100 sq. ft. of surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as herein specified. After curing, lightly work with a steel wire brush, or an abrasive stone, and water to expose non slip aggregate. Immediately following first floating operation, uniformly distribute approximately 2/3 of required weight of dry shake material over concrete surface, and embed by means of power floating. Follow floating operation with second shake application, uniformly distributing remainder of dry shake material at right angles to first application, and embed by power floating. After completion of broadcasting and floating, apply trowel finish as herein specified. Cure slab surface with curing compound recommended by dry shake hardener manufacturer. Apply curing compound immediately after final finishing.

g. Non-oxidizing Metallic Floor Hardener: All slabs in areas noted on the drawings, shall receive an application of the non-oxidizing, metallic floor hardener applied at the rate of 1.5 lbs/ft^2. Immediately following the first floating operation, uniformly distribute approximately 2/3 of the required weight of the non-oxidizing metallic floor hardener over the concrete surface, by mechanical spreader, and embed by means of power floating. The hardener shall be floated in and the second application made. The surface shall be floated again to properly bond the hardener to the base concrete slab. The surface shall then be troweled, at least twice, to a smooth dense finish. After completion of broadcasting and floating, apply trowel finish as herein specified. Cure slab surface with curing compound

recommended by hardener manufacturer. Apply curing compound immediately after final finishing.

h. Liquid Densifier/Sealer: All interior slabs subject to hard-wheeled vehicular traffic, and so noted on the drawings, shall be treated with the specified liquid densifier/sealer. Spray, squeegee or roll on liquid densifier to clean, dry concrete surface. The liquid should be scrubbed into the surface with a mechanical scrubber. Keep the surface wet with the densifier during the application process. When the product thickens, but not more than 60 minutes after initial application, the surface shall then be squeegeed or vacuumed to remove all excess liquid.

C. Slabs on Grade

1. General

a. Aggregate base and crushed stone base material and preparation is part of Work of Section 312000.
b. Where pavements to remain are damaged or destroyed as a result of the Work, patch, repair, or replace as required. Color to match existing.
c. Subgrade and/or aggregate base/crushed stone base shall be free of frost before concrete placing begins.
d. Control Joints:

1) Primary Method: Soff-Cut System method, by Soff-Cut International, Corona, CA (800)776-3328. Finisher must have documented successful experience in the use of this method prior to this project. Install cuts within 2 hours after final finish at each saw cut location. Use 1/8 inch thick blade, cutting $1^{1}/_{4}$ inch into slab.
2) Optional Method (Where Soff-Cut System Method Equipment is Not Available): Properly time cutting with the set of the concrete. Saw-cut control joints within 12 hours after finishing. Start cutting as soon as the concrete has
hardened sufficiently to prevent aggregates being dislodged by the saw. Complete cutting before shrinkage stresses become sufficient to produce cracking. Use 1/4" thick blade, cutting 1/4 slab depth.

2. Slabs where vapor barrier required

a. Provide vapor barrier for all interior slabs on grade except for pipe and duct and crawl spaces.
b. Install vapor barrier in accordance with manufacturer’s instructions and ASTM E1643. Just prior to concrete placement, check vapor barrier for punctures and repair as specified below.

1) Unroll vapor barrier with the longest dimension parallel to the direction of pour.
2) Lap barrier over footings and seal to foundation walls.
3) Overlap joints 6” and seal with pressure sensitive tape.
4) Seal all penetrations with pipe boots.

5) No penetration of the barrier is allowed except for reinforcing steel and permanent utilities.
6) Repair damaged areas by cutting patches of vapor barrier, overlapping damaged areas 6", and taping all four sides with pressure sensitive tape.

c. Pour slab to required thickness after installation of reinforcement.
d. Conduit, drains, piping and other items shall be placed prior to installation of the vapor barrier.

3. Slabs where vapor retarder required

a. Provide vapor retarder for all slabs on grade of pipe and duct and crawl spaces.
b. Place vapor retarded over compacted base, providing 6" minimum lap at ends. Install vapor retarder in accordance with manufacturer's instructions. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged areas 6.
c. Pour slab to required thickness after installation of reinforcement.

4. Slabs where no vapor barrier required

a. Dampen subgrade or aggregate/crushed stone base immediately prior to placement of concrete.
b. Pour slab to required thickness after installation of reinforcement.

5. Pavements, Areaways

a. Provide 4" thick concrete slab unless otherwise indicated.
b. Provide 6x6-W2.9xW2.9 WWF placed $1^{1}/_{2}$" from top surface.
c. When a flagpole is indicated on the ground, form a paved circle around the flagpole as indicated. The pavement in this area shall have a slope of 2" away from the pole.

6. Driveways

a. Provide 7" thick concrete slab.
b. Provide 4x4-W4xW4 welded wire reinforcing placed 2" from top surface.

3.8 MISCELLANEOUS CONCRETE WORK

A. Provide trap-pits, curbs, walls, retaining walls, ramps, athletic field work and other miscellaneous concrete items.

B. Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel troweling surfaces to a hard, dense finish with corners, intersection, and terminations slightly rounded. If the curb is part of a beam, the form shall be removed as specified in the section for beams.

3.9 PATCHING AND BONDING TO EXISTING CONCRETE

A. Provide bonding agent whenever new concrete is to be poured against existing concrete, whenever the time between concrete pours is longer than that allowed for proper bond, and wherever bonding agent is indicated on the Drawings to be applied.

B. Remove loose concrete from surface to be bonded with new concrete and clean. Remove rust from reinforcement and structural steel by power chipping and power driven brushes.

C. Apply bonding agent in accordance with manufacturer's specifications. Pour concrete as soon as bonding agent has cured and within 20 hours after application. If the 20-hour period has elapsed, then the bonding agent must be reapplied.

3.10 CURING AND PROTECTION

A. General

1. Begin curing concrete as soon as free water has disappeared from concrete surface after placement and finishing. Protect all freshly deposited concrete from rain, premature drying and excessively hot or cold temperatures and maintain it with minimal moisture loss at a relatively constant temperature for the period of time necessary for the hydration of the cement and proper hardening of the concrete. Detailed procedures are given in ACI 308 and Section BC 1905.11 of the 2014 NYC Building Code.

2. Cure floor surfaces in accordance with ACI 308.
3. Do not apply curing compounds to surfaces receiving waterproofing, adhesives, membranes or additional concrete unless approved by adhesive or material manufacturer or compound is removed in an approved manner. As an alternate, provide wet curing.
4. All exposed interior slabs, not receiving a liquid densifier, and troweled slabs receiving mastic applied adhesives or “shake-on” hardeners shall be cured with the specified curing and sealing compound. Exterior slabs, sidewalks, curbs, and architectural concrete, not receiving a penetrating sealer, shall be cured with the specified curing and sealing compound. Maximum coverage shall be 400 ft^2/gallon on steel troweled surfaces and 300 ft^2/gallon on floated or broomed surfaces for curing/sealing compound.

B. Procedure

1. Concrete surfaces not in contact with forms:

   a. Ponding or continuous non-manual sprinkling.
   b. Absorptive mat or fabric, sand, or other covering kept continuously wet. Place to provide coverage of concrete surfaces and edges, with 4” lap over adjacent covers.
   c. Cover concrete surfaces with moisture retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   d. Curing compounds conforming to ASTM C1315 or where bond and adhesion of mortar, adhesive or other finish material will be adversely affected use strippable curing compound conforming to ASTM C309.

e. Treat slabs, ramps, curbs and columns and walls two feet up from top of slabs with penetrating sealer in areas that will be exposed to deicing salts in service. Follow manufacturer's instructions for dosage and procedures.

2. Concrete surfaces in contact with forms:

a. Minimize moisture loss from forms exposed to heating by the sun by keeping forms wet until they are removed.
b. After form removal, cure with one of the methods listed in 1 above.

3. Being final curing immediately following initial curing and continue curing until a total of 7 days has elapsed during which the temperature of the air in contact with concrete has remained above 50°F, in accordance with ACI 301 procedures. Prevent rapid drying during and at the end of the curing period.
4. Remove all curing compounds with cleaners recommended by curing compound manufacturer.

C. Cold Weather Curing

1. Concrete must be protected from water loss. This shall be accomplished by the application as soon as possible without harm to the concrete surfaces of either (a) exhaust steam, or vapor-resistant paper or polyethylene film, or (b) curing compounds. In all other respects, curing shall conform to applicable provisions of this Section. Concrete temperature shall be maintained between 50°F and 70°F. Comply with ACI 306.1
2. Protection of concrete in cold weather shall continue long enough to ensure the strength required, but not less than 72 hours. The temperatures shall be kept sufficiently above freezing. Protection from freezing for the first 24 hours does not ensure the strength required.
3. The surface temperature of the concrete shall be monitored especially at corners and edges of concrete. Use thermometers or any other equipment approved for this type of work. The Contractor shall provide all the equipment necessary to protect and monitor the curing of concrete. After the concrete has cured and the above requirements are no longer necessary, the temperature shall be decreased slowly and gradually as required by ACI 306.1. Under no circumstances are sudden changes of temperature in the concrete allowed. Heating units shall be vented. The concrete shall be protected from drying when heated locally by the heating locally by the heating equipment.
4. The heating enclosures, if used, must be strong, windproof and weatherproof.
5. Concrete shall not be exposed to carbon dioxide (CO2) gas or any other pollution resulting from the use of heating equipment. The temperature shall not exceed those shown in ACI 306.1.
6. The use of urethane foams as insulation shall be avoided if possible or done with caution, as it generates highly noxious fumes when subject to fire.

D. Hot Weather Curing

1. During the period June 1 to October 1 or when hot weather conditions require it, maintain continuous water curing for a minimum period of twenty-four hours. Provide for windbreaks, shading, and other necessary provisions.

2. After 24 hours, curing shall be by one of the methods specified under B above. In all other respects, curing shall conform to applicable provisions of this Specification. Upon termination of the specified moist curing, every effort should be made to reduce the rate of drying by avoiding air circulation.
3. Comply with ACI 305R.

E. Protection from mechanical injury: Protect concrete from mechanical disturbances during curing period as described under "Protection and Cleaning".

F. Penetrating Sealer: Apply at a rate of 125 square feet per gallon. Sweep and power wash concrete surface before application. Do not apply until time period specified in manufacturer's instructions.

3.11 FIELD QUALITY CONTROL

A. Tests: Method of tests shall in all cases comply in detail with the latest applicable ACI and ASTM requirements as well as the NYC Building Code and be performed by an ACI Concrete Field Testing Technician Grade 1 or equivalent. Tests to be performed by the Owner's Testing Laboratory during construction are as follows:

1. Compliance of materials to Specifications tested from production samples.
2. Testing Agency may inspect and test materials and work at the source before shipment as well as at the site before, during or at any time after installation. Deficient or incomplete work or materials shall be corrected or replaced, as directed by the Engineer, without additional costs or delays to the Owner.
3. Determination of the slump of the concrete for each sample taken and whenever consistency of the concrete appears to vary using ASTM C143. When a high-range, water reducing admixture is being used, slump tests shall be made before and after the admixture is added. The Special Inspector will reject any concrete that does meet the slump requirements.
4. Determination of water content of freshly mixed normal weight concrete utilizing the procedure of AASHTO T318. Concrete that does not meet the maximum water to cement ratio or the proportions given in the approved design mix will be immediately rejected regardless of slump.
5. Strength tests on the specimens in accordance with ASTM C39:

    a. The frequency of conducting strength tests of concrete shall be in accordance with Section BC 1905.6.2 of the 2014 NYC Building Code, with additional cylinders taken for an additional strength test and one cylinder for a 7-day break. Strength tests shall be performed for each 50 cubic yards, or portions thereof, of concrete placed in any one day's concreting. Specimens will be stored at the site in the insulated curing box provided by the Contractor. Each group of specimens is considered one strength test. One cylinder will be broken at 7 days for information.

        1) Portland cement concrete: A strength test shall be performed at 28 days for acceptance. The remaining cylinders for the additional strength test will be tested only if the 28-day breaks are low or durability of the concrete is in question.
        2) Portland cement concrete with 40% alternate cementitious material: A strength test will be performed at 28 days to

determine if the strength has been made and/or if the strengths are sufficient to continue work, even if not at the required design compressive strength. Depending on temperature, concrete strength can be attained at 28 days even though the strength is considered a 56-day strength. If the first cylinder tested indicates the strength has not been met, the remaining cylinders of the test will be broken at a later date. One set of strength test will be done at 56 days.

b. If one specimen in a test manifests evidence of improper sampling, molding, or testing, it shall be discarded and the average strength of the remaining cylinders shall be considered the test result. Should all specimens in a test show any of the above defects, the entire test shall be discarded.

c. When intermediate conveyance is used to place the concrete, one additional set of cylinders shall be taken for each 150 cubic yards or fraction thereof for each type of concrete placed in any one day's concreting. These test cylinders shall be separate and distinct from those made in the mixer and shall be made in the same batch and cured and tested in the same manner as samples taken from the mixer.

d. Test reports shall include name of Testing Agency and project, date of concrete placement, type of concrete, exact location of concrete batch in structure and results of 7 and 28 day tests and shall be specially marked to clearly identify any and all results falling below specified strength.

6. Determination of air content and unit weight of normal weight concrete sample for each strength test in accordance with ASTM C173 or C231 and ASTM C138. Test every time compressive strength cylinders are taken. The results of such tests shall be included in the Testing Agency's written reports.

7. Determination of air content and unit weight of lightweight concrete sample for each strength test in accordance with ASTM C173 or C231 and ASTM C567. Test every time compressive strength cylinders are taken. The results of such tests shall be included in the Testing Agency's written reports.

8. Determination of temperature of concrete sample for each strength test. When the air temperature is below 40 degrees F or above 80 degrees F, test at discharge from every truck. The results of such tests shall be included in the written reports.

9. Tests for water soluble ion chloride content shall be made in accordance with ASTM C114 for concrete that has a maximum chloride ion content specified in this Specification. Test every time compressive strength cylinders are taken. The results of such tests shall be included in the Testing Agency's written reports.

10. For concrete with a design strength of more than 4 ksi, cement samples shall be taken directly from the hopper at the batching plant and tested in accordance with ASTM C109. Samples shall be taken randomly, in quantities directed by the Engineer, throughout the project at each shipments of bulk cement and at additional times as directed by the Engineer.

B. Inspections

1. Refer to "Source Quality Control" for responsibility and procedure.

2. The Contractor shall cooperate in the making of all tests by the Laboratory Technician by:

a. Providing a well-constructed shanty, to be approved by the Owner, located adjoining the Owner's inspector's office. This shanty shall have an area of not less than 50 sq ft, be well lighted, and provided with a table for mixing concrete, shelves for storage of the Laboratory's equipment, molds, etc., one chair, hinged door with suitable lock and complying with all requirements of ACI and ASTM.

b. Providing an insulated curing box of sufficient size and strength to contain all specimens made in any four consecutive working days. The Contractor shall furnish an outlet to provide the necessary temperature in the storage box, pending delivery to the Laboratory of the test cylinders.

c. Protecting the property of the Laboratory to be stored in the shanty and keeping test specimens free from vibration and other disturbances.

d. Providing a microwave of the size specified in AASHTO T318 and a portable generator.

e. Provide a complete set of all current Construction Documents (including a current sketch log) and Specifications.

f. Provide a current set of approved Shop Drawings.

h. Provide concrete placement schedules.

3. Inspections shall include but not be limited to:

a. Control of concrete at the batching plant, including tests of materials for moisture, gradation and cleanliness; and determination and recording of all mixture quantities and water/cement ratios. Verify that quantities and materials conform to the accepted trial mixes, adjusted for moisture content of aggregates.

b. Verification of sizes and thickness of structural members, such as slab and wall thickness, beam and column dimensions, etc. Layout, alignment, plumbness, etc. are the sole responsibility of the Contractor.

c. Inspection of all concrete placing, finishing, and curing operations. Verify that all concrete forms and reinforcing are clean and free of dirt and debris at time of pour and that concrete is properly deposited, consolidated, finished and cured.

d. Inspection of all reinforcing; verifying size, number, spacing, location, splices, support, wiring, etc. of all reinforcing bars, mesh, and stud rails. The location and installation details of reinforcing and prestressing steel shall be inspected for compliance with the approved Construction Documents and ACI 318. Inspections shall be made only with shop drawings bearing the Engineer's stamp and marked "No Exception Taken" or "Make Corrections Noted" only. Refer to Reinforcing Specification.

e. Placement and location of embedded items such as sleeves, inserts, railings, etc. is the responsibility of the Contractor and Construction Manager.

C. Evaluation and Acceptance of Concrete

1. Strength tests on structural concrete will be evaluated according to Section BC 1905.6.3.3 of the 2014 NYC Building Code.
2. When the average strength of the test cylinders, as defined in Section BC 1905.6.3.3 falls consistently below the specified strength (f'c), the Engineer shall have the right to order the Contractor to change the proportions or the water content of the concrete to secure the required strength for the remaining portion of the structure, all at the Contractor's expense. It is the Contractor's complete responsibility to modify the concrete mix design, material controls, and/or concrete operations where necessary to obtain the compressive strength required by the design and Specification.
3. When the average strength of test cylinders for any portion of the structure is less than that required by the design or Specification, or where there is other evidence that the quality of the concrete is below Specification requirements, the adequacy of the concrete will be checked according to the requirements of Section BC 1905.6 either by structural analysis or by core or load tests or by any combination of these procedures. The Engineer of Record will determine which procedures to use:

    a. Structural Analysis Computations (Section BC 1905.6.5.5), which will be performed by the Engineer of Record.
    b. Core Tests (Section BC 1905.6.5.2) - Performed in accordance with ASTM C42.
    c. Load Tests (AC1318 Paragraph 20.3 or Section BC 1713 of the Building Code).

4. Exterior concrete exposed to the elements with low strength test results or other evidence of poor durability will be rejected.
5. Low Strength Tests of Concrete or evidence of poor durability - Results

    a. Pay for additional costs of labor and materials required at the job for all damages resulting from load tests and the taking of cores. Remove and replace concrete work that is not of adequate strength or durability and cannot be made to work by remedial methods acceptable to the Owner at own cost. The Contractor shall be held responsible for all delays and damages to the work of other Divisions that occur as a result of non-conformance.
    b. Pay for all expenses borne by the Owner resulting from low strength test procedures or evidence of poor durability (such as high slump) specified above.

3.12 PROTECTION AND CLEANING

A. General

During the curing period, and thereafter as conditions may require, protect the concrete from damaging mechanical disturbances, particularly excessive load stresses, heavy shock, and excess vibration. Protect all finished concrete surfaces from damage caused by construction equipment, materials or methods, and by rain or running water. Self-supporting structures shall not be loaded in such a way as to overstress the concrete.

B. Floors

Floors that have received their final finish shall be closed to all traffic for at least 48 hours following the completion of troweling. Avoid damage to the floor and repair, clean, and prep floor for finishes.

3.13 ACCEPTANCE OF CONCRETE WORK

A. General

1. Completed concrete work that meets all applicable requirements will be accepted without qualification.
2. Completed concrete work which fails to meet one or more requirements but which has been repaired to bring it into compliance will be accepted without qualification.
3. Completed concrete work which fails to meet one or more requirements and which cannot be brought into compliance may be accepted or rejected as provided in these Specifications or in the Contract Documents. In this event, modifications may be required to assure that remaining work complies with the requirements.
4. Concrete work judged inadequate by structural analysis, core test, results of load test or deemed unacceptable due to appearance or durability concerns shall be repaired, reinforced with additional construction if so directed by the Engineer of Record, or be replaced if so directed by the Engineer at the Contractor's expense.
5. Pay all costs incurred by the Owner in providing additional testing and/or analysis required by this Section.
6. The Owner will pay all costs of additional testing and analysis made at its own request that is not required by this Section or that shows concrete is in compliance with the Contract Documents.

B. Dimensional Tolerances and Measurements

1. Lay out each part of the work in strict accordance with the Contract Documents. Precise measurements and layout are the sole responsibility of the Contractor.
2. Obtain all field measurements required for proper detailing, fabrication and installation of the work. Field verify all dimensions and locations of existing conditions shown on the Contract Documents. Where discrepancies exist, notify Engineer in writing, and by sketch when applicable, of discrepancies and proposed solutions to correct discrepancies.
3. For Formed Surfaces unless otherwise specified or noted on the Drawings, conform to the requirements given below or as given in ACI 117, whichever is more stringent. Variations from grade shall be measured prior to removal of formwork.

    a. Variation from plumb:
        i. In the lines and surfaces of columns, piers, walls, corners and the like:
            a. In any 10 ft. of length 1/4 in.
            b. Maximum for the entire height 1 in.
        ii. For exposed corner columns, control joint grooves, and other conspicuous lines:

a. In any 20 ft. of length 1/4 in.
b. Maximum for the entire height 1/2 in.

b. Alignment:
i. At slab and/or beam, alignment of columns or walls above and below:
a. Maximum offset 1/4 in.

c. Variation from level or specified grades and elevations:
i. In slab, beam and girder soffits and the like:
a. In any 10 ft. length 1/4 in.
b. In any bay or in any 20 ft. length 3/8 in.
c. Maximum for the entire length 3/4 in.
ii. In exposed horizontal grooves, and other conspicuous lines:
a. In any bay or in 20 ft. length 1/4 in.
b. Maximum for the entire length 1/2 in.

d. Sleeves, wall openings and floor openings:
i) Variation in size 1/4 in.
ii) Variation in location 1/2 in.

e. Variation in cross sectional dimensions of columns and beams and in thickness of slabs and walls:
i) Minus 1/4 in.
ii) Plus 1/2 in.

f. Variation in the location of anchors and inserts shown in accepted shop drawings, unless more stringent tolerances are required for work of other Sections:
i) Vertically 3/8 in.
ii) Horizontally 1/4 in.

g. Faces of formed slab edges, turned down spandrels, and parapets shall not deviate from theoretical position or alignment by more than the distance in consideration divided by 500 or by 1/2 inch, whichever is less.

h. Footings:
i) Variations in dimensions in plan:
a. Minus 1/2 in.
b. Plus 2 in.
ii) Misplacement or eccentricity:
a. 2 percent of the footing width in direction of misplacement but not more than 2 in.
iii) Thickness:
a. Decrease in specified thickness 5 percent
b. Increase in specified thickness No limit
iv) Elevation at steel bearing plates:
a. Plus 1/4 in.
b. Minus 1/4 in.

4. Formed surfaces resulting in concrete outlines smaller than permitted by the tolerances of this Section or Section 03100 shall be considered potentially deficient in strength and subject to the provisions of paragraph D below.

5. Formed surfaces resulting in concrete outlines larger than permitted by the tolerances of this Section or Section 03100 may be rejected and the excess material subject to removal. If removal of the excess material is permitted, it shall be accomplished in such a manner as to maintain the strength of the section and to meet all other applicable requirements of function and appearance.

6. Concrete members cast in the wrong location may be rejected if the strength, appearance, or function of the structure is adversely affected or if misplaced items interfere with other construction.
7. Inaccurately formed concrete surfaces exceeding the tolerances of this Section or Section 03100 and which are exposed to view may be rejected and shall be repaired or removed and replaced if required.
8. Slab tolerance from theoretical elevation is 1/2" plus or minus in accordance with ACI 117. Finished slabs exceeding the tolerances, including specified levelness tolerances, may be repaired provided that the strength or appearance is not adversely affected. High spots may be removed with a terrazzo grinder, low spots filled with a structural repair mortars, or other remedial measures performed as permitted. Provide self-leveling cement based materials for large expanses of deficient areas. All materials shall be approved by the Engineer of record and installed by the Contractor at its cost.
9. For tolerances not specifically indicated in the Contract Document, follow requirements of ACI 117.

C. Appearance

1. Concrete exposed to view with defects that adversely affect the appearance of the specified finish may be repaired only by approved methods.
2. Concrete not exposed to view is not subject to rejection for defective appearance.

D. Strength of Structure

1. The strength of the structure in place will be considered potentially deficient if it fails to comply with any requirements that control the strength of the structure, including but not necessarily limited to the following conditions:

    a. Low concrete strength as described under "Field Quality Control".
    b. Reinforcing steel size, quantity, strength, position, or arrangement at variance with the requirements of Section 03200 or the Contract Documents.
    c. Concrete that differs from the required dimensions or location in such a manner as to reduce the strength.
    d. Curing less than that specified.
    e. Inadequate protection of concrete from extremes of temperature during early stages of hardening and strength development.
    f. Mechanical injury as defined under "Protection and Cleaning", construction fires, accidents, or premature removal of formwork likely to result in deficient strength.

2. Structural analysis and/or additional testing may be required when the strength of the structure is considered potentially deficient.
3. Core tests may be required when the strength of the concrete in place is considered potentially deficient.

4. If core tests are inconclusive or impractical to obtain or if structural analysis does not confirm the safety of the structure, load tests may be required and their results evaluated in accordance with Chapter 20 of ACI 318.

3.14 CONCRETE STRUCTURAL REPAIRS

A. Perform structural repairs only where accepted, by Architect, Owner and Engineer, in detailed procedure submitted by Contractor in writing. All other defective areas shall be removed and replaced.

1. Conform to Article 1.7 of ACI 301, "Specification for Structural Concrete for Buildings" and to instructions of Engineer.

END OF SECTION 033000

LIST OF SUBMITTALS

SUBMITTAL	DATE SUBMITTED	DATE APPROVED
Product Data:		_____
1. Admixtures		
2. Curing compounds		
3. Hardener		
4. Densifier/Sealer		
5. Bonding agent		
6. Vapor barrier		
7. Vapor retarder		
8. Waterstop		
9. Beam clip		
10. Joint Fillers		
Samples:		_____
1. Vapor barrier		
2. Vapor retarder		
3. Waterstop		
4. Beam clip		
Design Data/Test Report:		_____
1. Foundation concrete mix		
2. Superstructure concrete mix		
Certificates:		_____
1. TR3		
2. Admixture chloride content		
3. Concrete laboratories certificate		
4. Concrete producer is NYSDOT Approved		
5. Concrete producer's Batch Ticket to field rep.		
Manufacturer's Instructions:		_____
1. Waterstop		
Qualifications		_____
1. Concrete Installer		
2. Concrete producer		
Survey:		_____
1. Slab survey		

Mock Up: _____

1. Smooth Form Finish
2. Architectural Concrete Finish
3. Exterior pavement texture

Sustainable Submittals: _____

1. Contractor's Sustainable Materials Form (see Section S01352).
2. Mfr's printed literature or statement on recycled and regionally extracted and manufactured material content.

CONCRETE MIX DESIGN SUBMITTAL FORM

Project:

City:

General Contractor:

Concrete Contractor:

Contact Name:

Address:

Phone Number:

Main Plant Location:

Miles from Project Site:

Date:

Design Characteristics

Use (describe):

Strength: psi at days

Density: pcf

Air: % Water/cementitious ratio:

Design Mix Information – check one

☐ Based on Standard Deviation Analysis of Trial Mixes or Field Experience.

No. of test cylinders: Avg. Strength: psi

Standard deviation: f'cr: psi

f'cr = f'c + 1.34s or f'cr = f'c' + 2.33s - 500

Refer to ACI 318 Sec. 5.3.1 for standard deviation factor if less than 30 tests

☐ Based on Trial Mix Test Data.

f'cr: psi

f'cr = f'c + 1200 psi, for up to 5000 psi

f'cr = 1.10 f'c + 700 psi, for greater than 5000 psi

Materials

	Type/Source	Specific Gravity	Weight Lbs.	Absolute Vol. Cu. Ft.
Cement				
Flyash				
Microsilica				
Fine Aggregate				
Coarse Aggregate				
Water				
Air				
Other				
Total				27.0 cu. ft.

Admixtures

	Manufacturer	Dosage Oz/Cwt
Water Reducer		
Air Entraining Agent		
High Range Water Reducer		
Non-Corrosive Accelerator		
Other		

Slump before HRWR inches

Slump after HRWR inches

Required Attachment Checklist

☐ Combined aggregate gradation report
Note: 8%-18% aggregate required to be retained on each side sieve except the top size and #100.

☐ Standard deviation analysis summary or trial mixture test data

☐ Admixture compatibility certification letters

SECTION 051200 – STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, conditions of the Contract (including General, Supplementary, and Special Conditions), Division 01 Specification Sections and all other Contract Documents apply to work of this Section.

1.2 WORK INCLUDED

A. Extent of structural steel work is shown on the Drawings, including schedules, notes and details to show size and location of members, typical connections, and type of steel required.

B. Provide all labor, materials, equipment, services and perform all operations required for complete furnishing, fabrication, and erection of all structural steel as indicated on the Drawings, specified in this Section, and required by job conditions.

C. The work shall include but not be limited to the following:

1. Columns, posts, struts and hangers.
2. Base plates and bearing plates.
3. Anchor bolts and plates to be embedded in concrete.
4. Templates for items to be embedded in or attached to concrete.
5. Structural steel support angles, channels, etc. for metal deck.
6. Shop painting, lacquering and galvanizing and field touch-up.
7. Bracing, guying, surveying and plumbing of erected steel.
8. Shoring and temporary bracing.
9. Connections.
10. Shop applied stud shear connectors.
11. Concrete reinforcing bar coupling devices which are to be welded to structural steel.
12. Drilled-in anchors into concrete or masonry to fasten structural steel.
13. Deformed anchor bars stud welded to structural steel.
14. Erection drawings, shop drawings and samples.
15. Protection of work of this Section.
16. Protection of other work from activities under this Section.
17. Submittals.
18. Provisions for other work.
19. All other work shown in the Drawings, specified in this Section or required to make the structural steel work complete.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals – Division 1 Sections.

B. Cast-In-Place Concrete - Section 03300.

1.4 CODES AND STANDARDS

A. Conform to the requirements of the New York City Building Code.

B. The following codes, specifications and standards shall apply to the work. Where conflict among codes, standards, and specifications exist, the one having the most stringent requirements shall govern.

1. Specification for Structural Steel Buildings - AISC 360-10 by the American Institute of Steel Construction ("AISC Specification").
2. Code of Standard Practice for Steel Buildings and Bridges, AISC 303-05 by the American Institute of Steel Construction ("AISC Code"). Sections 6 and 7 apply to the work; the remainder is specifically excluded. Chapter 10 applies to members designated in the Contract Documents as Architecturally Exposed Structural Steel (“AESS”).
3. Specification for Structural Joints Using High-Strength Bolts, August 1, 2014, by the Research Council on Structural Connections of the Engineering Foundation ("RCSC Specifications").
4. Standard Symbols for Welding, Brazing and Nondestructive Examination, AWS A2.4, by the American Welding Society ("AWS A2.4").
5. Structural Welding Code - Steel, AWS D1.1, by the American Welding Society ("AWS D1.1").
6. Structural Welding Code - Reinforcing Steel, AWS D1.4, by the American Welding Society ("AWS D1.4").
7. American Society for Testing and Materials ("ASTM") specifications cited shall be the latest edition listed in the Index of the Annual Book of ASTM Standards.
8. Detailing for Steel Construction, 2009, by the American Institute of Steel Construction.
9. SSPC Steel Structures Painting Manual, by the Steel Structures Painting Council ("SSPC").

C. Work of this Section shall conform to all applicable federal, state and local laws and regulations.

1.5 SUBMITTALS

A. Product Data and Samples: Submit producer's or manufacturer's specifications and installation instructions for the following products to the Engineer for acceptance prior to the start of any work. Include laboratory test reports and other data to show compliance with Specifications, including specified standards. Submit samples where requested by Engineer.

1. High-strength bolts (each size, length and type), nuts, and washers, including manufacturer's certification of conformance for each and every lot. When requested by Engineer, submit samples to Testing Agency for testing prior to start of any work or delivery of materials to job site or stockyards.
2. Shop-applied stud shear connectors.
3. Reinforcing bar coupling devices which are to be shop welded to a structural steel. Submit welded sample for testing when requested.
4. Deformed anchor bars to be stud welded to structural steel. Submit welded sample for testing when requested.
5. Drilled-in anchors.
6. Any other manufactured products specified under Part 2 - Products, or called for on the Drawings.

B. Mill Certificates: Submit certified copies of producer's mill certificates for each piece of steel to be used. Reports shall include chemical and physical properties. See AISC specification section A3.1c.

C. Deviations: Requests for deviations from Drawings or Specifications shall be submitted on Contractor's letterhead. Acceptance of shop drawings including deviations not detected during shop

drawing review will not relieve Contractor from responsibility to conform strictly to the Contract Documents. Deviations will be allowed only where permitted by Engineer in writing. Proposed deviations must be accompanied by documented and physical evidence, which will establish that its quality equals or exceeds the quality specified.

D. Shop Drawings: Submit shop drawings to the Engineer for acceptance in accordance with the requirements of the Contract Documents. Engineer shall have ten business days to review submittal packages from day after submittal arrives in Engineer's office until day that submittal is sent returned by Engineer.

1. At least two weeks prior to the first shop drawing submittal, Contractor shall provide Engineer with a comprehensive list of all shop drawing submittals, and a schedule indicating when all submittals are to be sent to the Engineer. If Contractor deviates from this schedule, Engineer shall be allowed additional time to review shop drawings.
2. Shop drawings furnished under this section shall be not less complete than indicated by the applicable procedures shown in AISC's "Detailing for Steel Construction", 2009. Shop drawings shall be prepared by competent engineering personnel under the supervision of an experienced Professional Engineer registered in the state of New York. As evidence of such, each and every shop drawing shall bear the seal and signature of said Engineer.
3. Submit complete job standards prior to detailing individual members. Standards shall describe all repetitive work. Provide calculations upon request.
4. Submit shop drawings to Engineer in coordinated packages so that all required information is in hand at time of review. Prior to resubmission of shop drawings, all changes from prior issue shall be clearly circled and identified. Do not fabricate before shop drawings have been reviewed and returned to Contractor marked either "No Exceptions Taken" or "Make Corrections Noted" only.
5. Prepare, submit and keep up to date, a complete drawing index, cross-referencing assigned piece mark with the drawing number upon which the piece is detailed.
6. Contractor shall coordinate and cross-check for accuracy, completeness and correct relationship to the work of other sections, each shop drawing prepared for the work of this Section, including each shop drawing prepared by subcontractors. Detail steel work so as not to interfere with the work of other trades. Engineer's review of shop drawings does not relieve Contractor from these responsibilities.
7. Prior to sending submittals to Engineer, Contractor and Construction Manager (if applicable) shall coordinate and cross-check for accuracy and completeness each shop drawings prepared for work of this Section with the approved construction Documents and Specifications. Shop drawings shall bear the stamp of Contractor and Construction Manager indicating that this review has been performed. Engineer will not review submittals for which Contractor and Construction Manager have not performed this review.
8. Prepare erection drawings to show clearly the size and location of each member, and the erection mark assigned to each member. Show each field connection complete with data and details necessary for assembling the structure. Direct attention to the possible need for special guying, bracing or shoring.
9. Prepare anchor bolt, base plate and embedded plate erection drawings with complete dimensions. Provide to the concrete trade in advance of applicable concrete work.
10. Submit, for review and acceptance, field work drawings depicting all field work required to accommodate field conditions.
11. Shop drawings shall include plans, elevations, sections and complete details and be accurately dimensioned. Indicate size and grade of steel for each piece. Detail to accommodate Contractor's field measurements of supporting and adjoining construction. Contractor shall make a complete survey of all existing conditions prior to detailing.

12. Design of structural steel connections to plates or anchors embedded in concrete shall be based on the most severe combination of structural steel, concrete structure, and embedded item location tolerance.
13. Identify the connection used at each location. Connections shall conform to controlling requirements given in the Drawings, specified herein, or required by the New York City Building Code. Proportion connections not completely detailed in the Drawings to resist loads and load combinations required by the Contract Documents or by the New York City Building Code. Provide temporary expansion joints in structural steel work and between the work of this Section and that of other sections providing support or restraint until such time as work is thoroughly stabilized. Close and secure such joints at that time.
14. Indicate clearly the grade, size and number of bolts, the type, number, position and orientation of each washer and the size of each hole, whether slotted or round. Proportion connection details to ensure adequate wrench clearance for correct bolt tensioning sequences. Indicate method of tensioning for all high strength bolts.
15. All welds shall be indicated by using symbols conforming to AWS A2.4 and shall indicate type, size, length, spacing, location, orientation, etc. as applicable. Complete and partial penetration welds shall be indicated by an AWS prequalified joint designation. In addition, for all penetration welds, the complete joint preparation and configuration shall be shown or indicated, including root opening, groove angle, root face, backing bar, etc. as applicable. Bevels shall be graphically detailed in large scale.
16. Welding processes and electrodes shall be indicated on each shop drawing.
17. Detail shear studs, deformed bar anchors, concrete reinforcing bar couplers and other items which are to be shop applied.
18. Show and dimension holes and other work in the structural steel work required for work of other sections. Provide fieldwork drawings for holes not shown in shop drawings.
19. Indicate all structural steel shelves required to support steel deck ends and edges at supporting beams, columns, and other structural steel elements.
20. Detail cleaning and painting requirements, including identification of "no-paint" areas.

E. Work engineered by Contractor: Submit, for record purposes, drawings and calculations as applicable, signed and sealed by a Professional Engineer registered in the state of New York, for all work engineered by the Contractor. Such work shall include all crane and crane-related engineering, shoring and bracing procedures and sequences, and any other areas noted on the Drawings or required by the New York City Building Code.

1.6 INSPECTION AND TESTING

A. General: Owner will engage and pay for the services of an independent Testing Agency acceptable to the Engineer.

1. Contractor shall be responsible for providing the Testing Agency and Engineer with proper notice of the initiation of each phase and portion of work requiring testing or inspection. Written notice of commencement date shall be provided at least 5 working days prior to the start of shop work and the start of fieldwork. Subsequently, Contractor shall give a minimum of 24 hours verbal notice of work, or completion of work as applicable, requiring inspection and/or testing.
2. Contractor shall furnish Testing Agency with a complete set of Construction Documents and Specifications, along with one copy of each accepted shop drawing bearing the Engineer's review stamp, mill test certificate and manufacturer's certification. Provide reasonable office space to Testing Agency at fabrication plants and at the site. Provide Testing Agency

personnel with convenient and safe access to the work and all reasonable assistance necessary to permit effective inspection and testing work.

3. Testing Agency may inspect and test materials and work at the source before shipment, as well as at the site before, during or at any time after installation. Deficient or incomplete work or materials shall be corrected or replaced, as directed by the Engineer, without additional costs or delays to the Owner.
4. The Testing Agency shall report directly to the Owner and Engineer the results of all testing and inspection by means of daily written reports. When any test or inspection reveals deficient or non-conforming work, Testing Agency shall notify Owner and Engineer immediately by means of a written report specially and clearly marked and identified to show deficient areas of work. Furthermore, the Testing Agency shall provide a table of all known members, noting when each piece was shop inspected, field inspected, any deficiencies and when the deficiencies were corrected. This table is to be provided to the Owner and Engineer with the weekly submission of daily reports. The format of this table is to be submitted to the Owner and Engineer for approval before inspection is begun.
5. Performance or waiving of inspection, testing or surveillance by Testing Agency for a given portion of the work will not relieve Contractor from responsibility to conform strictly to the requirements of the Contract Documents.
6. Where additional tests are deemed necessary by Engineer due to failure to pass tests, the cost of additional testing will be deducted from payments to Contractor.
7. If, due to errors by the Contractor or failure to perform his work in accordance with the Contract Documents, the Engineer must perform additional design or drafting work or review proposed solutions, the Contractor shall, through the Owner, reimburse the Engineer in accordance with the Engineer's current fee schedule plus out of pocket expenses incurred.

B. Shop Inspection and Testing: Work performed at fabrication plants shall be subject to inspection and testing as follows:

1. The Testing Agency shall review the fabricator's quality control program and make a written report of such.
2. Each piece of fabricated steel shall be examined for straightness, alignment and proper conformance to details on accepted shop drawings.
3. Mill certificates for all steel shall be examined.
4. Manufacturer's certifications for all bolting materials to be used in the shop shall be checked and lot numbers on containers shall be verified to match certificates.
5. High strength bolts and bolting operations shall be tested and inspected in accordance with part 1.06 E of this Section.
6. Welds and welding operations shall be tested and inspected in accordance with part 1.06 D of this Section.
7. Surface preparation and painting of all steel members where blast cleaning is specified shall be inspected. When requested by the Engineer, dry film thickness of paint layers shall be measured.
8. Stud welding operations shall be inspected and tested in accordance with AWS D1.1 Sections 7.7 and 7.8.

C. Field Inspection and Testing: Work performed in the field shall be subject to inspection and testing as follows:

1. Testing Agency shall verify that all steel pieces and connections are installed completely and properly in the correct location and manner in accordance with accepted shop drawings.

2. Lot numbers on containers of all bolting materials shall be verified to match submitted manufacturer's certifications. Manufacturer and grade markings on all components of bolt assemblies shall be verified.
3. High strength bolts and bolting operations shall be tested and inspected in accordance with part 1.06 E of this Section.
4. Welds and welding operations shall be tested and inspected in accordance with part 1.06 D of this Section.
5. Steel exposed to the weather shall be inspected to verify that paint has been properly touched up at damaged or scratched areas.

D. Welding: Inspection and testing of welds and welding operations shall be performed in accordance with AWS D1.1 Section 6 by the Testing Agency using AWS Certified Welding Inspectors.

1. Testing Agency shall verify:

    a. Welding materials and equipment conform to the Contract Documents and AWS requirements and are used in correct positions and procedures.
    b. Size, length and location of all welds, and correct and appropriate processes are used.
    c. Welds are only made by welders certified by AWS for applicable process and position.
    d. At appropriate intervals, performance of individual welders and preparation and fit-up of joints.
2. All welds shall be visually inspected. Acceptance criteria shall be per AWS D1.1 as applicable.

3. Fifty percent of all full and partial penetration welds, whether made in the shop or field, shall be ultrasonically tested, for 100% of their length, in accordance with AWS D1.1 Section 6 Part C as applicable.

    a. If testing discloses a large ratio, in the opinion of the Engineer, of unacceptable welds, the required percentage shall be increased to 100% by the Engineer.

    b. If, in the opinion of the Engineer, the testing consistently discloses acceptable welds, the percentage of tested welds may be reduced by the Engineer to a minimum of 25%.

4. Fifty percent of all fillet welds, for 100% of their length, shall be tested by dye penetrant (ASTM E165) or magnetic particle (ASTM E709) method. Acceptance criteria shall be per AWS D1.1 as applicable.

    a. If testing discloses a large ratio, in the opinion of the Engineer, of unacceptable welds, the required percentage shall be increased to 100% by the Engineer.
    b. If, in the opinion of the Engineer, the testing consistently discloses acceptable welds, the percentage of tested welds may be reduced by the Engineer to a minimum of 25%.

5. Welds which are not satisfactory or which are found to be defective by the Testing Agency shall be cut out and replaced by a satisfactory weld at no additional cost or delay to the Owner.

E. High Strength Bolting: High strength bolts and bolting operations shall be tested and inspected as specified herein and in accordance with the RCSC Specification, Section 9.

1. Storage and Handling: The Testing Agency shall verify that bolting materials are properly stored and protected and at time of installation, are clean and free of rust and thread damage.

2. Assembly: The Testing Agency shall verify that the proper bolting assembly is installed by checking size and grade of bolt, type and grade of nut, location and number of flat washers, and location, orientation and type of direct tension indicator (if used).
3. Snugging: The Testing Agency shall verify that all bolts in a connection are properly snugged in accordance with RCSC Specification procedures and requirements of this Section before final tensioning of any bolt in a connection.
4. Calibration: The Contractor shall provide a tension-measuring device (Skidmore-Wilhelm or similar), with proper calibration certification, at the jobsite at all times when bolts are being tensioned. At the start of work, when requested by the Engineer, and whenever deemed appropriate by the Testing Agency, installation procedures shall be confirmed by tensioning a representative sample of bolts in the tension measuring device. A representative sample shall consist of not less than three bolts of each size, grade, length and producer being used. Installation procedures shall achieve a tension not less than that given in Table 4 of the RCSC Specification within 10 seconds from a snug tight condition.
5. Twist-off Bolts: Twist-off type bolts shall be inspected by observing installation procedures and by verifying that the splined end of every bolt shank has been properly broken off by the wrench chuck.
6. Direct Tension Indicators: Bolts installed with direct tension indicators shall be inspected by observing installation procedures and by measuring the average residual gap of the DTI on every bolt in accordance with the manufacturer's recommendations.
7. Turn-of-nut Installation: Bolts installed by the turn-of-nut method shall be inspected by measuring torque with a calibrated wrench. At the beginning of work, when deemed appropriate by the Testing Agency, whenever conditions such as lubrication or surface dirt change, and when a new or different manufacturer's material is being used, an inspecting torque shall be established. This shall be done by tensioning 5 bolts of each grade, diameter and manufacturer in a Skidmore-Wilhelm device to a tension not less than 105% of the minimum required and measuring torque with a properly certified calibrated wrench. The high and low values shall be discarded and the middle three averaged to establish an inspecting torque for each grade, diameter and producer. A minimum of 10 percent of the bolts, but not less than 2, in every connection shall be inspected. The Contractor shall provide the Skidmore-Wilhelm device, a calibrated wrenches, scaffolding and laborers as needed to perform such procedures at times requested by the Testing Agency.
8. Verification Procedures: If the Testing Agency reasonably suspects that any bolts may not be properly tensioned, due to relaxation as a result of improper snugging or any other reason, the arbitration inspection method of the RCSC Specification, Section 9(b), shall be used, except that all bolts in the connection in question shall be checked. The Contractor shall provide a Skidmore-Wilhelm device, calibrated wrench, a laborer and scaffolding as required to safely and properly perform such verification.
9. Laboratory Testing: High strength bolting materials shall be randomly tested throughout the project at times and in quantities chosen by the Engineer.

    a. Tension tests of full-size bolts shall be performed to determine the proof load and ultimate tensile strength in accordance with ASTM F606 using Method 1, Length Measurement.

b. Rockwell hardness of bolts shall be determined on the wrench flats after removal of surface material in accordance with ASTM F606. The reported hardness shall be the average of three hardness readings.
c. Rockwell hardness of nuts shall be determined on the bearing face in accordance with ASTM F606.
d. Surface hardness of hardened washers shall be determined in accordance with ASTM F606.
e. In addition the surface hardness, the core hardness of 5/16 inch thick washers shall also be determined in accordance with ASTM F606.
f. Direct tension indicators shall be tested in accordance with ASTM F959.
g. If requested by the Engineer, chemical properties and dimensional tolerances of bolting materials may also be tested.

1.7 QUALITY ASSURANCE

A. General: Contractor shall examine all Contract Documents and note any discrepancies and special construction problems requiring close coordination and exact time schedules; assume the responsibility of same and administer action such that the proper solution will result.

1. Contractor's quality assurance procedures shall be effective and shall assure that all work fulfills the requirements of applicable provisions of the Contract Documents.
2. Contractor shall maintain, on staff, sufficient office, field engineering, and field supervision staff to assure that all data and layout drawings for work of other Sections is transmitted to detailers to allow proper detailing of holes, penetrations, chases, and the like and to assure proper execution of the work in the field.
3. Perform quality control functions required to achieve and to document that work conforms to the Contract Documents. Provide access to Contractor's quality control documents and reports upon request of Owner, Architect, Engineer or Testing Agency. Provide reasonable numbers of photocopies of specific quality control reports on request.
4. Contractor and Construction Manager shall coordinate and schedule the work of this Section with the work of other Sections of this Specification in order to optimize quality and to avoid delay in overall job progress.
5. Prior to starting applicable phases of the work of this Section, Contractor shall cooperate and coordinate with each trade affected by the work of this Section, including areas where work of other Specification Sections joins or relates to work of this Section. Contractor shall report unsatisfactory or nonconforming conditions to Engineer in writing prior to the start of work.

B. Fabrication: The fabricator shall be certified by and use the AISC Quality Certification Program in establishing and administering a quality control program. Such program shall ensure that the work is performed in accordance with the Contract Documents.

C. Erection: The erector shall maintain a quality control program to the extent necessary to ensure that all of the work is performed in accordance with the Contract Documents. The erector shall provide the equipment, personnel and management for the scope, magnitude and specified quality of the work.

D. Qualifications: Throughout the progress of the work of this Section, provide at least one person who shall be thoroughly familiar with the specified requirements, completely trained and experienced in the necessary skills, and who shall be present at the site and shall direct all work performed under this Section.

1. The structural steel detailing firm shall be subject to acceptance by the Engineer. To ensure continuity, there shall be a single structural steel detailing firm. As a minimum requirement for acceptance, the structural detailing firm shall demonstrate experience in detailing of not less than five buildings of the type of this work and shall demonstrate in-house quality control procedures to the satisfaction of the Engineer.
2. Fabricator shall have experience in the fabrication of structural steel for at least five buildings of the type of this work and shall possess all capabilities and qualifications required for AISC Type II Certification.
3. Erector shall have experience in the erection of structural steel of at least five buildings of the type of this work.
4. Welders and welding operators performing work under this Section shall be qualified in accordance with the building code and with applicable AWS requirements for each specific welding procedure and process which the welder will use in this work. When requested by the Engineer, Contractor shall require welders to be retested.
5. Each welding procedure shall be described fully in the shop drawings and shall be designated prequalified under AWS D1.1 or shall be qualified in accordance with provisions of AWS D1.1 prior to use in the work. Each weld shall be visually inspected by the welder performing the work.

    a. Contractor shall comply with AWS D1.1 Section 6.6.

E. Contractor's Responsibilities: The Contractor shall be solely responsible for the items listed below. While the following list is not intended to be a complete listing of all responsibilities, it is provided to bring these items to the specific attention of the Contractor. Engineer's review of shop drawings or other submittals, or performance or waiving of inspection or testing, does not relieve Contractor from these responsibilities.

1. Safety and stability of the work. Construction sequences, whether stated or implied, are intended only to assist the Contractor in coordinating the work of the project.
2. Fabrication procedures and the means, methods, techniques, sequences and procedures of construction.
3. Correctness of dimensions and quantities, for the fitting to other or existing elements, for conditions to be confirmed and correlated at the site, and for the verification of the physical interrelationships of elements of the work.
4. The amount, method of distributing, and proposed supplemental support of loads during construction. Construction loads shall not exceed the superimposed load which the member, with necessary supplemental support, is capable of carrying safely without damage.
5. Obtain all field measurements required for proper fabrication and installation of work covered by this Section. Precise measurements are the responsibility of Contractor.
6. Report unsatisfactory or non-conforming conditions to the Engineer in writing prior to the start of work.

1.8 MEASUREMENTS AND TOLERANCES

A. Measurements: Lay out each part of the work in strict accordance with the Contract Documents. Precise measurements and layout are the sole responsibility of the Contractor.

1. Obtain all field measurements required for proper detailing, fabrication and installation of the work. Field verify all dimensions and locations of existing conditions shown on the Contract Documents. Where discrepancies exist, notify Engineer in writing, and by sketch when

applicable, of discrepancies and proposed solutions to correct discrepancies.

2. Lay out the work from at least 2 pre-established benchmarks and axis lines, individually correct for length and bearing.

B. Tolerances: Structural steel shall be fabricated and erected within the tolerances specified in the AISC Specification and Code, except that more restrictive tolerances, when specifically shown or noted in the Drawings or provided under this Specification, shall take precedence and shall apply to the work.

1. In lieu of the criteria given in Section M.4.4 of the AISC Specification, fit of finished compression splices shall be as follows: at least 65 percent of the contact area shall be in uniform bearing about the centroid of the bearing surface, with no separation greater than 1/32 inch. This requirement also applies to both shop and field connected base plates and bearing plates.

1.9 DELIVERIES, STORAGE AND HANDLING

A. Anchor bolts, embedded plates, anchorage devices, and other items required to be embedded in cast-in-place concrete shall be delivered to the project site at times coordinated by Contractor to allow convenient installation and orderly cast-in-place concrete operations.

B. Include setting drawings, templates, and directions for installation with all anchor bolts and with all other items or devices furnished and delivered to the project site for installation under other sections of this Specification.

C. Structural steel members which are stored on or off the project site shall be supported above ground on platforms, skids or other supports so as to protect steel members from overstress, permanent deformation, corrosion and other damage.

D. Materials shall be delivered to the site in the manufacturer's original and unopened containers and packaging, bearing labels as to type of material, brand name, and manufacturer's name. Delivered materials which are damaged or otherwise not suitable for installation, shall be removed from the jobsite and replaced with acceptable materials.

E. Handling, shipping and erecting of shop painted steel pieces shall not be performed until the paint has dried thoroughly. Protect the paint from damage and keep individual members free from contact with the ground and with each other.

1. Contractor shall furnish members in-place, fully painted, including all touch-up painting required as specified herein, at all locations where painting is required in the drawings by provisions of this Specification, and by the New York City Building Code.

1.10 DEFICIENT WORK

A. Deficient work or any work failing to strictly conform to the Contract Documents shall be removed and replaced, or repaired if accepted by Engineer, at no cost to the Owner, Architect or Engineer.

1. Contractor shall prepare appropriate details and procedures to bring such work into conformance with the Contract Documents and submit to Engineer for review and acceptance. Contractor shall, through the Owner, reimburse the Engineer for time and expense incurred reviewing proposal procedures and details in accordance with the Engineer's current fee schedule.
2. Nonconforming work may be rejected by Owner, Architect or Engineer at any time, regardless of prior acceptance in shop drawings, prior inspection, inclusion in inspection or test reports, or inclusions in certificates of payments.

B. Deficient work shall include, but not be limited to:

1. Bent, twisted or warped pieces.
2. Unauthorized cutting or reaming.
3. Cracking, interior or surface defects.
4. Painted or unpainted surfaces not sufficiently clean to finish coat.
5. Workmanship not in accordance with the Drawings, with this Specification, with accepted samples, or with referenced codes or standards.
6. Exceedance of tolerances.

PART 2 - PRODUCTS

2.01 STEEL

A. Structural steel furnished for each location shall provide the minimum yield point given in the drawings, shall conform to the applicable ASTM steel specification, shall meet the requirements of the New York City Building Code, shall be suitable for use in welded structures and shall meet the requirements both of the drawings and of this Specification. All materials shall be new and of the best commercial quality. Steel produced to modified ASTM specifications shall not be used without the Engineer's prior written acceptance.

2.02 PAINT

A. Shop and field-applied paint where designated in the Drawings, specified herein, and where required by the Building Code shall be selected from the following:

1. Alkyd primer:

    a. Tnemec 10-99 by Tnemec Co.
    b. Kem Kromik Primer by Sherwin-Williams Co.
    c. Dulux 67-Y-834 by Dupont Co.
    d. Carbocoat 150 or Carbocoat 818 by Carboline.
    e. Amercoat 5105 by Ameron International.

2. Zinc-rich primer:

    a. 90-97 Tneme-Zinc by Tnemec Co.
    b. Zinc Clad 5 by Sherwin-Williams Co.
    c. Ganicin 347-Y-937 by Dupont Co.
    d. Carbozinc 859 (class B Slip Critical) Epoxy Zinc-Rich by Carboline.
    e. Amercoat 68HS by Ameron International.

3. Epoxy based:

    a. Series 66 Hi-Build Epoxoline by Tnemec Co.
    b. Tile-Clad II Epoxy by Sherwin-Williams Co.
    c. Corlar 823 HB by Dupont Co.
    d. Carboguard 890 Series or Carobguard 888 by Carboline.
    e. Amercoat 385 by Ameron International.

4. Polyurethane:

    a. Series 73 Endura-Shield III by Tnemec Co.
    b. Hi-Solids Polyurethane by Sherwin-Williams Co.
    c. Imron 333 by Dupont Co.
    d. Carbothane 133 HB or Carobthane 833 by Carboline.
    e. Amercoat 450 series (450HS, 450SA) by Ameron International.

5. Cold galvanizing:

    a. ZRC Cold Galvanizing Compound by ZRC Products.
    b. LPS Cold Galvanize by LPS Laboratories, Inc.
    c. Carbozinc 4195 by Carboline.

6. Color of paint for steel exposed to view shall be selected by the architect.

2.03 WELDING MATERIALS

A. Welding materials shall conform to AWS A5.1, A5.5, A5.17, A5.18, A5.20, A5.23, A5.28 or A5.29. Welding electrodes which have been wet or contaminated by grease or other substances deleterious to welding shall not be used in the work.

B. Welding electrodes for welding of stainless steel to stainless or carbon steel shall be E308L.

2.04 STUDS

A. Stud shear connectors and welding equipment used for installation shall conform to AWS D1.1.

2.05 BOLTING MATERIALS

B. General: Bolts, nuts and washers for a given grade and diameter of bolt shall come from a single domestic manufacturer. For each diameter, only one grade may be used. Bolting materials shall be shipped to the jobsite in the bolt manufacturer's unopened containers with nuts and washers assembled and lot numbers marked on the container.

C. Bolts: Bolts shall conform to ASTM F3125 except where ASTM A307 are specifically permitted in notes or details on the drawings and clearly designated in accepted shop drawings.

1. Bolts shall be cold forged with rolled threads.
2. Type 2 A325, Type 3 A325 or A490 bolts shall not be used.

D. Nuts: Nuts for A325 bolts shall conform to ASTM A563 Grade C, D or DH or ASTM A194 Grade 2 or 2H. Nuts for A490 bolts shall conform to ASTM A563 Grade DH or ASTM A194 Grade 2H. Nuts for A307 bolts shall conform to ASTM A563 Grade A.

E. Washers: Hardened washers shall conform to ASTM F436 and the requirements of the RCSC Specification.

F. Direct Tension Indicators: DTI's shall conform to ASTM F959.

G. Galvanized Steel Bolting Materials: Bolts shall conform to ASTM Type I, nuts shall be ASTM A563 Grade DH or A194 Grade 2H only. Bolts, nuts and washer shall be galvanized under the supervision of the bolt manufacturer in accordance with either ASTM B695 Class 50 or A153 Class C. Nuts must be tapped after hot dip galvanizing or slightly overtapped before wax or equal. The galvanized bolt, washer, nut assembly shall be tested by the bolt manufacturer in accordance with ASTM F3125 and shipped and stored in plastic bags in closed containers. Direct tension indicators for galvanized bolts shall be coated by the DTI manufacturer only, in accordance with ASTM B695 Class 50, and tested by the manufacterer after coating.

H. Stainless Steel Bolting materials: Bolts shall conform to ASTM A193 Grade B8. Nuts shall conform to ASTM A194 Grade 8M.

2.06 GALVANIZING

A. Galvanized steel members shall be hot-dipped galvanized in accordance with ASTM A123 All galvanized steel with coating to be repaired shall be done in accordance to ASTM A780.

2.07 LACQUER

A. Milled Surfaces: Coat with Blue Lacquer by Varcroft Paint Co., or M-2658 Blue Lacquer by U.S. Steel Corp.

2.08 DRILLED-IN ANCHORS

A. Adhesive Anchors: HVU Adhesive Anchors by Hilti, HIT HY 200 by Hilti, Epcon by ITW/Ramset, Ultrabond by U.S. Anchor, or other accepted by Engineer.

B. Expansion Bolts: Kwik-Bolt III Anchors by Hilti, HSL Heavy Duty Sleeve Anchors by Hilti, Trubolt Wedge by ITW/Ramset, or other accepted by Engineer.

2.09 COUPLERS FOR CONCRETE REINFORCING BARS

A. Concrete reinforcing bar couplers, which are to be welded to structural steel, shall be Lenton Half Couplers as manufactured by Erico Products, Grip Twist Coupler by BarSplice Products, or other accepted by Engineer.

2.10 STAINLESS STEEL

A. Stainless steel shall be type 18-8 conforming to AISI Grade 304 or 316.

2.11 DEFORMED ANCHOR BARS

A. Deformed bars to be stud welded to structural steel shall be D2L anchors as manufactured by Nelson Stud Division of TRW or other accepted by Engineer.

PART 3 - EXECUTION

3.01 PREPARATION FOR CONSTRUCTION

A. Adjacent Structures: Contractor is solely responsible for the protection, shoring, bracing and stability of existing structures either on or adjacent to the site. Details and extent of such work shown on the Drawings are suggestions only; Contractor is to determine requirements and methods. All of the above operations shall be done under the supervision of a qualified Professional Engineer.

B. Examination of Field Conditions: Contractor shall examine all existing surfaces, structures and the like which the work must attach to, clear or abut. Notify Engineer in writing of any conditions, which will delay or be detrimental to work. Start of work shall represent acceptance by Contractor of existing conditions as suitable for completing work as specified.

C. Field Measurements: Contractor shall verify, by measurements at the site, all existing dimensions, which affect the work of this Section. Field dimensions varying from those on the design drawings or accepted shop drawings shall be brought to the Architect's and Engineer's attention in writing.

3.02 FABRICATION

A. General: Structural Steel shall be shop fabricated in strict accordance with the shop drawings, certificates, and other submitted data accepted by the Engineer. Workmanship shall be of the best practice of relevant trades and shall be performed by skilled mechanics making use of modern tools and equipment in good condition. To the extent practical, fabrication shall be performed in the shop and not in the field.

B. Straightening and Tolerances: Contractor shall straighten, square, flatten and torsionally align plates and shapes as necessary to provide fabricated elements within allowable tolerances as well as to provide correct alignment, good fit and uniform erection clearance, as applicable.

1. Fabrication tolerances shall not exceed those of the AISC Code.

2. Material straightened prior to fabrication shall be examined carefully for signs of distress and for other defects before being placed in fabrication. Distressed or otherwise defective material shall not be used in the work. Straightening by the use of properly controlled heat will be permissible if done by personnel skilled in heat straightening, using equipment and techniques in accordance with written procedure documents and applicable detail sketches prepared by the fabricator and accepted by the Engineer.

3. Sharp corners, projections, and similar rough or sharp surfaces or edges shall be eased and smoothed by grinding. Fabricated materials containing sharp kinks or bends shall be rejected.

C. Cutting: Except where accepted by the Engineer, cutting shall be by machine. Gas cutting shall provide smooth, uniform, workmanlike surfaces and shall conform to the prescribed line. Minimum 1/2 inch radius of cut shall be provided at all reentrant corners. Gas cut surfaces shall be made uniform and notch-free by chipping, planing, grinding and welding as required.

D. Finished Surfaces: Finishing shall be mean milled to ANSI 500 or smoother. Finished surfaces shall be protected by a corrosion inhibiting substance as provided herein. Plane contact surfaces of grillages and base plates. Mill edges of bearing stiffeners.

E. Bolt Holes: Bolt holes shall be normal size unless specifically accepted by the Engineer. Do not make or enlarge holes by burning. Drill material where thickness exceeds the connector diameter and in all material thicker than 7/8 inch. Remove burrs from drilling operations. Elongated punch and die sets shall be used to punch elongated holes.

F. Miscellaneous:

1. Members shall not be shop or field spliced except where specifically accepted by the Engineer and detailed on shop drawings.

2. Pipes, tubes and built-up box members shall be completely sealed with cap plates unless specifically designated otherwise in the Drawings.

3. Curved members of rolled sections shall be bent to uniform smooth curvature by means acceptable to the Engineer.

3.03 ERECTION

A. General: Erection of steelwork shall be performed by skilled workmen in accordance with the accepted shop drawings and certificates and shall conform strictly to the Contract Documents.

B. Embedded Items: Furnish anchor bolts, embedded plates and any other items specified in this Section which are to be cast into concrete in a timely manner. Provide steel templates and layout drawings with setting instructions and tolerances.

C. Shoring, Bracing and Guying: Contractor shall be solely responsible for stability and safety of the structure during the construction process. This responsibility includes any and all engineering for cranes, methods and sequences of erection, and temporary storage of materials such as metal decking.

1. Provide temporary bracing as required in order to resist safely all imposed vertical and horizontal loads during construction and to maintain correct alignment. Design of temporary shoring, bracing and guying is the Contractor's sole and complete responsibility, including all details of installation and removal, methods, sequence and timing. Remove temporary members and their connections after structure is completed.

2. Anchor bolts as shown in the Drawings are intended for requirements of the fully completed structure. Anchor bolt requirements for erection purposes and loadings shall be determined by the Contractor.

D. Measurements and Tolerances: Contractor shall employ a licensed Surveyor experienced in surveying steel building frameworks and report all discrepancies to the Engineer. Contractor shall not proceed with erection until acceptable corrections have been made. Contractor's steel surveys shall establish permanent bench marks as necessary, shall check elevations of bearing surfaces and locations of anchor devices and shall provide data during the course of the Work and a final survey showing the E-W, N-S and elevation position of the work points of each steel frame, truss and other major member as compared to theoretical location. Such surveys shall be submitted for record at the completion of

steel erection and at times requested by the Engineer.

1. Erection tolerances shall not exceed those of the AISC Code.

E. Compression Splices: Fastening of compression splices and joints shall be performed after the abutting surfaces have been brought uniformly into contact. Bearing surfaces shall be cleaned before the parts are assembled.

1. At least 65 percent of the contact area shall be in uniform bearing about the centroid of the bearing surface, with no separation greater than 0.02 inches, except locally at flange toes or corners which may be separated 0.03 inches without need for corrective measures. These requirements apply to both shop and field connected base plates and bearing plates. The above requirements specifically supersede Section M4.4 of the AISC Specification.

F. Field Modifications and Corrections: Field modifications and/or correction of fabrication or detailing errors shall not be made without the prior acceptance of field work drawings by the Engineer.

1. Bolt holes shall not be cut or enlarged with a gas torch.

2. Field cut beam openings shall only be made where expressly permitted by the Engineer. Openings to be cut with a mechanically guided torch after which all edges are to be ground smooth with proper radii at corners. Required reinforcing is to be placed prior to cutting opening.

3.04 BOLTING

A. General: Bolting procedures shall meet all of the requirements of the RCSC Specification and those given herein.

1. Bolts, nuts and washers, at time of tightening, shall be clean, rust-free and free from thread damage.

2. Impact wrenches shall be of adequate capacity and sufficiently supplied with air to perform the required tightening of each bolt within 10 seconds.

B. Acceptable Methods of Installation: All ASTM A325 and A490 bolts shall be fully tensioned to the minimum values given in Table 7 of the RCSC Specification unless specifically permitted otherwise by the Engineer in writing.

1. Bolts shall be tensioned using one of the following methods, as defined by the RCSC Specification and requirements herein, within the limitations given:

a. Twist-off type bolts, for diameters not exceeding one inch.
b. Direct tension indicators.

c. Turn-of-nut, provided that every bolt in every connection is marked with white or yellow keel after snugging and prior to final tightening ("match marking"). Turn-of-nut may not be used for bolts larger than one inch diameter.

2. ASTM A307 bolts shall be tightened using full manual effort on a suitable wrench. After installation, score threads to prevent nuts from loosening.

C. Snugging: Regardless of the installation method being used, connections shall be properly "snugged" prior to final tensioning of any bolt in the connection. Snug tight is defined as the condition where all plies of the connection are in firm contact. Snugging of bolts shall progress systematically from the most rigid part of the connection to the free edges. Impact wrenches shall be used on larger connections if manual effort on spud wrenches is not sufficient to bring plies together.

D. Twist-off Type Bolt Installation: Connections shall be properly snugged prior to tensioning of any bolt, which breaks the splined tip. A hardened washer shall be provided under the nut.

E. Installation with Direct Tension Indicators: Tensioning methods, number, thickness, location, orientation and type of washers, procedures and measurements shall be in strict accordance with the manufacturer's latest printed instructions.

1. DTI's shall be provided in addition to all other washers required.
2. Impact wrenches used shall be those recommended by the DTI manufacturer for the grade and size of bolt being installed and shall be in good repair and sufficiently supplied with compressed air.
3. Protrusions of the DTI shall bear only against the underside of the bolt head or against a hardened 3/16-inch thick hardened washer, as applicable.
4. Bolts larger than one-inch diameter shall be lubricated with Johnson's Stick Wax 140 on threads and face of turned element prior to tightening.
5. Connections shall be properly snugged prior to final tensioning of any bolt, which flattens the protrusions of the DTI.
6. In calibration procedures, the DTI need only indicate a tension of 100 percent of the minimum specified tension and not 105 percent as required by Section 8.2.4 of the RCSC Specification.

F. Installation by Turn-of-Nut: Installation shall be in strict accordance with the RCSC Specification and the additional requirements given herein.

1. A hardened washer shall always be provided under the bearing face of the turned element (nut or bolt head).
2. Bolts shall be properly snugged and match marked prior to final tensioning of any bolt in a connection.
3. During tightening of bolts, the unturned element shall not be allowed to rotate. The unturned bolt element shall be held without rotation using the correct size spud wrench or other suitable correct size of open end, closed end or socket wrench.

G. Oversized and Slotted Holes: Washers, plate washers and/or continuous bars shall be provided for ASTM A325 and A490 bolts in accordance Section 6 of the RCSC Specification.

H. Reuse of Bolts: ASTM A490 bolts and galvanized ASTM A325 bolts, if completely or partially untorqued, shall not be reused. ASTM A325 bolts may be reused only with specific written acceptance by the Engineer.

I. Field Modifications or Corrections: Unfair holes shall not be enlarged by burning or drifting alone. Enlarge holes where necessary and permitted by flame piercing and reaming or by reaming alone or by other means accepted by the Engineer. Holes after enlargement shall be true round holes normal to the surfaces joined. Increase bolt size to fill enlarged and reamed holes.

J. Galvanized Bolts: Galvanized bolts shall be provided wherever the connection is exposed to the

weather.

1. Bolt threads and the face of the turned element shall be lubricated with Johnson's Stick Wax 140 prior to installation.

3.05 WELDING

A. General: Welding processes and materials shall comply with AWS D1.1 and any additional requirements specified herein.

B. Quality Control and Certifications: Quality of all welds shall conform to AWS D1.1 for the type of weld and specified method of inspection.

1. All welds shall be visually inspected by the welder who made the weld.
2. Welds shall only be made by welders with AWS certification, and any local building code license if required, for the type of weld, welding process and position of the weld being made.
3. Field welds shall be subject to the same acceptance criteria as shop welds.
4. Cracking or incomplete penetration shall be cause for rejection of each weld possessing such defects, regardless of other acceptance or rejection criteria.
5. Base metal containing gross discontinuities, before or after welding, or lamellar tearing after welding, shall be repaired in accordance with accepted procedures or shall be discarded and replaced.
6. The Contractor shall comply with the requirements of AWS Article 6.6.

C. Materials and Processes: Welding materials and processes shall be selected from those specified herein and shall conform to accepted welding procedure specifications.

1. Complete and partial penetration welds shall be made using only AWS prequalified procedures following all requirements for joint preparation, fit up, orientation, etc.
2. Welding electrodes or flux contaminated by deleterious substances or moisture shall not be used and shall be removed promptly from the work location. Low hydrogen electrodes which cannot be used promptly after opening of hermetically sealed containers shall be stored in electric holding ovens at 250ºF (minimum).

D. Preheating: Welding shall be performed on material preheated to a temperature above the dew point, regardless of other preheating requirements.

1. Joints in which material is two inches or more in thickness shall not have the weld interrupted after operation has started, unless at least 2/3 of its size, for its full length, has been completed without an interruption of more than one hour. Welding may be interrupted for longer periods, provided the preheat temperature is maintained for full length of joint for the entire time welding is interrupted.

E. Miscellaneous:

1. Sizes of fillet and partial penetration welds shall equal or exceed minimums required by the AISC Specification regardless of all other requirements.
2. All backing bars shall be continuous across the entire length of the weld.
3. Slag shall be removed from all welds for inspection.

4. Shop stud welding of headed stud shear connectors and deformed anchor bars shall be in accordance with Paragraph 3.07 A of this Section.
5. Exposed exterior structural steel shall have all joints seal welded.
6. Welding of ASTM A6 Group 4 and 5 rolled shapes spliced in tension shall conform to AISC specification Section J1.7.

3.06 FINISHING, PAINTING & GALVANIZING

A. General: Steel work shall be cleaned, painted or galvanized as provided herein. Cleaning and priming shall be done in the shop, intermediate and top coats may be done in the shop or in the field unless otherwise specified.

1. Steel which is to be encased in concrete shall be cleaned to meet the requirements of SSPC SP-2, by wire brush or other means at the option of the contractor. Reclean after erection to the extent required to achieve the original condition.
2. Steel which is to be enclosed and not spray fireproofed shall be cleaned to meet the requirements of SSPC SP-3 and shop sprayed with an alkyd primer, not less than 2.5 mils nor more than 3.5 mils dry film thickness.
3. New steel which is to be exposed to weather shall be cleaned to meet the requirements of SSPC SP-6, shop sprayed with zinc-rich primer not less than 2.5 nor more than 3.5 mils dry film thickness (DFT), intermediate spray coated with epoxy-based paint not less than 4.0 nor more than 6.0 mils DFT, and top coated with polyurethane paint not less than 3.0 nor more than 5.0 mils DFT.
4. Existing steel which will be permanently exposed to weather shall be cleaned to meet the requirements of SSPC SP-3 and coated twice with Carboline Rustbound Penetrating Sealer or Carboguard 954 followed by epoxy-based paint, for a total coating dry film thickness not less than 7.0 mils nor more than 15.0 mils dry film thickness. Test topcoat over existing coatings to verify compatibility. If total system dry film build excess 15.0 mils, including existing paints, then removal of this high thickness must be conducted.
5. New steel exposed to the weather but not painted, and where noted in the Drawings, shall be hot-dip galvanized.

B. Painting: Paint shall be applied thoroughly and evenly without sags or holidays by suitable spray equipment in strict accordance with the paint manufacturer's printed instructions. Provide a dry film thickness within the range specified herein, including around outside corners or other abrupt changes in surface profile.

1. Paint shall be applied only to dry surfaces and only at times when steel surface temperatures are at least 5º F above the dew point and above the minimum temperature recommended by the manufacturer for the particular paint.
2. For alkyd primer, epoxy-based paint and polyurethane, surfaces to be subsequently bolted or welded shall be blocked out for a minimum of 2 inches each direction from edge of bolt holes or welds.
3. For Zinc-rich primer, surfaces to be subsequently welded shall be blocked out. Surfaces to be bolted shall not be blocked if slip-critical Class B zinc-rich primer is utilized (no topcoat).
4. Contractor shall reasonably protect painted surfaces from damage, abrasion and soiling.
5. Sharp edges, such as those created by flame cutting or shearing, shall be broken and rounded prior to surface preparation. Breaking the edge can be accomplished by a single pass of a grinder in order to flatten the edge.

C. Field Touch-Up: Field touch-up shall be provided at all blocked areas and points of damage, including bolts and welds installed after coating.

1. Touch-up for one coat treatment shall be power tool cleaning to SSPC SP-3 and one coat of zinc-rich primer.
2. Touch-up for two coat treatment shall be power tool cleaning to SSPC SP-3, one coat of zinc-rich primer and one coat of epoxy-based paint.
3. Touch-up for three coat treatment shall be power tool cleaning to SSPC SP-3, one coat of zinc-rich primer and two coats of polyurethane paint.
4. Touch-up for galvanized steel shall be power tool cleaning to SSPC SP-3 and painting with cold galvanizing compound.

3.07 MISCELLANEOUS

A. Stud Welding: Use automatic stud welding systems in strict accordance with the manufacturer's instructions to weld all studs and deformed anchor bars installed in the shop. Prepare structural steel surfaces as recommended by the stud shear connector or anchor bar manufacturer. Fillet welding shall be used for repair welding only. All welding ferrules shall be broken and removed to allow visual inspection of the stud welds. All weld repairs to stud welds shall be made to the extent required by AWS D1.1.

B. Drilled-In-Anchors: Drilled-in anchors into concrete or masonry shall be installed in strict accordance with the manufacturer’s instructions. Drilled holes shall be cleaned thoroughly with compressed air blown into the bottom of the drilled hole with a tube.

C. Rebar Couplers: Concrete reinforcing bar couplers welded to structural steel shall be installed in strict accordance with the manufacturer’s instructions and AWS D1.1.

END OF SECTION 051200

SECTION 083919 – FLOOD PANELS AND BARRIERS

PART 1 GENERAL

1.1 SUMMARY

A. The Contractor shall furnish, fabricate and install flood panels and barriers. The flood panels and barriers shall be provided complete with all accessories and fastenings required for a satisfactory installation.

B. An index of the Articles in this Section is given below for convenience:

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1.2 PAYMENT

C. Payment for Work associated with this Section shall be made in accordance with each Job Order that includes such Work, and the Contract.

1.3 REFERENCES

D. FEMA Technical Bulletin 3-93 - Non-Residential Flood Proofing.

E. AWS Structural Welding Code.

F. ASME Liquid Penetrant Inspection Section VIII.

G. SEI/ASCE 24 Floor Resistant Design and Construction.

1.4 DESIGN REQUIREMENTS

H. The Contractor shall supply the fabricated flood barriers and panels as per the Contract Drawings and as follows:

1. Design watertight planks to perform under hydrostatic loads (and hydrodynamic or other loads as specified) to control short-term load pressures indicated. All

water pressure loads and operating loads are transferred to the flood wall structure.

2. Design loads considered shall be in accordance with FEMA Technical Bulletin 3-93 - Non-Residential Flood Proofing and SEI/ASCE 24 Flood Resistant Design and Construction Requirements.

1.5 QUALITY ASSURANCE AND QUALIFICATIONS

I. Shop Inspections

1. Shop inspections may be made by Battery Park City Authority or its representative.

2. The Contract shall give ample notice to the Engineer prior to the beginning of any fabrication, so that the inspection may be made.

3. The Battery Park City Authority and/or its representative may conduct the following quality assurance inspection operations at the manufacturer's facility:

a. Visual inspection of welding, as per AWS D1.6.

b. Visual and dimensional inspection welding of completed work.

J. Manufacturer Experience: The manufacturer shall provide information supporting at least five (5) years of experience in the design and manufacture of the product specified.

1.6 SUBMITTALS

K. The Contractor shall prepare and submit to the Engineer for approval, shop drawings and other material required to substantiate conformance in accordance with Vol. III General Requirement 01330 – Submittal Procedures.

L. Shop drawings shall be sealed and signed by a NYS Registered Professional Engineer.

M. Shop drawings shall include but not be limited to:

1. Dimensioned plans and elevations, sections, connections and anchorage, and parts list.

2. Calculations: Submit calculations, approved by a NYS Registered Professional Engineer, to verify the barrier's ability to withstand the design pressure loading.

3. Certified weld inspection reports.

4. Copies of certified materials test reports, both chemical and physical and test report for susceptibility to intergranular corrosion of the stainless steel material, as applicable.

5. The manufacturer's specifications, load table, installation instructions, setting drawings and templates for location and installation of miscellaneous metal items, appurtenances and anchorage devices.

N. The following samples shall be furnished: Representative samples of bolts, anchors, inserts, gasket types, floor barrier finishes, flood barrier numbering tags

as requested by the Engineer. The Engineer's review shall be for type and finish only.

O. List of material manufacturers with the components provided, including but not limited to mill test reports.

1.7 DELIVERY, STORAGE AND HANDLING

P. Shall be transported, handled and stored without being over-stressed, deformed or otherwise damaged and as per the manufacturer's instructions and recommendations.

Q. Coatings shall be applied in the shop; the units are to be delivered ready for installation.

PART 2 PRODUCTS

1.8 MANUFACTURERS

A. Flood Panels and Barriers shall be manufactured by:

1. Presray Corporation, Wassaic, NY
2. Flood Control International, NY
3. Flood Panel, Jupiter, FL
4. PS Flood Barriers, Grand Forks, ND
5. Hydro Gate, New York, NY
6. Flood Barrier Inc., Miami, FL
7. Or approved equal.

1.9 MATERIALS/EQUIPMENT (FACTORY FABRICATED STACKABLE BARRIER)

B. Flood barrier shall be Model Fastlog STM-SD as manufactured by Presray Corporation, Model FloodLog Flood Barriers as manufactured by Flood Panel, or approved equal.

C. Stop Logs: aluminum channels or planks.

D. Frames: Jamb Extrusion; no sills necessary unless mandated by the manufacturer's engineer. Steel jambs optional for certain conditions.

E. Finish: Stop logs mill-finish aluminum; jambs mill-finish aluminum. Stop log assembly including jambs shall be clear anodized-finish aluminum.

F. Gasket: High-density closed cell neoprene sponge with skin, retained in the stop logs and jambs.

G. Hardware: compression brackets; hold down brackets; turn knobs.

H. Design:

1. Stop logs shall be designed with a minimum 2:1 factor of safety based on material yield strength, and shall provide an effective seal against the design flood level.
2. Frame shall have mounting holes for concrete anchors and bolts (options available include epoxy anchors for block walls, and studs for embedment in concrete).
3. The barrier shall be designed such that it attaches to the wet side of the building envelope and load is transferred from the flood panel or barrier to the existing construction through bearing.
4. Stop logs shall have lifting handles for ease of operation during deployment. Stop logs shall have optional use of installation equipment.
5. Lifting device shall be provided to remove and install the stop logs as specified herein. The lifters shall be extendible so that they will function with different stop log plank lengths. The device shall be oriented in its position by the stop log plank guides and shall be capable of securing and releasing the stop logs with the use of a lanyard from the operating floor.
6. Stop logs shall be stenciled with identification for ease of use in deployment. Bottom logs shall be stenciled

1.10 MATERIALS/EQUIPMENT (FACTORY FABRICATED FLOOD PANEL)

I. Flood barrier shall be Model CG22 as manufactured by Presray Corporation, Flood Panel System/Puddle Panel as manufactured by Flood Panel or approved equal.

J. Materials:

1. Panel: 6061 – T6 aluminum plate.
2. Finish: Bright Aluminum Finish.
3. Gasket: Low compression set type molded (extruded gaskets not acceptable).
4. Hardware
   a. Attachment bolts: stainless steel bolts.
   b. Grab Handles: Welded lift attachments on face of panel.
   c. Design.

K. Flood barrier(s) shall be designed with a minimum 2:1 factor of safety based on material yield strength, and shall provide an effective seal against the design flood level.

L. Panel shall be designed for installation using expansion anchors and bolts.

1.11 FLOOD PANEL AND BARRIER STORAGE

M. The Contractor shall install flood panel and barrier storage containers.

N. Location and details of storage containers shall be coordinated with the Operating Bureau and be submitted to the Engineer for approval prior to installation.

O. Storage shall consist of but not limited to the following:

1. Storage containers with interior racking systems along the interior of the container, capable of withstanding equipment weight.
2. Storage containers shall be compatible with forklift access.
3. Storage locations within storage container shall be labeled clearly to indicate the name and deployment location of the flood barriers.

1.12 SOURCE QUALITY CONTROL

P. The manufacturer shall have and perform quality control operations based on a written quality control program that includes the following:

1. Review and rejection of incoming materials based on certified test reports and visual inspections.
2. Frequency of inspection and inspection requirements.
3. All quality control inspection reports shall be dated and maintained by the flood panel/barrier manufacturer for a minimum period of seven years.
4. All prototype test records for custom flood panels/barriers and all production test records shall be dated and maintained by the flood panel/barrier manufacturer for a minimum period of seven (7) years.
5. All prototype test records for the manufacturer's standard flood panel/barrier designs shall be permanently archived.

PART 3 EXECUTION

1.13 FACTORY TESTING/QUALITY CONTROL

A. Finished assembly or assembly similar in design shall be factory leak tested to verify that it will withstand the design hydrostatic pressure.

B. All welds on flood barrier assemblies that may be potential "leak path" shall be liquid penetrant inspected in accordance with ASME section VIII Div. of Appendix 8.

C. The Contractor shall conduct a full-size test on one pre-engineered modular flood barrier, using the project's design loading criteria and performance criteria. It is acceptable to conduct the test at an offsite facility, providing that similar boundary conditions and criteria stated are followed.

D. Contractor shall correct any deficiencies revealed during testing at no additional cost to the Battery Park City Authority. Additional testing and inspection shall be at the Contractor's expense to demonstrate compliance with the above requirements.

1.14 SITE INSPECTION & FIELD VERIFICATION

E. The Contractor shall verify that the area to receive the barrier is properly prepared and set to the proper elevation.

F. Contract shall meet the requirements of the manufacturer's installation recommendations and approved shop drawings.

G. Do not begin installation until substrates have been properly prepared.

H. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

I. Field Testing:

1. Perform visual dry test for gasket alignment, continuity contact and pre-compression.

2. Construct temporary water barrier and test installed flood barrier.

3. The Contractor shall conduct a full-size test on one of the gates fabricated for the project using the project design hydrostatic and equivalent hydrodynamic load criteria – impact can be ignored for the test.

4. The barrier selected for testing should be representative of the most common conditions present in the final design. It is acceptable to conduct the test at the project site or at an offsite facility using similar boundary conditions.

5. The test leakage rate must be less than or equal to 0.1 gallons of water per minute per linear foot of sealed perimeter.

6. Contractor shall correct any deficiencies revealed during testing at no additional cost to Battery Park City Authority. Additional testing and inspection shall be at the Contractor's expense to demonstrate compliance with the above requirements.

7. Qualified factory representative shall provide eight (8) hours of training for facility Battery Park City Authority personnel. Representative shall complete a Certification of Proper Installation and provide copies to the Battery Park City Authority, Engineer, Contractor, and Manufacturing Facility.

J. Products to be operated and field verified including the sealing surfaces to assure that they maintain contact at the correct sealing points.

K. Verify that hinging and latching assemblies operate freely and correctly.

L. Verify all anchorage is in accordance with manufacture's installation instructions and applicable data sheets.

1.15 INSTALLATION

M. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by the manufacturer for optimum results. Do not install products under environmental conditions outside the manufacturer's absolute limits.

N. Coordinate Work with other operations and installation of adjacent materials to avoid damage.

O. Install in accordance with the manufacturer's installations instructions, approved shop drawings, shipping, handling, and storage instructions, and product carton instructions for installation.

P. Flood panel or barrier shall be installed on the wet side of the building envelope

Q. Flood panel/barrier(s) and their components shall be adjusted for proper alignment and operation.

R. Touch-up, repair or replace damaged installed products or components.

S. Clean all sealing surfaces.

T. Protect installed products until completion of project.

END OF SECTION 083919

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following exterior substrates:

1. Concrete.
2. Steel and iron.

B. Related Requirements:

1. Section 05100 "Structural Steel" for preparation of metal substrates.

1.3 DEFINITIONS

A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

D. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

E. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

F. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
2. Indicate VOC content.

B. Samples for Selection: For each type of topcoat product.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Landscape Architect will select one surface to represent surfaces and conditions for application of each paint system.
   a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
2. Final approval of color selections will be based on mockups.
   a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Landscape Architect at no added cost to Owner.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Landscape Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Sherwin Williams.

B. Approved equal.

C. Products: Subject to compliance with requirements, provide product listed in the Exterior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. Colors: As selected by Landscape Architect from manufacturer's standard full range .

2.3 PRIME COAT

A. Fast-cure polyamide epoxy.

B. Product: Macropoxy 646-100 Fast Cure Epoxy, as manufactured by Sherwin Williams.

C. Finish: Semi-gloss.

2.4 TOP COAT

A. Polyester modified, aliphatic, acrylic polyurethane.

B. Product: Acrolon 218 HS Acrylic Polyurethane as manufactured by Sherwin Williams.

C. Finish: Semi-gloss.

2.5 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Landscape Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

3.3 APPLICATION

A. Paints shall be shop-applied. Touch-up painting on site is authorized.

B. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Landscape Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 EXTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Steel Substrates:

1. Acrylic System :
   a. Prime Coat: Primer, alkali resistant, water based.
   b. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5).

END OF SECTION 099113

SECTION 31 10 00 - SITE CLEARING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This section covers all those measures required during the Contractor's initial move onto the site to protect existing fences, facilities, and associated improvements, and utilities adjacent to the construction areas from damage due to boulders, trees or other objects dislodged during the construction process; clearing, grubbing and stripping.

1.2 RELATED SECTIONS

A. The following is a list of Specifications which may be related to this section:

1. Section 31 20 00 - Earth Moving
2. New York City Building Code (NYCBC), Latest Edition
3. New York City Department of Transportation (NYCDOT)
4. Manual of Uniform Traffic Control Devices (MUTCD), recent edition
5. New York State Department of Transportation (NYSDOT)
6. OSHA Safety and Health Standards for Construction 29 CFR 1926

1.3 REFERENCE

A. The Geotechnical Engineering Report.

1.4 ACTUAL SITE CONDITIONS

A. The Contractor shall determine the actual condition of the site as it affects this portion of the Work.

B. Site preparation shall not damage existing structures or cause obstruction and/or contamination to the property. The Contractor shall repair or replace any damaged property at no cost to the BPCA.

C. While work is being performed, the Contractor shall provide adequate access to all operating equipment for routine operation and maintenance. The Contractor shall erect and maintain fences, warning signs, barricades, and other devices as required for the protection of the Contractor's employees and the BPCA’s personnel at the job site. The Contractor shall remove all such protection when the earthwork operations are completed, or as directed by the Engineer.

1.5 SUBMITTALS

A. Submittals for items specified herein shall be submitted by the Contractor and shall be in accordance with the Contract Documents.

B. A copy of this specification section, with any addendum updates included, and all referenced and applicable sections, with any addendum updates included, shall be submitted with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (□) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. The submittal shall be accompanied by a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

C. Submittals shall be provided to confirm that materials to be used comply with information specified herein.

D. The Contractor shall submit to the Engineer a schedule of proposed disposal locations and written authorization from disposal site owner.

E. The Contractor shall submit Work Plans and Safety Measure Drawings.

F. The Contractor shall submit a pre-construction survey of the area of work including existing topography, above grade structures, and below grade structures and utilities within the area of work.

1.6 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.
3. Provide a Maintenance and Protection of Traffic Plan (MPT) in accordance with the latest NYC and NYS DOT standards for work in the right-of-way.

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by the Engineer.

C. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises as directed by the Owner.

D. Utility Locator Service: Notify utility locator service Dig Safe System and One Call for area where Project is located before site clearing.

E. Do not commence site clearing operations until temporary erosion- and sedimentation-control and tree-protection measures are in place.

F. Tree- and Plant-Protection Zones: Protect according to requirements on the contract drawings and in Section 015639 "Temporary Tree and Plant Protection."

PART 2 PRODUCTS

2.1 SAFETY BARRIERS

A. The proximity of the Work to the Right-of-Way (ROW) and existing structures will require construction of appropriate safety barriers such as temporary fencing, berms, or similar facilities.

B. To minimize disturbance to pedestrians and/or vehicular traffic, safety barriers or fencing shall allow for operation of construction equipment and staging of materials associated with this Work.

C. The Contractor shall prepare a submittal to the Engineer with Contract Drawings that define the proposed safety measures prior to any construction activity.

D. All work shall be performed in conformance with the rules and regulations pertaining to safety as established by NYCDOT and OSHA.

PART 3 EXECUTION

3.1 CLEARING, GRUBBING, AND STRIPPING

A. Where existing utilities interfere with the Work, the Work shall be stopped, and the Engineer and BPCA shall be notified of interferences before restarting the work in accordance with the Contract Documents.

B. All construction areas shall be cleared of structures, concrete or masonry debris, landscaping, trees, logs, upturned stumps, grass, weeds, loose boulders, and any other objectionable material of any kind which would interfere with the performance or completion of the Work, create a hazard to safety, or impair the Work's subsequent usefulness or obstruct its operation.

C. Loose boulders within 10 feet of the top of cut lines shall be incorporated in landscaping or removed from the site. Trees and other natural vegetation outside the actual lines of construction shall be protected from damage during construction.

    a. Within the limits of clearing, the areas below the natural ground surface shall be grubbed to a depth necessary to remove all stumps, roots, buried logs, and all other objectionable material.

D. Cleanouts and connection lines and any other underground structures, debris or waste shall be totally removed if they are found on the site. All objectionable material from the clearing and grubbing process shall be removed and disposed of according to the governing regulations.

E. Additional requirements for excavating or removing existing facilities and soil are shown on the Contract Drawings.

F. Unless otherwise shown or specified, native trees larger than three inches in diameter at the base shall not be removed without the Engineer's approval.

G. The removal of any trees, shrubs, fences, or other improvements outside of the limits of construction as deemed necessary by the Contractor, shall be arranged and authorized by BPCA.

H. Trees and shrubbery adjacent to the trench, pole lines, fences, signs, survey markers and monuments, buildings and structures, conduits, pipeline under or above ground, all roadway facilities and any other improvements or facilities within or adjacent to the work shall be protected from injury or damage, and, if ordered by the Engineer, the Contractor shall provide and install suitable safeguards approved by the Engineer to protect such objects from injury or damage.

I. Serious injuries to trees to remain shall be avoided. No major roots or branches crossing the trench shall be cut if such cutting would seriously injure or imperil the safety of the tree or trench. All limbs, roots or branches, which are cut or broken, shall be trimmed and painted with an approved tree seal. If other objects are injured or damaged by reason of the Contractor’s operations, they shall be replaced or restored, at the Contractor’s expense, to the condition at the time the Contractor entered upon the work.

J. The Engineer shall be notified when site preparation work is completed.

3.2 REGRADING AND SUBGRADE PREPARATION

A. In areas to receive fill, the stripped surface should be scarified to a depth of about 6 inches below the excavated level, conditioned to near optimum moisture content and proof-rolled to the inspection and satisfaction of the Engineer.

B. Any holes remaining after stripping and grubbing shall be backfilled unless they are located within an area designated for further excavation or over-excavation and replacement.

C. Subgrade preparation, backfill material and placement shall be in accordance with Section 31 20 00 - Earth Moving.

3.3 DISPOSAL OF DEBRIS

A. Dispose of removed materials, waste, trash, and debris in a safe, acceptable manner, in accordance with applicable laws and ordinances and as prescribed by authorities having jurisdiction.

B. Burying of trash and debris on the site will not be permitted.

C. Burning of trash and debris at the site will not be permitted.

D. Remove trash and debris from the site daily so that its presence will not delay the progress of the Work.

E. Removed materials, trash, and debris shall become the property of the Contractor and shall be removed from the BPCA's property and disposed of in a legal manner. Location of disposal site and length of haul shall be the Contractor's responsibility.

3.4 UTILITY INTERFERENCE

A. If an existing utility is not indicated on the Contract Drawings but is encountered during the Work, the Contractor shall notify the Engineer and BPCA for further direction.

B. The determination to relocate or reroute conflicting utilities will originate from BPCA and will be reported to the utility owners for acknowledgement and permission.

3.5 RELOCATION AND REPLACEMENT

A. Where existing above-ground items and structures interfere with the Work and require relocation and/or replacement, the Contractor shall replace or relocate the items to as close as their original condition.

END OF SECTION 310000

SECTION 311500 - EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 THE REQUIREMENT

A. The Work specified in this Section includes shoring systems for the support of excavations including, but not limited to, trench and structure excavations. The Contractor shall design, furnish, install, and remove upon completion of the required construction, unless shown otherwise, all systems of supports, including all bracing and associated items to retain the sides of the excavations. The Contractor shall be responsible for the selection of methods, the design, construction and removal of all shoring systems. Shoring shall be required.

B. Design of ground support system and methods should be the sole responsibility of the Contractor. The Contractor's ground support plan must take into consideration the subsurface conditions at the site. The Contractor should independently evaluate ground support systems and make his own selection of appropriate ground support techniques which meet the project requirements. The ground support and dewatering system are interdependent and, as such, the ground support and dewatering systems shall be submitted by the Contractor at the same time for review.

C. The provisions specified hereunder shall be understood:

1. To complement, and not to substitute or diminish, the obligations of the Contractor for the furnishing of a safe place of work pursuant to the provisions of the Occupational Safety and Health Act of 1970 and its subsequent amendments and regulations and for the protection of the Work, structures, and other improvements.
2. To represent a minimum requirement:

    a. For the number and types of means needed to maintain soil stability,
    b. For the strength of such required means, and
    c. For the methods and frequency of maintenance and observation of the means used for maintaining soil stability.

D. Excavation support shall include sheeting, shoring, bracing, and other means and procedures required to maintain the stability of soils

E. Excavation supports shall be provided:

1. Where, as a result of excavation work and an analysis performed pursuant to general Engineering design practice,

    a. The excavated face or surrounding soil mass may be subject to slides, caving, or other type of failure, or

b. The stability and integrity of structures and other improvements may be compromised by settlement or shifting of soils.

2. For trench and pit (shaft) walls as required per New York OSHA.
3. As required per New York OSHA Construction Safety Orders, Article 6 and OSHA 29 CFR 1926 (Occupational Safety and Health Standards- Excavation; Final Rule).

F. The Contractor shall obtain any necessary permits from the New York City, Division of Industrial Safety. The Contractor shall pay all costs in connection with said permits and proof of such permits shall be submitted to the Engineer prior to commencing trench work.

G. Trench shoring and bracing shall conform to provisions in Section 5-1.02A, "Trench Excavation Safety Plans", of the New York Standard Specifications and to the specification herein. If a conflict exists between the New York Standard Specifications and specifications herein, the more stringent shall apply.

H. Related to "Sheeting, Shoring, and Bracing":

1. In accordance with the provisions of the governing body and BPCA
2. Each bidder shall list, in the bid item indicated, the amount included in his/her bid for trench and excavation, adequate sheeting, shoring and bracing, or equivalent method for the protection of life and limb, work that shall conform to applicable New York City Construction Safety Orders. By listing this sum in his/her bid, the bidder warrants that his/her action does not convey tort liability to the BPCA, the BPCA’s officials or employees, the Design Engineer, or the Contractor.

I. Related to " Bidder Responsibility":

1. Carefully study all reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site that have been identified and carefully study all reports and drawings of a Hazardous Environmental Condition, if any, at the Site, that may have been identified.
2. Provide, obtain, and carefully study (or assume responsibility for doing so) all additional, independent, or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and underground facilities) at or contiguous to the Site that may affect cost, progress, or performance of the Work or that relate to any aspect of the means, methods, techniques, sequences, and procedures of construction expressly required by the Project Manual and safety precautions and programs incident thereto.
3. Retain and use the services of one or more registered professional Engineers with expertise in geotechnical Engineering for analyzing the "technical data" contained in the geotechnical report and making recommendations related to means, methods, techniques, sequences, and procedures of construction that may be affected by job site soils conditions. Such means and methods shall include, but shall not be limited to: control of groundwater,

surface water, and excavation drainage, excavation, sheeting, shoring, bracing, backfill, compaction, construction equipment, temporary construction facilities, and other construction-related procedures.

4. Agree at the time of submitting its Bid that no further examinations, investigations, explorations, test, studies, or data are necessary for the determination of its Bid for performance of the Work at the price bid and within the times and in accordance with the other terms and conditions of the Project manual.

J. Related Sections

1. Division 31 Section 312319 - Dewatering
2. Division 31 Section 312000 - Earth Moving

1.2 STANDARDS AND REGULATIONS

Except as modified by the governing codes and by the Contract Documents, comply with the applicable provisions and recommendations of the following:

A. Occupational Safety and Health Administrative Code.

B. Manual of Steel Construction, AISC, 9th Edition.

C. American Society of Testing and Materials (ASTM) standards, latest editions.

D. The Contractor's attention is directed to the provisions for "Shoring and Bracing Drawings"

E. The Contractor, prior to beginning any trench, pit, or structure excavation, shall submit to the Engineer and shall be in receipt of the Engineer's written acceptance of the Contractor's detailed plan showing design of all shoring, bracing, sloping of the sides of excavation, or other provisions for worker protection against the hazard of caving ground during the excavation of such trenches or structure excavation.

F. Plans shall be prepared and sealed by a Civil or Structural Engineer registered in the City of New York.

1.3 DESIGN CRITERIA

A. In all areas, the shoring system, including all the components, shall be designed by the Contractor to support earth pressure (saturated and unstaturated), hydrostatic pressures, utility loads, equipment, applicable traffic and construction loads, and other surcharge loads in such manner as will allow the safe and expeditious construction of the permanent facilities without movement or settlement of the ground and will prevent damage to or movement of adjacent structures and utilities.

B. Shoring systems shall meet the following minimum performance requirements and design criteria.

1. Comply with all governing regulations pertaining to excavation safety (e.g., the most current edition of New York/OSHA construction safety orders, article 6).
2. Be compatible with the surface and subsurface soil and groundwater conditions mapped and encountered and resist lateral earth pressures and hydrostatic pressures (where not dewatered).
3. Protect personnel that enter the excavation.
4. Protect existing utilities, pavements, and structures.
5. Installation of the shoring system must occur in a manner and sequence that does not damage existing structures, pavements, and utilities including through settlement, heave or vibrations.
6. Prevent caving (i.e., raveling, running, or flowing) or lateral movement of excavation walls and associated loss of adjacent ground and adjacent ground surface settlement, even when subjected to construction vibrations.
7. Provide stable excavation walls and bottom (e.g., prevent bottom heave).
8. As permitted by the specifications, allow for removal or abandonment of shoring in a manner and sequence that (1) is in step with the backfilling sequence (i.e., shoring should not be removed ahead of backfilling) and (2) does not damage the finished utility line or structures or existing structures, pavements, and utilities including through settlement, heave or vibrations.
9. Resist lateral earth pressures including those from hydrostatic pressures and lateral loads from vehicular traffic, construction equipment and spoils.
10. Allow construction of thrust blocks in jacking shafts adequate to resist anticipated jacking forces with appropriate safety factors.
11. Special shoring and/or ground improvement, including grout stabilization may be required and designs shall be provided by the Contractor, where excavations are in close proximity to structures, utilities, or unlined drainage to minimize potential excavation-related damage. Special shoring and/or ground improvement designs shall be required where excavations are:

    a. Within an imaginary plane protected downward at an inclination of 2H:1V from the nearest foundation edge or utility line.
    b. Below the depth of flow within adjacent unlined drainageways.
    c. Experiencing flowing, running and/or raveling ground conditions (i.e., soils with little to no stability or support).

12. The Contractor shall design each member to support the maximum loads that can occur during construction. For the purpose of this Section, the design load means the maximum load the support member of the shoring system will have to carry in actual practice.
13. The submittals shall provide Contractor's Shop Drawings and design calculations for each stage of the excavation including installation and removal of the shoring system. The Contractor shall submit all design assumptions and design criteria, as well as references for the design criteria and assumptions used. The strut preloading procedure, including information on the jacking system and calibration data for the hydraulic jacks, shall also be submitted for review.

14. The Contractor shall design the bottom of the support system to be carried to a depth below the main excavation adequate to prevent excessive bottom heave, lateral and vertical movements, and ensure stability of the excavation.
15. Review of the Contractor's plans and methods of construction shall not relieve the Contractor of the sole responsibility of providing an adequate support system to support all load configurations encountered to complete the required work.
16. The struts shall be preloaded to 50 percent of the design load. Preloading shall be accomplished by jacking between the struts and wales. Provisions shall be made for permanently fixing each member, after preloading, with steel shims or wedges welded in place. Wood wedges shall not be allowed.
17. The sequence of excavation, installation, and removal of the shoring and preloading of the struts shall be carried out in a manner that lateral movement and settlement of the soil surrounding the excavations is minimized.
18. The vertical spacing of the struts shall not exceed 10 ft.

C. It is the Contractor's responsibility to review the existing underground utilities to make his own interpretation regarding the ground conditions as described in the referenced report, and to make any other additional surveys and/or borings he believes are necessary to determine the types and extent of bracing and shoring systems required to accomplish the Work. All of the foregoing costs shall be included in the Contractor's total price for performing the Work.

D. Sloped excavations shall not be permitted, unless otherwise approved by the Engineer.

1.4 CONTRACTOR SUBMITTALS

A. Submittals for items herein shall be submitted by the Contractor and shall be in accordance with the Contract Documents.

B. A copy of this specification section, with any addendum updates included, and all referenced and applicable sections, with any addendum updates included, shall be submitted with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph.

C. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. The submittal shall be accompanied by a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

D. Submittals shall be provided to confirm that material to be used comply with information specified herein.

E. Contractor’s Shop Drawings. The Contractor shall submit Contractor’s Shop Drawings of temporary excavation support systems. The Contractor’s Shop Drawings shall be prepared and sealed by a Civil or Structural Engineer registered in the New York City.

1. The Contractor, prior to beginning any trench or structure excavation more than 5 ft deep shall submit to the Engineer a detailed plan showing design of all shoring and bracing of the sides of excavation, or other provisions for worker protection against the hazard of caving ground during the excavation of such trenches or structure excavation. The Contractor's attention is directed to the provisions for "Shoring and Bracing Drawings" in Section 6705 of the New York Labor Code. Plans shall be prepared by a Civil or Structural Engineer licensed in the New York City.
2. The Contractor shall prepare and submit drawings and supporting calculations showing proposed shoring systems. The submittals shall include details, arrangement, and method of construction for the proposed shoring systems including levels of struts and shores, as applicable and permissible depth to which excavation may be carried before such supports are installed. Show full excavation depth load to be carried by various members of the support system, and, if required, the preloads. Design calculations shall include design surcharge loads and calculated deflections of shoring and support members. Drawings and calculations shall be prepared by a Civil or Structural Engineer licensed in the New York City.
3. The Contractor shall submit proposed method of installing shoring including the sequence of driving, template, and driving equipment description. The proposed construction sequence including strut placement and strut and shore removal as related to excavation, construction, and backfilling operations shall be shown.

F. All expenses incurred in performing the Work described in this Section shall be borne by the Contractor.

1.5 JOB CONDITIONS

A. Provision for Contingencies:

1. The Contractor shall provide contingency plans or alternative procedures to be implemented if unfavorable shoring system performance is evidenced.

2. The Contractor shall keep on hand materials and equipment necessary to implement contingency plan or alternate procedures

B. The Contractor shall proceed with caution in areas where utilities are within the shoring and excavation prism. Such utilities shall be exposed by hand excavation or other methods acceptable to the BPCA.

C. If existing utilities interfere with proposed method of support, the Contractor shall modify the support system at his own expense.

1.6 TOLERANCE

A. Location of the necessary shoring shall be within 3 inches of that shown on the Contractor's Shop Drawings.

B. In the areas adjacent to existing facilities, the excavation shoring system shall deflect vertically and/or horizontally no more than 1 inch from its original position.

1.7 RELATED REPORTS

Geotechnical Engineering Report of this project.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All timber and structural steel used for the supporting system, whether new or used, shall be sound and free from defects that may impair their strength.

B. If used, sheet piling shall be of a continuous interlocking type forming a continuous wall. Sheet piling and all accessories shall conform to the requirements of ASTM A328.

C. Trench boxes can also be used in lieu of sheet piling and will need to be installed per manufacturer's specifications .

D. Structural steel members shall be designed in accordance with the Manual of Steel Construction. Timber members shall be designed in accordance with the Uniform Building Code.

PART 3 - EXECUTION

3.1 STEEL SHEET PILING (IF USED)

A. The Contractor shall drive sheet piling in plumb position with each pile interlocked with adjoining piles for its entire length so as to form a continuous diaphragm throughout the length of each run of wall, bearing tightly against original ground.

B. The Contractor shall exercise care in driving to avoid damage to existing utilities so that interlocking members can subsequently be extracted without injury to adjacent fills or existing utilities.

C. The methods of driving, cutting, and splicing shall conform to the Contractor's Shop Drawings.

D. The Contractor shall maintain a sufficient quantity of material on hand for sheeting, shoring, bracing, and other operations for protection of work and for use in case of emergency.

E. Sheet pile driving shall be restricted to the hours between 8:00 a.m. and 5:00 p.m.

3.2 INTERNAL BRACING SUPPORT SYSTEM

A. The Contractor shall provide internal bracing support system including lagging and sheeting, sheet piles, wales, struts, and/or shores.

1. All struts with intermediate bracing shall be provided as needed to enable them to carry maximum design load without distortion or buckling.

2. All web stiffeners, plates, or angles shall be provided as needed to prevent rotation, crippling, or buckling of connections and points of bearing between structural steel members that allow for eccentricities caused by field fabrication and assembly.

B. The Contractor shall install and maintain all bracing support members in tight contact with each other and with the surface being supported. Support system monitoring provisions shall be installed as indicated on the approved Contractor's Shop Drawings.

C. If necessary to control shoring movement, the Contractor shall preload bracing members by jacking struts to 50 percent of the design load. Preload bracing members shall be loaded in accordance with methods, procedures, and sequence as described on the approved Contractor's Shop Drawings. Excavation work shall be coordinated with the installation of bracing and preloading. Steel shims and steel wedges welded or bolted in place to maintain the preloading force shall be used in the bracing after release of the jacking equipment pressure.

1. Procedures that produce uniform loading of bracing members to avoid eccentricities or overstressing and distortion of members of wall system shall be used.

2. Preloading systems shall include a method to measure the amount of preload induced into bracing members to within 5 percent.

D. Excavation shall proceed to no more than 2 ft below the point of the support about to be placed. The support shall be installed and preloaded immediately after installation and prior to continuing excavation.

3.3 REMOVAL OF SUPPORTING SYSTEM

A. The Contractor shall remove all shoring, including sheet piles, wales, struts, lagging and shores from the excavation unless indicated otherwise on the Drawings. Removal of the supporting system shall be performed in a manner that will avoid damage of adjacent construction or facilities. All voids created by the removal of the supporting system shall be immediately filled with well-graded cohesionless sand, lean concrete or sand cement grout.

3.4 ORITECT EXISTING UTILITIES

A. Contractor shall shore and protect existing utilities when working on or adjacent to such utilities.

3.5 INSTALLATION

A. Excavation support shall be installed as indicated in the approved submittals.

B. Excavations, including trenching, shall not begin until the excavation support submittals have been accepted and until the materials necessary for the installation are on site.

END OF SECTION 311500

SECTION 31 20 00 - EARTH MOVING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This Section covers all earthwork required for construction of the new Flood Wall. Such earthwork shall include, but not be limited to the loosening, removing, loading, transporting, depositing, and compacting in its final location of all materials wet and dry, as required for the purposes of completing the new Flood Wall specified in the Contract Documents and/or Contract Drawings (including Contract Drawings). The new Flood Wall shall also include the supporting of structures (such as fencing) and utilities (such as drainage and corrosion protection utilities, where warranted) above and below the ground, all backfilling around structures and utilities and all backfilling of trenches and pits, the disposal of excess excavated materials, borrow of materials to make up deficiencies of fill/s, and all other incidental earth works, all in accordance with the requirements of the Contract Documents and/or Contract Drawings.

1.2 RELATED SECTIONS

A. The following is a list of Specifications which may be related to this Section:

1. Section 31 10 00 - Site Clearing
2. Section 31 50 00 - Excavation Support and Protection
3. Section 31 23 19 - Dewatering
4. Section 03 30 00 - Cast-in-Place Concrete

1.3 REFERENCE

A. Geotechnical Engineering Report and Supplemental Memorandum Reports

B. The following is a list of standards which may be referenced in this Section:

1. New York City Building Code (NYCBC), Latest Edition
2. New York City Department of Transportation (NYCDOT)
3. New York State Department of Transportation (NYSDOT)
4. OSHA Safety and Health Standards for Construction 29 CFR 1926
5. Manual of Uniform Traffic Control Devices (MUTCD), recent edition
6. United States Army Corps of Engineers (USACE) Specifications and Design Manuals:

a. EM 1110-2-2104, Strength Design for Reinforced Concrete Hydraulic Structures
b. EM 1110-2-2105, Design of Hydraulic Steel Structures
c. EM 1110-2-2502, Retaining and Flood Walls
d. EM 1110-2-2705, Structural Design of Closure Structures for Local Flood
e. EM 1110-2-1901, Seepage Analysis and Control for Dams
f. EM 1110-2-2100, Stability Analysis of Concrete Hydraulic Structures

7. American Society for Testing and Materials International (ASTM):

a. C330, Standard Specification for Lightweight Aggregates for Structural Concrete
b. D1556, Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
c. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 or 2,700 kN-m/m^3).
d. D2419, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
e. D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
f. D2844, Standard Test Method for Resistance R-Value and Expansion Pressure of Compacted Soils.
g. D3744, Standard Test Method for Aggregate Durability Index.
h. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
i. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
j. D4355, Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon-Arc Type Apparatus.
k. D4491, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
l. D4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
m. D4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
n. D4833, Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.

o. D5261, Standard Test Method for Measuring Mass Per Unit Area of Geotextiles.
p. D4533, Standard Test Method for Trapezoid Tearing Strength of Geotextiles.

q. D6938, Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.4 QUALITY ASSURANCE

A. The Contractor shall accomplish the specified compaction for backfill or other earthwork. Compaction testing will be provided by the BPCA or General Contractor at a testing laboratory of the BPCA or General Contractor's choice.

B. Where soil material is required to be compacted to a percentage of maximum density, the maximum density at optimum moisture content shall be determined in accordance with ASTM D1557.

C. Where cohesionless, free draining soil material is required to be compacted to a percentage of relative density, the calculation of relative density shall be determined in accordance with ASTM D4253 and ASTM D4254.

D. Particle size analysis of soils and aggregates shall be performed using ASTM D422.

E. Determination of sand equivalent value shall be performed using ASTM D2419.

F. The determination of aggregate durability index shall be made using ASTM D3744.

G. Existing asphalt or concrete cannot be buried.

H. No recycled materials shall be used.

I. Asphalt cannot be reused as fill.

J. Materials used within the NYS and NYC DOT right of way as base and subbase materials for pavement shall follow the latest specifications and standards of the governing agency.

1.5 QUALITY CONTROL

A. Field density in-place tests (special inspections) shall be performed in accordance with ASTM D1556, ASTM D6938, or by such other means acceptable to the Engineer. It is the responsibility of the Contractor to accomplish the specified compaction for earthwork.

B. The Contractor shall give the Engineer a minimum 24 hours' notice before requiring compaction testing services in the field. The Contractor will be charged for the cost of all re-tests where the tests do not meet the requirements of the Specifications.

C. In case the tests of the fill or backfill show non-compliance with the required density in the field, the Contractor shall accomplish such remedy as may be required to insure compliance. Subsequent testing to show compliance shall be by a testing laboratory selected by the BPCA or General Contractor and shall be at the Contractor's expense.

1.6 SUBMITTALS

A. Submittals for all material, and equipment items specified herein shall be submitted by the Contractor and shall be in accordance with the Contract Documents and/or Contract Drawings: The following is a list of material and work and shall by no means be exhaustive:

1. Geotechnical laboratory results of onsite subsurface soils, such as gradation analysis, compaction (modified proctor) at maximum dry density and optimum moisture, etc.
2. Mill certificate and geotechnical laboratory results of all imported fill/structural fill.
3. Specifications for soil excavating and compaction equipment (including gross vehicle weight).
4. Signed and sealed flowable fill mix design.

B. A copy of this Specification Section, with any addendum updates included, and all referenced and applicable Sections, with any addendum updates included, shall be submitted with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole.

C. If deviations from the Specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the Specifications.

D. The submittal shall be accompanied by a detailed, written justification for each deviation. Failure to include a copy of the marked-up Specification Sections, along with justification(s) for any requested deviations to the Specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

E. Submittals shall be provided to confirm that materials to be used are in full compliance with information specified herein.

F. The Contractor shall submit to the Engineer a schedule of proposed disposal locations and written authorization from disposal site owner, where soils and fill material are planned to be disposed of.

G. The Contractor shall submit their work safety plans (including means and methods), work safety measures drawings and other diagrammatic safety protocols pertaining to this work.

H. The Contractor shall submit equipment and material (such as fill) staging plans, including notes on work sequencing.

PART 2 PRODUCTS

2.1 SUITABLE MATERIALS GENERAL

A. Aggregate Base

1. Where applicable, Aggregate Base may be used to form a stable base ofr roadways and structures where needed.
2. Aggregate Base shall conform to the following gradation requirements:

Aggregate Base	
Sieve Size	Percent Passing
1-inch	100
¾-inch	90-100
No. 4	35 - 60
No. 30	10 - 30
No. 200	2- 9

3. Aggregate Base shall be hard, sound and durable gravel or crushed rock, which shall not slake or disintegrate in water. Recycled materials are not acceptable. It shall be free from vegetative or other organic matter and other deleterious substances and form a firm, stable base when compacted.

B. Coarse Bedding Material

1. Coarsely graded bedding material may be used as bedding material for foundations and other underground structures where drainage is considered.
2. Coarse bedding material should be clean, durable, crushed (i.e., angular) aggregate rock conforming to the following gradation requirements:

Coarse Bedding Material	
Sieve Size	Percent Passing
2-inch	100
1 ½-inch	95-100
¾-inch	5-30
⅜-inch	5-20
No. 200	0-4

C. Drain Rock

1. Drain Rock may be used for temporary path/roadways for heavy equipment.
2. Drain rock shall be ½-inch diameter crushed rock or gravel, durable and free from slaking or decomposition under the action of alternate wetting or drying.

The material shall be uniformly graded and shall meet the following gradation requirements:

3.

Drain Rock	
Sieve Size	Percent Passing
1-inch	100
¾-inch	90-100
⅜-inch	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

D. Gravel

1. Gravel shall refer to ½- or ¾-inch diameter clean crushed rock or gravel, durable and free from slaking or decomposition under the action of alternate wetting or drying.
2. The material shall be uniform in size and angular in shape.
3. Gravel may be used in conjunction with geotextiles to allow a less-thick placement for over excavations.

E. Flowable Fill

1. Flowable Fill (controlled low strength material) may be used to fill in voids encountered during excavation.

2. Flowable Fill mix shall be composed of a cementitious material, water, fine aggregate and an admixture. The cementitious material shall be Portland cement in combination with fly ash (if authorized by NYCDEP). The admixture shall be an air-entraining agent.
3. The proportions of all material used in the flowable fill shall conform to the specific mix design as intended by the Engineer.
4. Flowable Fill shall have an unconfined compressive 28-day strength from 50 psi (hand excavatability) to a maximum of 100 psi (backhoe excavatability).
5. The wet unit weight of the flowable fill shall be no greater than 100 pounds per cubic foot (pcf); the cured unit weight shall be no greater than 120 pcf
6. Consistency of the flowable fill shall be flowable and self-leveling, with slump from 6 to 10 inches.
7. Any aggregates which produce performance characteristics of the flowable fill may be submitted for approval. Flowable Fill mixture shall contain no aggregate that is larger than ⅜-inch.

8. The amount of material passing the No. 200 sieve shall not exceed 12 percent; no plastic fines shall be present.
9. The air content by volume based on measurement made immediately after discharge from the mixer shall be determined by ASTM C231 as is based on the specified cured unit weight.
10. Provide the Engineer with delivery tickets for each truck load that shows the flowable fill mix, the batch size and the time batched.

a. Cement shall conform to ASTM C150, Type II.
b. At NYCDEP's direction, concrete that is in contact with potable water shall not contain recycled content (fly ash) due to potential leaching issues shall conform to ASTM C618, Class F.
c. If authorized by NYCDEP, fly ash and other pozzolanic material admixtures may be added at a rate not to exceed 30 lb per 94 lb of cement. The admixture shall conform to ASTM C618:

i. Fly ash shall not inhibit the entrainment of air during application.
ii. Fly ash shall not leach into the groundwater.

d. Air entraining admixture shall conform to ASTM C260.

11. Flowable Fill shall be batched by a ready mixed concrete plant and mixed and delivered to the jobsite by means of transit mixing trucks.
12. Field testing of flowable fill shall be as specified for concrete based on ACI standards and the Contract Drawings.
13. No equipment or traffic shall be allowed on the flowable fill until the surface of the flowable fill will withstand the weight of equipment or traffic without displacement or damage. If necessary to prevent displacement or damage, provide steel trench plates that span the trench or other means that prevent equipment or traffic contact with flowable fill.

F. Lightweight Fill

1. Lightweight fill shall conform to ASTM Designation C330 Standard Specification for Lightweight Aggregates for Structural Concrete.
2. Lightweight aggregate shall have a proven record of durability and non-corrosive with the following properties:

a. The gradation should conform to the ASTM C330 Size Designation Coarse Aggregate, which is as follows:

Sieve Size	Percent Passing
1-inch	100
3/4-inch	80-100
3/8-inch	10-50
No. 4	0-15

No. 100	0-5

b. The dry, loose unit weight shall be less than 55 pcf. The Contractor shall verify a compacted density of less than 60 pcf, as measured in accordance with ASTM D-698 (the standard test methods of moisture-density relations of solid and aggregate mixtures using a 5.5 lb. hammer and 12-inch drop).

3. Lightweight fill shall be placed in layers not exceeding twelve (12) inches, measured prior to compaction. Lightweight fill behind the Flood Wall, where warranted, shall be compacted according to the manufacturer's Specification and shall not induce excessive stresses to the new Flood Wall.
4. Construction equipment, other than for compaction, shall not operate on the exposed lightweight fill.
5. The areas to be backfilled shall not have any standing water in it prior to placement of the lightweight fill.
6. Lightweight fill shall not be placed when frozen or on frozen material.
7. Lightweight fill shall have a pH between 6.5 and shall conform to ASTM C88 for soundness and durability.

G. Sand

1. Sand shall be free of organics and other deleterious materials.
2. Sand should be chemically inert and non-corrosive.
3. Sand may be backfilled as utility bedding or for purposes of leveling or setting.
4. Sand shall meet the following gradation requirements:

Sieve Size	Percent Passing
No. 4	95-100
No. 200	0-5

F. Native Material

1. Native Material may be reused if it meets the requirements below and only where native material is indicated for use on the Contract Documents and/or Contract Drawings:

a. Native soil below the stripped layer (topsoil or fill) and having an organic content of less than 3 percent by volume.

b. Native soil that does not contain rocks or lumps larger than 6 inches in greatest dimension with not more than 15 percent larger than 2.5 inches.

c. Native soil shall be considered unsuitable material as outlined below.

1) Unsuitable soils for fill material shall include, but not be limited to, all soils which when classified under ASTM D2487 fall in the classification of PT, OH, CH, MH, or OL.
2) In addition, any soil which cannot be compacted sufficiently to achieve the percentage of maximum density specified for the intended use shall be classified as unsuitable material.
3) Detrimental amounts of organic matter shall be no more than 5 percent. Amount of organic matter shall be determined based on ASTM Test Method D2974.
4) Materials containing rock or similar irreducible material with a maximum dimension greater than 6 inches.
5) Materials containing foreign manmade objects, such as construction debris.
6) Materials of such unstable nature as to be incapable of being compacted to specified density using ordinary methods at optimum moisture content.
7) Materials that are too wet to be properly compacted and circumstances that prevent suitable in-place drying prior to incorporation into the new Flood Wall. However, the presence of excessive moisture in a material is not, by itself, sufficient cause for determining that the material is unsuitable – this shall be assessed by the Geotechnical Engineer during earthmoving activities.
8) Materials that are unsuitable for the planned use as described in the Contract Documents and/or Contract Drawings.

2.2 USE OF FILL, BACKFILL, AND EMBANKMENT MATERIAL TYPES

A. The Contractor shall use the types of materials as designated herein and as shown on the Contract Documents and/or Contract Drawings for all required construction.

B. Fill, backfill, and embankment types shall be used in accordance with the following provisions:

1. Earthwork not included below or specified elsewhere shall be constructed of Fill Material as defined herein and within the Contract Documents and/or Contract Drawings.
2. Aggregate Base materials under pavements, sidewalk slabs, curb and gutters shall be constructed to the thicknesses shown or specified in the Contract Documents and/or Contract Drawings. Materials shall meet the requirements of NYC or NYS DOT.
3. Backfill materials beneath the Flood Wall foundations shall be as shown in the Contract Documents and/or Contract Drawings.
4. Trench backfill and final backfill for utilities under slabs shall be the same material as used within the pipe zone, except where concrete encasement is required by the Contract Documents and/or Contract Drawings.

PART 3 – EXECUTION

3.1 GENERAL

A. Excavations shall be shored and braced as set forth in the rules, orders, and regulations of the City of New York and OSHA. The Contractor's shoring and bracing and general trenching operation shall consider vehicular and other loads that may be applied near the edge of an open trench and shall be in accordance with Section 31 50 00 - Excavation Support and Protection.

B. Excavation shall include removal of all waters that interfere with the construction work. Dewatering shall be in accordance with Section 31 23 19 - Dewatering.

C. Excavated spoils not used for backfill in approved areas shall be dumped directly into trucks for hauling off the site.

D. Excavated spoils may be staged correctly with the appropriate slopes and at a height no higher than 6 feet at an authorized area within the site and covered/protected from the elements.

E. Staged and protected excavated spoils shall not obstruct pedestrian and worker passage within Right-of-Ways (ROW).

F. Dumping of excavated materials onto adjacent pavements will not be permitted.

G. Excavation widths for the installation of the new Flood Wall foundations and associated appurtenances is shown on the Contract Drawings.

H. Safe and convenient passage for pedestrians shall be provided during trench excavations. The Engineer may designate a passage to be provided at any point deemed necessary. Access to fire stations, fire hydrant, and hospitals shall be maintained at all times.

3.2 STRUCTURE, PAVEMENT AND UTILITY EXCAVATIONS

A. The Contractor shall submit an excavation plan for review before any excavation commences.

B. All excavations shall be protected and secured from pedestrian and vehicular traffic. This will entail the Contractor to provide appropriate fencing, concrete barricades, signage and other Maintenance and Protection of Traffic (MPT) controls.

C. Excavations near areas of pedestrian or vehicular traffic shall be open the minimum time necessary to complete the work but shall not exceed 4 days maximum before backfilling the trench or excavation.

D. Except when specifically provided to the contrary, excavation shall include the removal of all materials of whatever nature encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the new Flood Wall.

E. The removal of said materials shall conform to the lines and grades shown or ordered. Unless otherwise provided, the entire construction site shall be stripped of all vegetation and debris, and such material shall be removed from the site prior to performing any excavation or placing any fill.

F. All excavations shall be supported in a safe manner in accordance with applicable State safety requirements and the requirements of OSHA as specified herein.

G. All excavations shall be dewatered in accordance with Section 31 23 19 - Dewatering and shored in accordance with Section 31 50 00 - Excavation Support and Protection, if necessary.

H. Excavations shall be carried to a grade of 12 inches below the bottom of the foundation footing or key.

I. At all slabs on grade, the excavation shall be carried to a grade of 6 inches below the bottom of the slab.

J. Ample workspace within the protected excavation shall be provided.

K. Excavation under areas to be paved shall extend to the bottom of the Aggregate Base unless additional removal is required for removal of existing fill materials and unsatisfactory soils as outlined herein. After the required excavation has been completed, the exposed surface shall be scarified, brought to optimum moisture content and compacted.

L. Unless otherwise shown, ordered, or accepted by the Engineer, excavation for utilities shall be vertical trenches, shored if required, and shall be uniform width from top to bottom.

M. Existing utilities, manholes, drainage structures, and other facilities shall be protected, supported, and kept in service.

N. The bottom of the trench shall be excavated uniformly. The trench bottom shall be given a final trim, using a laser to set the string line for establishing grade, such that

each pipe section when first laid will be continually in contact with the ground along the extreme bottom of the pipe.

O. Rounding out the trench to form a cradle for the pipe will not be required. Bell holes shall be excavated in the pipe bedding material as required to ensure uniform bearing of the pipe barrel on the bottom of the trench.

P. If the maximum trench width is exceeded, the Contractor shall consult the Engineer immediately, and the Contractor shall provide additional bedding, another more stringent type of bedding, or higher strength pipe as directed by the Engineer at no additional cost to the BPCA or General Contractor.

Q. The maximum lengths of open trench permitted in any one location shall be the length necessary to accommodate the amount of pipe installed in a single day or 100 ft, whichever is lesser. The distance is the collective length at any location, including open excavation, pipe laying and appurtenance construction, and backfill that has not been temporarily resurfaced.

R. All trench excavations shall be fully backfilled at the end of each day, unless use of steel plates is permitted.

S. Use of steel plates as open trench covers are permitted with approval by the Engineer and the BPCA or General Contractor and as described below:

1. Trench plates will be allowed to cover a minimum area over the end of the last section of pipe installed each day, provided the trench is properly shored.
2. Temporary backfill of the trench in the plated area is not required.
3. When pedestrian or vehicular traffic plates are authorized, they shall be provided with non-skid coating and cold mix asphalt around the plate perimeter.

T. Where steel plates cannot be used, trenches shall be backfilled with an approved fill material (such as Gravel or Aggregate Base) and topped with temporary paving.

3.3 OVEREXCAVATION AND REPLACEMENT

A. Where actual conditions during Construction-Phase indicate that trenches shall be over-excavated and when directed by the Engineer, they shall be excavated to the depth as directed by the Engineer, and then backfilled/compacted to the grade of the bottom of the bedding.

B. If the bottom of the excavation is found to consist of soft or unstable material which is incapable of properly supporting the pipe or structure, the Engineer shall be advised immediately. At the Engineer's direction, such material shall be removed to the depth and for the lengths specified and the trench installed with the appropriate geotextile to

prevent migration of fines and backfilled to grade with Gravel or compacted Drain Rock.

C. When over-excavation is ordered by the Engineer, compensation will be provided to the Contractor.

1. The Contractor shall obtain the Engineer's written approval prior to over-excavating.
2. Any over-excavating and resultant backfill and compaction without such approval shall be at the Contractor's expense. The quantity of approved unsuitable material excavated and its replacement shall be paid for as extra work, as directed by the Engineer.

3.4 DISPOSAL OF EXCESS EXCAVATED MATERIAL

A. The Contractor shall remove and dispose of all excess excavated material in a legal manner at a site located off-site as selected by the Contractor and reviewed by the Engineer.

3.5 FOUNDATION SUBGRADE

A. All native soils and existing fills at the subgrade level shall be cleaned of deleterious materials, visually inspected and probed by the Engineer to determine if satisfactory for foundation support.

B. Where unsatisfactory soils and other deleterious material are encountered by the Contractor during excavation to the foundation subgrade elevations, removal and replacement shall be performed per the Overexcavation and Replacement Sections.

C. The subgrade soils beneath rigid concrete pavements and foundations shall be proof-rolled using the appropriate compaction equipment with the effective number of overlapping passes as noted in the Contract Drawings and/or as directed by the Engineer.

D. Prior to placing any concrete, subgrade soils shall be moisture conditioned between 2 and 5 percent above laboratory optimum moisture per ASTM D1557.

3.6 GENERAL BACKFILL OF MATERIALS

A. Backfill shall not be dropped at a significant height directly upon any structure or pipe.

B. Backfill shall not be placed around or upon any structure until the concrete has attained sufficient strength to withstand the loads imposed and has been in place for seven (7) days.

C. Backfill around water retaining structures shall not be placed until structure has been tested, and structures shall be full of water when backfill is being placed.

D. Except for materials being placed in over-excavated areas, backfill shall be placed after all water is removed from the excavation.

E. Backfill materials shall be placed and spread evenly in layers, loose depth 8 inches or less as specified herein.

F. During spreading of the backfill, each layer shall be thoroughly mixed as necessary to promote uniformity of material in each layer.

G. Where the backfill material moisture content is too low to permit the specified degree of compaction, water shall be added before or during spreading until the proper moisture content is achieved. Jetting will not be permitted for compaction.

H. Where the backfill material moisture content is too high to permit the specified degree of compaction, the material shall be dried until the moisture content is satisfactory.

I. Storage of backfill materials overnight at the job site is prohibited, unless stored in a designated stockpile area.

3.7 FLOOD WALL BACKFILL MATERIALS

A. Where at-grade foundation footprints transition from excavation backfill to the existing soil outside the excavation, existing soil shall be over-excavated to a minimum depth of three feet below the bottom of the foundation and backfilled with Aggregate Base and shall be in accordance with the requirements defined herein for removal of existing fill materials and weak soils and site preparation beneath all slab-on-grade and concrete foundations.

B. In localized areas, where there is not adequate space to properly compact backfill, Sand shall be used as backfill. Flowable Fill may be used to mitigate voids and other inaccessible areas where backfill and compaction cannot be performed effectively.

C. Fill material shall be spread and compacted in uniform horizontal lifts not exceeding 8 inches in loose thickness and to a minimum relative compaction as noted herein.

D. Original pavements (asphalt or concrete), tree stumps, roots, topsoil, organic soils, construction debris, garbage and other deleterious material cannot be left in place and backfilled over – these materials shall be removed completely before backfilling.

E. Flowable Fill shall be designed and placed using approved and accepted methods, at location where warranted by the Engineer (such as voids or around areas where backfill and compaction equipment is not possible).

3.8 UTILITY TRENCH BEDDING AND BACKFILL

A. Pipe zone backfill materials shall be manually spread around the pipe so that when compacted, the pipe zone backfill will provide uniform bearing and side support.

B. Sand or Coarse Bedding shall first be placed to a depth so that the pipe has support over its full length. Additional bedding material will be placed to a point no greater than ¼ of the pipe diameter. The bedding shall then be uniformly placed in maximum 6-inch thick loose lifts on each side of the pipe, thoroughly shovel-sliced into the haunch area of the pipe before the backfill is brought up to the spring line of the pipe. Above the spring line of the pipe, pipe zone backfill shall be brought up in 8-inch lifts to a point that is 12 inches over the top of the pipe; placed and compacted.

C. The pipe zone shall be backfilled with the specified backfill material as specified in the Contract Documents and/or Contract Drawings. The Contractor shall exercise care to prevent damage to the pipeline coating, cathodic bonds if present and the pipe itself during the installation and backfill operations.

D. Bell or coupling holes shall be provided. Do not shovel-slice bedding material into the bell or coupling hole.

E. After the pipe zone backfill has been placed as specified above, and after all excess water has completely drained from the trench, backfilling of the trench zone may proceed.

F. Trench zone backfill shall be placed in maximum 8-inch-thick loose lifts.

G. Where pipe embedment is disturbed after compaction, such as by the removal of sheeting and shoring, the BPCA or General Contractor may require recompaction to the specified minimum limit.

H. If the allowable deflection specified for the pipe is exceeded, the Contractor shall expose and re-round or replace the pipe, repair all damaged lining and coating, and reinstall the pipe zone material and trench backfill as specified at no additional expense to the BPCA or General Contractor.

3.9 COMPACTION OF ALL BACKFILL MATERIALS

I. If Aggregate Base is used as backfill around the wall foundations, it shall be compacted in lifts no greater than 8 inches in thickness to at least 95 percent of maximum dry density (i.e., relative compaction) and at a soil moisture content at or near optimum soil moisture. The maximum dry density and optimum moisture content shall be determined by ASTM D1557 test methods.

J. If Gravel is to be used as backfill around the wall foundations, minimal compaction by the appropriate equipment shall be used.

K. Compaction equipment chosen by the Contractor shall not exert damaging forces on the adjacent structures/walls.

L. Each layer of backfill materials as defined herein shall be mechanically compacted to the specified percentage of maximum density. Equipment that is consistently capable of achieving the required degree of compaction shall be used and each layer shall be compacted over its entire area while the material is at the required moisture content. Lightweight tampers or vibrating plate compactors shall be used in utility trenches to prevent damage to existing or new utilities.

M. All backfill shall be uniformly moisture-conditioned to between 2 and 6 percent above the optimum moisture content and placed in horizontal lifts less than 8 inches in loose thickness.

N. Compaction of backfill adjacent to all subgrade structure walls shall follow a pattern of compaction that begins at the wall face and progresses outward to the outside edge of the excavation before beginning a new lift.

O. Flooding, ponding, or jetting shall not be used as a means for compaction.

P. All backfill materials placed below 3 feet above the top of the pipe should be compacted with hand-compaction equipment. Materials placed above 3 feet above the top of the pipe shall be compacted using heavier, self-propelled compaction equipment.

Q. After hand-compacting the bedding, the Contractor shall perform a final trim using a string line for establishing grade, such that each pipe Section when first laid will be continually in contact with the bedding along the extreme bottom of the pipe.

R. Additional QC tests may be made at the request of the Engineer to verify that compaction is meeting the specified requirements.

S. If compaction fails to meet the specified requirements, the Contractor shall remove and replace the backfill at proper compaction or shall increase the compaction to specified level by other means acceptable to the Engineer. Subsequent tests required to verify that the reconstructed backfill meets the specified compaction shall be paid by the Contractor.

T. Track rig, loader or dump truck walking of fill to achieve compaction shall not be allowed.

U. The following compaction test requirements shall be in accordance with ASTM D1557, or in accordance with ASTM D4253 and D4254, as applicable:

Location of backfill	Required % Compaction
Asphaltic and concrete pavements	95
Beneath footings, foundation walls, slabs and pads	95
Around footings and slabs	95
Beneath anchor blocks and around threaded anchor bar trenches	95
Behind existing and new Flood Wall	92
Behind foundation walls	90
Beneath landscaped areas and walkways	90
Behind new Flood Wall between STA 3+11.10 and STA 4+05.15	90
Above and around utility pipe zone	90

3.10 DISPOSAL OF SURPLUS MATERIAL

A. Remove excess earth materials, unsuitable materials, and debris from the site and dispose of it in a legal manner. Location of disposal site and length of the haul shall be the Contractor's responsibility. Site shall be located off BPCA or General Contractor property.

3.11 EXISTING UTILITIES

A. Locate and indicate on the Contract Drawings utilities and/or other facilities, which may conflict with, cross, or lie close to the new Flood Wall.

B. While the existing utility locations shown in the Contract Drawings are believed to be reasonably correct, neither the Engineer nor the BPCA can guarantee the accuracy or adequacy of this information.

C. The Contractor shall verify the location and depth (elevation) of all existing utilities and services prior to performing excavation work in an area. Contractor shall record on the record drawings the location and depth (elevation) of all existing utilities and services and any that are discovered during excavation.

D. The Contractor shall call One Call or Call Before You Dig (811) at least 5 working days prior to start of any excavations and confer with all agencies and utilities that have or may have aboveground and/or underground facilities in the vicinity of the new Flood Wall and other associated utilities.

E. The purpose of One Call is to notify said agencies and utilities of the proposed construction schedule and locate and/or verify the locations of all facilities, including connections, in the area of the new Flood Wall within the ROW.

F. The Contractor shall arrange for all necessary suspension of service and make arrangements to physically locate and avoid interference with all existing utilities and facilities.

G. The Contractor may make arrangements for alterations or relocations for his sole convenience (not actually required to complete foundation or utility installations); such alterations or relocations shall be completely at the expense of the Contractor.

H. Where existing utilities and/or other facilities, aboveground and/or underground, are encountered during construction, they shall not be displaced or molested unless necessary.

I. If it is necessary to relocate a utility or if a utility is disturbed or accidentally damaged in the construction of the new Flood Wall, the Contractor shall notify the BPCA, the General Contractor or the proper Authority.

J. The Contractor shall abide with the requirements of and cooperate with BPCA or Authority (who may enter upon the new Flood Wall construction zone at any time) while protecting, repairing, replacing or relocating such utilities.

K. All abandoned pipelines that are severed during the new Flood Wall construction shall be immediately plugged by the Contractor with approved material, unless otherwise directed by the Authority.

L. A 12-inch minimum clearance shall be maintained at all utility crossings. Adjustments to the pipe alignment and elevation will be made by the Contractor where exploratory work indicates the need.

M. Excavation around utilities shall follow the general protocol below:

1. Excavation and other work under or adjacent to utilities shall not interfere with their safe operation and use.
2. Contractor shall carefully probe to determine the exact location of utility, and hand excavate where necessary to avoid damages.
3. In the event of damage incurred during construction, the Contractor shall immediately notify BPCA or the Authority and shall arrange for immediate repairs at his expense.

3.12 GEOTEXTILE FABRIC

A. The fabric shall be provided in rolls wrapped with protective covering to protect the fabric from mud, dirt, dust, debris, ultraviolet radiation, and abrasion due to shipping and handling.

B. The fabric shall be free of defects or flaws that significantly affect its physical properties as it is intended for this Contract.

C. Each roll of fabric in the shipment shall be labeled with a number or symbol to identify that production run.

D. Geotextile fabric shall be handled and installed in accordance with the manufacturer's recommendations and as noted in the Contract Drawings. The fabric shall be stretched, aligned, and placed in a wrinkle-free manner.

E. Punctures in the geotextile shall be covered with a minimum 12-inch square patch.

3.13 SHORING REMOVAL

A. Shoring shall be removed as soon as the trench backfill has been placed and compacted to a level adequate to support the trench walls, unless otherwise indicated.

B. Compaction of the backfill shall be continuous throughout the shoring removal process in order to minimize the potential creation of voids between trench walls and compacted trench backfill.

C. Observable voids created by removal of shoring shall be backfilled with the appropriate and approved fill material discussed herein and compacted as discussed herein.

D. Shoring shall be completely removed prior to compaction of the top 4 feet of trench depth.

END OF SECTION 312000

SECTION 312319 - DEWATERING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This section covers controlling groundwater, site drainage, and storm flows during construction. The Contractor is cautioned that the Work involves construction in and around drainage channels, local rivers, and areas of local drainage. These areas are subject to frequent periodic inundation.

1.2 RELATED SECTIONS

A. The following is a list of Specifications which may be related to this section:

1. Section 312000 - Earth Moving
2. Section 311000 - Site Clearing
3. Section 315000 - Excavation Support and Protection

1.3 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. New York City Department of Transportation (NYCDOT)
2. New York City Department of Environmental Protection (NYCDEP)
3. American Society for Testing and Materials International (ASTM):

    a. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft^3 or 600 kN-m/m^3).

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Support of excavation and dewatering Contractor shall have, as a minimum, three (3) successful past installations and operations similar to those found on the Work.

1.5 SUBMITTALS

A. Contractor shall submit a Water Control Plan to the Engineer two (2) weeks prior to execution of this Work. At a minimum, the Water Control Plan shall include:

1. Descriptions of proposed groundwater and surface water control facilities including, but not limited to, equipment, methods, standby equipment and power supply, means of measuring inflow to excavations, pollution control facilities, regulatory permitting (NYCDEP), effluent testing, discharge locations to be utilized, and provisions for immediate temporary water supply as required by this Section.

2. Drawings showing locations, dimensions, and relationships of elements of each system.
3. Design calculations demonstrating adequacy of proposed dewatering systems and components.
4. If system is modified during installation or operation, revise or amend and resubmit Water Control Plan.

PART 2 PRODUCTS

2.1 MATERIALS

A. Onsite materials may be used within the limits of construction to construct temporary dams and berms. Materials such as plastic sheeting, sand bags, and storm sewer pipe may also be used if desired by Contractor.

PART 3 EXECUTION

3.1 GENERAL

A. For all excavation, Contractor shall provide suitable equipment and labor to remove water, and keep the excavation dewatered so that construction can be carried on under dewatered conditions.

1. Water control shall be accomplished such that no damage is done to adjacent channel banks or structures.
2. Continuously control water during course of construction, including weekends and holidays and during periods of work stoppages, and provide adequate backup systems to maintain control of water.

B. Contractor is responsible for investigating and becoming familiar with all site conditions that may affect the Work including surface water, potential flooding conditions, level of groundwater and the time of year the work is to be done.

C. Contractor shall conduct operations in such a manner that storm or other waters may proceed uninterrupted along their existing drainage courses.

1. By submitting a bid, Contractor acknowledges that Contractor has investigated the risk arising from such waters and has prepared bid accordingly and assumes all of said risk.

D. For all excavation, Contractor shall provide suitable equipment and labor to remove water, and keep the excavation dewatered so that construction can be carried on under dewatered conditions.

1. Any damage to adjacent property resulting from Contractor’s alteration of surface or subsurface drainage patterns shall be repaired by Contractor at no additional cost to Owner.

E. Pumps and generators used for dewatering and water control shall be quiet equipment enclosed in sound deadening devices.

F. Contractor shall remove all temporary water control facilities when they are no longer needed or at the completion of this Work.

G. All excavations made as part of dewatering operations shall be backfilled with the same type material as was removed and compacted to ninety-five percent (95%) of Maximum Standard Proctor Density (ASTM D698) except where replacement by other materials and/or methods are required.

3.2 CONSTRUCTION

A. Surface Water Control:

1. Surface water control generally falls into the following categories:

   a. Normal low flows along the channel.
   b. Storm/flood flows along the channel.
   c. Flows from existing storm drain pipelines.
   d. Local surface inflows not conveyed by pipelines.

2. Contractor shall coordinate, evaluate, design, construct, and maintain temporary water conveyance systems:

   a. These systems shall not worsen flooding, alter major flow paths, or worsen flow characteristics during construction. Contractor is responsible to ensure that any such worsening of flooding does not occur.
   b. Contractor is solely responsible for determining the methods and adequacy of water control measures.

3. At a minimum, Contractor shall be responsible for diverting the quantity of surface flow around the construction area so that the excavations will remain free of surface water for the time it takes to install these materials, and the time required for curing of any concrete or grout.
4. Contractor is cautioned that the minimum quantity of water to be diverted is for erosion control and construction purposes and not for general protection of the construction site.

   a. It shall be Contractor's responsibility to determine the quantity (volume and flow) of water which shall be diverted to protect from damage caused by stormwater, perched water and /or groundwater.

5. Contractor shall, at all times, maintain a flow path for all channels:

   a. Temporary structures such as berms, sandbags, pipeline diversions, etc., may be permitted for the control of channel flow, as long as such measures are not a major obstruction to flood flows, do not worsen flooding, or alter historic flow routes.

B. Groundwater Control:

1. Contractor shall install adequate measures to maintain the level of groundwater below the foundation subgrade elevation and maintain sufficient bearing capacity for all structures, pipelines and earthwork.

    a. Such measures may include, but are not limited to, installation of perimeter subdrains and swales, or by pumping from sumps installed below the subgrade elevation.

2. The structure bearing surfaces are to be kept dewatered and stable until the structures or other types of work are complete and backfilled.

    a. Disturbance of foundation subgrade by Contractor operations shall not be considered as originally unsuitable foundation subgrade and shall be repaired at Contractor's expense.

3. Contractor shall dispose of groundwater as follows:

    a. Containment: upon extraction, store groundwater extracted in the process of construction dewatering in containers prior to discharge or disposal of water, as applicable. Keep containers locked to prevent accidental or purposeful discharge of the water. Contain and store the water on-site and in such a manner that it will not interfere with the Contractor's existing or continued construction operations.
    b. Obtain discharge permit for water disposal from authorities having jurisdiction.
    c. Treat water collected by dewatering operations, as required by regulatory agencies, prior to discharge.
    d. Discharge water as required by discharge permit and in manner that will not cause erosion or flooding, or otherwise damage existing facilities, completed Work, or adjacent property.
    e. Remove solids from treatment facilities and perform other maintenance of treatment facilities as necessary to maintain their efficiency.

4. Any temporary dewatering trenches or well points shall be restored following dewatering operations to reduce permeability in those areas as approved by Engineer.
5. Extracted groundwater of sufficient quality as shown by test data may be used on site with Engineer's written approval for those purposes approved by the Engineer.

END OF SECTION 312319

SECTION 323116 - WELDED WIRE FENCE PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Custom made metallic-coated-steel, welded-wire fences panels to match existing as directed by Owner.

B. Related Requirements:

1. Section 051200 – “Structural Steel” for steel fence posts.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For fencing panels

1. Include plans, elevations, sections, post spacing, and mounting attachment details.

C. Samples: for Verification: Submit samples for welded wire mesh to match existing as selected by Owner

1. Provide Samples 12-inches in length for linear materials.
2. Provide Samples 16-inches square for wire mesh.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Include three panels length of fence complying with requirements.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of custom welded wire fences panels and other construction contiguous with fence by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Wind Loading:

1. Fence Height: As indicated on drawings.
2. Design Criteria: Refer to drawings.

2.2 METALLIC-COATED-STEEL, WELDED-WIRE FENCES

A. Fence Fabric: Metallic-coated-steel wire. For wire pattern coordinate with Owner selection to match selected existing fence.

B. Fasteners: Manufacturer's standard tamperproof, corrosion-resistant, color-coated fasteners matching fence components with resilient polymer washers or clips.

2.3 PANEL IN-FILL FENCE MATERIALS

A. Metallic-Coated-Steel Wire: Welded-wire fence fabric, hot-dip galvanized after fabrication. Weight of zinc coating shall be not less than 1.0 oz./sq. ft..

B. Plates, Shapes, and Bars: ASTM A36/A36M.

C. Tubing: ASTM A500/A500M, cold-formed steel tubing.

D. Galvanizing: For components indicated to be galvanized and for which galvanized coating is unspecified, hot-dip galvanize to comply with ASTM A123/A123M. For hardware items, hot-dip galvanize to comply with ASTM A153/A153M.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.5 METALLIC-COATED-STEEL FINISHES

A. Galvanized Finish: Clean welds, mechanical connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.

B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FENCE INSTALLATION

A. Install fences according to manufacturer's written instructions.

B. Install infill fences panels by setting between posts as indicated and fastening to posts. Peen threads of bolts after assembly to prevent removal.

END OF SECTION 323116

SECTION 323120 - ARCHITECTURAL METAL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Architectural aluminum panels.

B. Related Requirements:

1. Section 051200 "Structural Steel" for Structural Steel Floodwall.
2. Section 099113 “Exterior Painting” for structural steel priming and painting.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For architectural panels.

1. Include plans, elevations, sections, gate locations, post spacing, mounting and attachment details.

C. Samples: For each fence material and for each color specified.

1. Provide Samples 12 inches in length for linear materials.
2. Provide Samples 36 inches square for architectural panel including architectural pattern for verification of pattern, finish and workmanship.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Include three full-size single panels, including attachment hardware mounted to structural steel wall and complying with requirements. Mock up to reflect conditions along West Street.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Wind Loading:

1. Comply with applicable Building Code and Regulations.

2.2 ARCHITECTURAL ALUMINUM PANELS

A. Architectural Aluminum Panels: Panels made from aluminum plate.

B. Architectural Panels: Aluminum plate, type 6061, 1/4 inch thick.

C. Architectural pattern: 'Stix' by ANOVA Furnishings. Panels to have 1.5" solid continuous border with pattern inset.
1. Pattern to be designed for largest panel and centered, then trimmed from the sides or bottom as necessary to accommodate smaller panels. No stretching of the pattern.
2. No openings that pass a 4" sphere authorized.

D. Fasteners: Stainless steel, tamperproof, with neoprene washers and sleeves to prevent galvanic action.

E. Fabrication: Custom panel patterns may be produced by laser-cutting, water jet or CNC.

1. Edges shall be smooth without sharp edges, burs or creases.

F. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.

2.3 ALUMINUM

A. Aluminum, General: Provide alloys and tempers with not less than the strength and durability properties of alloy and temper designated in paragraphs below for each aluminum form required.

B. Plate and Sheet: ASTM B 209, Alloy 6061-T6.'

2.4 STEEL AND IRON

A. Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.5 COATING MATERIALS

A. Epoxy Zinc-Rich Primer for Uncoated Steel: See Section 099113 “Exterior Painting”.

B. Anti-Graffiti Coating for Architectural Panels: Clear protective coating that provides a barrier between the applied to surface and graffiti.

1. Product: Anti-Graffiti Coat as manufactured by Coval Molecular Coatings, Burleson, TX (817) 233-6926.

2.6 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for strength and compatibility in fabricated items.

B. Neoprene-backed washers and sleeves.

1. For separating dissimilar metals to prevent galvanic actions. See Drawings.

a. Stainless steel neoprene-backed washers.
b. Neoprene sleeves.
c. Nylon sleeves and washers.

C. Surface Cleaner for Anti-Graffiti Coating system: Surface cleaner applied prior to application of anti-graffiti coating.

1. Product: Step #1 Cleaner for Painted Surfaces as manufactured by Coval Molecular Coatings, Burleson, TX (817) 233-6926.

D. Sealant

1. Silicone, single component, nonsag, 50% expansion capable, in contact with anodized aluminum and painted metal.
2. Type S, Grade NS, Class 50, Use: A, O.
3. Color- clear.

2.7 ALUMINUM FINISHES

A. Class 1 clear architectural anodization- A41 per AAMA 611-98.

2.8 STEEL FINISHES

A. Shop-Painted Finish: Comply with Section 099113 "Exterior Painting."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.

B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Mark locations of panel lines and corresponding bracket mounting hardware locations.

3.3 ARCHITECTURAL PANEL INSTALLATION

A. Install panels by mounting as indicated and fastening infill panels to floodwall panels as shown on the Drawings.

END OF SECTION 323119

SECTION 329113 - SOIL PREPARATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes planting soils including layered soil assemblies specified by composition of the mixes based on existing soils AND the reinstallation of the existing soils to be salvaged and amended prior to reinstallation. The intent of this work is to use all soils on site with required amendments based on existing soil samples to be provided by the contractor. Should additional quantities of soil be required testing requirement are herein. Prior to beginning any work existing soils shall be tested and tests submitted to the landscape architect

B. Related Requirements:
   1. Section 311000 "Site Clearing"
   2. Section 329300 "Plants"

1.3 UNIT PRICES

A. Work of this Section is affected by unit prices specified in Section 012300 "Alternates & Unit Prices".

1.4 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Compaction: Compaction of the soil fabric is any force applied to the soil that reduces porosity and where 90 percent of all compaction can be accomplished with only three application of force under optimum soil moisture conditions.

C. Dry Soil: The condition of the soil at or below the wilting point of plant available water in which the soil is subject to blowing.

D. Finish Grade: Elevation of finished surface of planting soil.

E. Frozen Soil: The point at which the soil water has frozen and the soil has become very hard and cloddy. Ice crystals can be seen in the pore spaces of the soil.

F. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

G. Moist Soil: the condition of the soil in where it can be formed into a ball and maintain its shape. Deformation of the soil is difficult with hand pressure. Free water is not visible and is usually considered the point between the wilting point and filed capacity of the soil.

H. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

I. Planting Area: Areas to be planted.

J. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

K. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

L. Saturated: All the pore space within a soil is filled with water and the remaining water is under gravitational forces to drain through the profile.

M. Scarification: The loosening of the surface of a soil lifts by mechanical or manual means to alleviate compaction of the soil surface. Depth of scarification is dependent on material and extent of compaction.

N. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

O. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

P. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

Q. Wet Soils: Soil that is considered wet will easily be deformed by hand pressure, maintain their shape and free water will be visible within the pore spaces. The water content at this soil condition is considered field capacity or wetter.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: The contractor shall examine previous work, related work and conditions under which this work is to be performed and shall notify the Landscape Architects in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means the contractor accepts substrates, pervious work and conditions. The Contractor shall not place any planting soil until all work in adjacent areas is complete and approved by the Landscape Architect.

1.6 ACTION SUBMITTALS

A. Product Data: Submit technical descriptive data for each manufactured or packaged product of this Section. Include manufacturer's product testing and analysis and installation instructions for manufactured or processed items and materials.

B. Locations: Submit locations of material sources. Submit location of mixing sites.
   1. Soil Mix supplier shall have a minimum of five years experience in supplying custom planting soil mixes.
   2. Submit supplier name, address, telephone and fax numbers and contract name.
   3. Submit certification that accepted supplier is able to provide sufficient quantities of materials and mixes for the entire project.
   4. Landscape Architect shall have the right to reject any soil supplier.

C. Test Reports – Soil Analysis: The Contractor shall submit representative samples of all soil materials and organic material components which are intended to be used for planting soil mixes and final mixes, to a Soil and Plant Testing Laboratory listed here. All reports shall be sent to the Landscape Architect for approval. Samples of all soil materials to be brought to the site must be approved before delivery. Deficiencies in the soils shall be corrected organically (peatmoss is not acceptable) by the Contractor, as directed by the Landscape Architect after review of the testing agency report. Testing reports shall include the following:

   1. Date issued.
   2. Project Title and names of Contractor and material supplier.
   3. Testing laboratory name, address and telephone number, and name(s), as applicable, of each field and laboratory inspector.
   4. Date, place, and time of sampling or test, with record of temperature and weather conditions.
   5. Location of material source both on and off site.
   6. Type(s) of test.
   7. Results of tests including identification of deviations from acceptable ranges.
   8. Particle size analysis to include sand sieve analysis shall be performed and compared to the USDA Soil Classification System per ASTM D422 (hydrometer test) or ASTM F1632 (pipette test). The silt and clay content shall be determined on soil passing the #270 sieve and shall be reported separately.
   9. Percent of organic shall be determined by an Ash Burn Test or Walkley/Black Test, ASTM F1647.
   10. Saturated hydraulic conductivity per any of the test methods stated in ASTM F1815.
   11. Chemical analysis shall be undertaken for Nitrate, Ammonium, Nitrite, Phosphorous, Potassium, Calcium, Magnesium, Iron, Manganese, Zinc, Copper, Soluble Salts, Cation Exchange Capacity, and acidity (pH).
   12. Soil analysis tests shall show recommendations for soil additives, including organic and inorganic soil amendments, necessary to accomplish particular planting objectives noted.

13. All tests shall be performed in accordance with the current standards of the Association of Official Agriculture Chemists.

14. Certified reports on analysis from producers of composted organic materials are required, particularly when sources are changed. The analysis performed shall include pH, density, salinity, total organic nitrogen, C:N Ratio, Solvita Maturity Index, moisture, sodium, potassium, calcium, magnesium, and phosphorous.

15. Soil Components and Soil Mix Sampling requirements: At middle height of wind row/pile, remove sample two feet into the pile. Place sample in clean container. Repeat gathering methods for five to ten times at equidistant spacing on both sides of the pile. Mix gathered samples with clean utensils. Remove approximately 500g of composite samples and place that final sample by overnight courier to the testing laboratory. Submit sample with completed testing laboratory submission form.

16. Biological Tests for organisms in compost and mixes:
    a. Contact the testing laboratory to review testing and sampling requirements before sending samples.
    b. Sampling requirements: At middle height of wind row, remove sample two feet into the pile. Place sample in clean container. Repeat gathering methods for five to ten times at equidistant spacing on both sides of the compost pile. Mix gathered samples with clean utensils. Remove approximately 500g of composite samples and place that final sample by overnight courier to the testing laboratory. Submit sample with completed testing laboratory submission form.
    c. Maintain clear and concise records for testing and sampling procedures.

17. Testing Agencies: The following firms are acceptable testing agencies for the various components.
    a. Compost testing:
        a. Woods End Research Laboratory, PO Box 297, Mt. Vernon, ME 04352, phone 800-451-0337, fax 207-293-2488.
    b. Physical soil analysis including particle size analysis and hydraulic conductivity
        a. A. McNitt & SerenSoil Testing, 1338 Deerfield Drive, State College, PA 16803 phone 610-360-5985
    c. Nutrient analysis:
        a. Penn State Extension, Agricultural Analytical services Laboratory, 111 Ag Analytical Svcs Lab, University Park, PA 16802 phone 814-863-0841
    d. Compost/Biological Testing:
        a. Soil Foodweb New York, 17 Clinton Street, Center Moriches, NY 11934, tel. 631-750-1553, fax 631-750-1554.

D. All approved samples to be submitted to Landscape Architect:

1. Leaf mold, each source, 5 lb. packaged.
2. Sand, each source, 5 lb. packaged.
3. Loam, each source, 5 lb. packaged.
4. Base component material, each source, 5 lb. packaged.
5. Yard Waste Compost, each source, 5 lb. packaged.
6. Each mix type specified 5 lb. packaged.

E. Statement(s) of Qualifications: Submit within 45 days of notice to proceed to confirm qualifications as specified herein.

F. Equipment Data: Submit descriptive information with wheel load data for each proposed item of equipment to be used for execution of earthwork of this Contract. Equipment Data will be evaluated for conformance to site restriction of use.

G. Schedule and Protection Plan: Submit a detailed plan for scheduling and sequencing of all contract work and for protection of soil mixes and other completed work including coordination with contractors requiring access through the site. Indicate with schedules and plans the utilization of finished work protection measures (wooden protection boards or other approved methods) over the work area of construction operations concurrent with all construction operations until substantial completion.

H. Schedule for performing percolation tests.

1.7 QUALITY ASSURANCE

A. Agricultural Chemist/Soil Scientist: Experienced person or persons employed by public or private soils testing laboratory, qualified and capable of performing tests, making soil recommendations, and issuing reports as specified. The Testing Laboratory shall be as approved by the Battery Park City Parks Conservancy.
   1. Preapproved supplier:
      a. The Dirt Company, Alan Marolf 917-524-5054

B. References:
   1. Association of Official Agricultural Chemists.
   2. American Society for Testing and Materials (ASTM) using test criteria as specified or required by other references.
   3. Soil Science Society of America, Methods of Soil Analysis.

1.8 TESTING REQUIREMENTS

A. General: Perform all tests on components and soil blends according to requirements in this article.

   1. Soil, leaf mold, mulch and other material testing and soil mix testing required in this Section or additionally required by the landscape architect or Battery Park City Parks Conservancy, shall be furnished and paid for by Contractor.

   2. Landscape Architect reserves the right to take and analyze at any time such additional samples of materials as deemed necessary for verification of conformance to specification requirements. Contractor shall furnish samples for this purpose upon request and shall perform testing as requested.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.

B. Soil or amendment materials stored on site temporarily in stockpiles prior to placement shall be protected from intrusion of contaminants and erosion. All temporary storage means and methods shall be approved by Landscape Architect.

C. Store and handle packaged materials in strict compliance with manufacturer's instructions and recommendations. Protect all materials from weather, damage, injury and theft.

D. In addition, the following provision is established: Material should not be handled or hauled, placed or compacted when it is wet as after a heavy rainfall or is frozen. Soil should be handled only when the moisture content is less than the point where maximum compaction will occur (as defined by Landscape Architect).

E. After mixing, soil materials shall be covered with a tarpaulin until time of actual use and protected from contamination or erosion.

F. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Do not amend or blend soil mixes, move or handle materials when they are wet or frozen.
4. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General- Salvaged Planting Soils

1. Existing Planting Soils shall be removed, labeled and maintained off site during construction. Prior to reinstallation, and as early as weather permits, soils shall be tested for organic content and quantitative biological testing for 5-7% organic content. If these soils do not meet that criterion they shall be amended with the specified organic matter resulting in a 5-7% organic content. In addition, they shall be tested for quantitative biological as specified herein.

B. General – Newly Blended Soils-for augmentation of existing soils

1. Newly blended soil quantities to be determined by quantities calculated during removal with appropriate "fluff" factor.
2. All soil mix material shall fulfill the requirements for new soil mixes as specified.
3. Samples of individual components of soil mixes and also blended soil mixes shall be submitted by the Contractor for testing and analysis to the approved testing laboratory. Include verification testing of on-site sub soils. Comply with specific materials requirements specified.

a. No base component or soil components for soil mixes shall be used until certified test reports by an approved agricultural chemist have been received and approved by the Landscape Architect.

b. As necessary, make any and all soil mix amendments and resubmit tests reports indicating amendments until approved.

4. The Landscape Architect, Construction Manager or Owner may request additional testing by Contractor for confirmation of mix quality and/or soil mix amendments at any time until completion.

5. Base Component Material shall be sand that meets the requirements outlined below mixed by volume with loam material that meets the requirements outlined below. Base component materials can be site salvaged and or off-site borrow material.

6. Test Base Component Materials, both individual components and mixed materials, for compliance with material specifications. These test criteria and results, when approved, shall establish the standard to which all subsequent Base Component Material tests must conform.

7. Prior to mixing Base Component Material with organic matter (leaf mold or yard waste compost), have one (1) composite sample tested from each 50 c.y. of material intended for use in soil mixes of planting work.

8. Test sand and loam components individually as components and together to form the Base Component mixed materials, for compliance with material specifications. These test criteria and results, when approved, shall establish the standard to which all subsequent Base Component Material tests must conform.

9. Organic matter (leaf mold or yard waste compost) shall be tested prior to mixing Base Component Material with organic matter. Have one (1) composite organic matter sample tested from each 50 c.y. of material intended for use in soil mixes of planting work.

C. Sand for Base Component Material shall meet the following requirements:

1. Texture:

Sand Fraction	Size (mm)	Sieve Size	% Passing
Gravel	> 2.0	#10	95 – 100%
Very coarse sand	1.0 – 2.0	#18	90 – 100%
Coarse sand	0.5 – 1.0	#35	65 – 75%
Medium sand	0.25 – 0.5	#60	15 – 20%
Fine sand	0.1 – 0.25	#140	0 – 4%
Very fine sand	0.05 – 0.1	#270	0 – 2%

2. Chemical Analysis:
   1) Soil reaction (pH) - 5.0 – 6.5 ± 0.5
   2) Soluble salt content (Conductivity) - < 1.5 dSm^{-1}

3. Material shall have a saturated hydraulic conductivity rate of no less than 30 inches per hour, per ASTM 1815.

D. Loam for Base Component Material shall meet the following requirements:

1. Soil Texture per ASTM D422 or ASTM F1632, as determined on material passing a 2 mm screen:

Main Fractions	Size (mm)	Percent
Sand	0.05-2.0	83 - 87
Silt	0.002-0.05	7 - 10
Clay	<0.002	4 – 8

In addition, maximum size shall be ½", the total gravel (> 2 mm) shall be less than 10% of the total material, and the sand passing the 2 mm screen shall have the following particle size distribution:

Sand Fraction	Size (mm)	Sieve Size	% Passing
Very coarse	1.0 – 2.0	#18	87-90
Coarse	0.5 – 1.0	#35	65-71
Medium	0.25 – 0.5	#60	34-42
Fine	0.10 – 0.25	#140	17-23
Very fine	0.05 – 0.10	#270	14-18

2. Chemical Analysis:
   1) Organic matter content (%) oven dry weight of soil shall be within the range of 4 to 10%.
   2) Soil reaction (pH) - 6.0 ± 0.5
   3) Soluble salt content (Conductivity) - < 1.5 dSm^{-1}

E. Before base sand-loam mix (base component) is used for mixing with organic amendments, handle and pile the mix in the following manner:
   a. Mix the base sand with base loam in a ratio of 3 parts sand to 1 part loam. Adjustments to the ratio may have to be made to meet the specifications for the base component. Homogenize to make a uniform mix, free of subsoil lenses and other irregularities.
   b. Aerate the base component to make a friable planting medium.
   c. Screen out all clay lumps, stones, roots, and other debris.

These proportions are approximate and may need to be adjusted to meet specifications.

1. Base Component Mix: The final mix of sand and loam materials shall substantially conform to the following:

   a. Soil Texture per ASTM D422 or ASTM F1632, as determined on material passing a 2 mm screen:

Main Fractions	Size (mm)	Percent
Sand	0.05-2.0	95.0
Silt	0.002-0.05	3.0
Clay	<0.002	2.0

In addition, maximum size shall be ½", the total gravel (> 2 mm) shall be less than 5% of the total material, and the sand passing the 2 mm screen shall have the following particle size distribution:

Sand Fraction	Size (mm)	Sieve Size	% Passing
Very coarse sand	1.00	#18	92-95
Coarse sand	0.50	#35	67-73
Medium sand	0.25	#60	20-26
Fine sand	0.10	#140	5-9
Very fine sand	0.05	#270	5

B. Organic Matter: Organic matter for amending planting media shall be a stable, material produced from the aerobic decomposition and curing of yard wastes. The compost shall meet the following criteria:
   1) Organic matter content of no less than 40% as determined by ASTM 2974
   2) Moisture content of 35 to 70% as determined by ASTM D2974.
   3) Carbon to nitrogen ratio of 15:1 to 30:1
   4) Soluble salts not exceeding 4 dSm-1
   5) Solvita Maturity Index 6 to 8
   6) 95 – 100% passing a 3/8" screen
   7) pH 6 to 7.5
   8) Biological Organisms: The compost shall have the following levels of organisms (direct microscopy).
      · 15 to 25 or more µg active bacteria /g dry weight (dw) compost
      · 100 µg (fungal compost) to 300 or more µg (bacterial compost) total bacteria /g dw compost
      · 15 to 25 µg or more active fungi /g dw compost
      · 100 to 300 µg total fungal biomass /g dw compost
      · 10,000 or more flagellates
      · 10,000 or more amoebae
      · 50 - 100 ciliates.
      · 20 – 30 Total nematodes (No root feeding nematodes)

C. Nutrient cycling capacity will be a minimum of 200 lbs/available nitrogen per acre due to microbial presence and activity.
   Nutrient Analysis:
      1. Ammonium (NH4) and Nitrate (NO3): below 100 ppm
      2. Phosphorous
      3. Potassium
      4. Calcium (CA), Magnesium (Mg): ratio of 7 part Ca to 1 part Mg
      5. Iron (Fe) 1 to 4 ppm
      6. Manganese (Mn) 3 to 20 ppm
      7. Zinc (Zn) 0.1 to 70 ppm
      8. Copper (Cu) 0.3 to 8 ppm

D. Chemical Analysis:
   1. Organic matter content (%) oven dry weight of soil: 1- 4%
   2. Soil reaction (pH): 6 - 7
   3. Soluble salt content (Conductivity) - < 1.5 dSm^{-1}

E. Saturated hydraulic conductivity of no less than 15 inches per hour per ASTM 1815.

2.2 PLANTING SOILS MIXES

A. Adequate quantities of mixed planting soil materials shall be provided to attain, after compaction and natural settlement, all design finish grades.

B. Uniformly mix ingredients using a mechanical soil blender designed for such purpose as specified for each Mix Type (Base Component Material, compost, and other ingredients deemed to be necessary as a result of testing). Wind rowing/tilling on an approved hard surface area may also be used as an alternative. Organic matter shall be maintained moist, not wet during mixing.

1. Mixing of Amendments: Add organic amendment in proportions as specified and as confirmed by testing. Other amendments shall not be added unless approved to extent and quantity by Battery Park City Parks Conservancy and additional tests have been conducted to verify type and quantity of amendment is acceptable.

C. Testing of Mixes:

1. Perform initial tests to confirm compliance with base material and mix specifications. These test results, when approved, will establish the standard to which all other test results must conform.

2. Follow-up Testing: Have one (1) composite sample delivery and upon arrival to the site from each 10 c.y. or as required by the Landscape Architect for use in each type plant mix to include the following:

a. Particle size analysis: Use sieve sizes as specified for Base Component Material.

b. Organic matter content as per mix specified.

c. Nutrient Analysis:

1) Have nutrient levels (pH, ammonium nitrogen, nitrate nitrogen, nitrite nitrogen, phosphorus, potassium, magnesium, calcium, magnesium, zinc, iron, copper, and manganese) tested, and request testing laboratory recommendations for additional fertilizer requirements at all plant areas if nutrient levels are below average. Soluble salts shall also be tested.

2) Contractor shall not use amendments to correct nutrient deficiencies.

d. Biological Organisms: The mixes shall have a minimum of the following levels of organisms (direct microscopy). Natural nutrient cycling will be a minimum of 150 lbs per acre, available Nitrogen from microbial activity. Mix shall have microbiological populations as listed below. Acceptance or rejection of mixes based on these test values will be determined by the Landscape Architect.

Plant Material	Active Bacterial Biomass (ug/g)	Total Bacterial Biomass (ug/g)	Active Fungal Biomass (ug/g)	Total Fungal Biomass (ug/g)	Hyphal Diameter (ug/g)	Protozoa Numbers/g Flagellates	Ciliates	Amoebae	Total Beneficial Nematode Numbers (#/g)
Deciduous Trees and Shrubs	40-60	400-800	30-45	400-900	3.0	10,000	10,000	50-100	20-30

PART 3 - EXECUTION

3.1 GENERAL

A. Place planting soil according to requirements in other Specification Sections.

B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil. If contamination by foreign or deleterious material or liquid is present in soil, remove the soil and contamination as directed by Landscape Architect and replace with new planting soil to the extend directed by the Landscape Architect or BPCPC.

C. Proceed with placement only after unsatisfactory conditions have been corrected.

3.2 PLACING MANUFACTURED PLANTING SOIL OVER EXPOSED SUBGRADE

A. General: When placing either the Salvaged Planting Soils or the Newly Blended Supplemental Soils DO NOT apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet

B. Salvaged Planting Soils: Prior to placing Salvaged Planting Soils test for organic matter and quantitative biological as stated here in. The top 8" of Salvaged Planting Soils shall be amended as per these test results and placed after scarifying the installed Salvaged Planting Soils

C. Newly Blended Soils: Apply manufactured soil on-site in its final, blended condition.

D. New Blended Soils Application: Place planting soil layers in the depths needed to total depth not less than required to meet finish grades after natural settlement. Do not handle, spread soil or subgrade if frozen, muddy, or excessively wet.

1. Lifts: Apply planting soil in lifts not exceeding 6 inches.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Perform the following tests and inspections:

1. Compaction: Test planting-soil compaction after placing each soil profile using a densitometer or soil-compaction meter calibrated to a reference test value based on laboratory testing according to ASTM D 698. Space tests at no less than one for each planter and three total at the street tree pits of in-place soil or part thereof.
2. Insitu Verification Testing: Contractor shall provide biological, pH, organic and soil texture test reports from labs used for approval of mixes for every 500 square feet of planter and 1 test for the tree pits.

1. Soil will be considered defective if it does not pass tests.

E. Label each sample and test report with the date, location keyed to a site plan or other location system, visible conditions when and where sample was taken, and sampling depth.

3.4 PROTECTION

A. Protection Zone: Protection Zones for the installation of salvaged soils and the specified blended soils of this specification are indicated on the drawings.

B. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:

Storage of construction materials, debris, or excavated material.
Parking vehicles or equipment.
Vehicle traffic.
Foot traffic.
Erection of sheds or structures.
Impoundment of water.
Excavation or other digging unless otherwise indicated.

C. If planting soil or subgrade is over compacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by Landscape Architect and replace contaminated planting soil with new planting soil.

3.5 CLEANING

A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.

B. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.

C. Dispose of excess subsoil and unsuitable materials on-site where directed by Owner.

END OF SECTION

SECTION 329300 - PLANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Trees
2. Shrubs
3. Goundcovers, Perennial, Herbaceous Plants and Vines
4. Mulch, fertilizer and other soil amendment applications to suit plant type during and after planting.
5. Protecting completed work.
6. Warranty
7. Coordination with other trades
8. Clean up

B. Related Requirements:
1. Section 311000 Site Clearing – for salvaged planting soil to be reused
2. Section 329113 Soil Preparation

1.3 UNIT PRICES

A. Work of this Section is affected by unit prices specified in Section 012300 “Alternates & Unit Prices."

B. Unit prices apply to authorized work covered by quantity allowances.

C. Unit prices apply to additions to and deletions from the Work as authorized by Change Orders.

1.4 REFERENCES

A. ANLA: American Nursery and Landscape Association (Formerly: AAN-American Association of Nurserymen)

B. ANSI: American National Standards Institute

C. AOAC: Association of Official Agricultural Chemists

D. ASTM: American Society for Testing Materials.

1.5 APPLICABLE STANDARDS

A. The references listed herein shall be in the standards used for performance of the Work: All standards shall include the latest additions and amendments as of the date of advertisement for bids.
   1. American National Standards for Tree Care Operations, ANSI A300. American National Standards Institute, 11 West 42nd Street New York, NY 10036.
   2. American Standard for Nursery Stock, ANSI Z60.1 American Nursery and Landscape Associating, 1250 Eye Street NW Suite 500 Washington DC 20005
   3. Horticultural Standards, American Nursery & Landscape Association.
   4. Hortus Third, The Staff of the L.H.Bailey Hortorium. 1976. MacMillan Publishing Co, New York
   5. Standardized Plant Names, American Joint Committee on Horticultural Nomenclature, 1942 edition
   6. American Society for Testing Material (ASTM)
   7. International Society of Arboriculture.

1.6 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with a ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.

C. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

D. Finish Grade: Elevation of finished surface of planting soil.

E. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.

F. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

G. Planting Area: Areas to be planted.

H. Planting Soil for Soil Profiles: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

I. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

J. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.7 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1.

1.8 ACTION SUBMITTALS

A. Submittals shall conform to Section 013300-Shop Drawings, Product Data and Samples

B. Product Data: For each type of product.

1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
2. Plant Photographs: Include color photographs in **digital** format of each required species and size of plant material as it will be furnished to Project. These photos shall be submitted a minimum of 10 workings days prior to the tagging trip they are to be tagged. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 15 plants are required, include a minimum of three photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.

C. Samples for Verification: For each of the following:

1. Shrubs: Landscape Architect and BPCPC will accompany landscape contractor for tagging all plant material.
2. Milled Leaf Mulch: 1-quart (1-L) volume in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.

1.9 INFORMATIONAL SUBMITTALS

A. Qualification Data: For landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.

B. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following. Submit inspection certificates required by authorities having jurisdiction. Supply Certificates of Compliance for all materials required for fabrication and installation, certifying that each material item complies with, or exceed, specified requirements

1. Manufacturer's certified analysis of standard products including but not limited to:
   a. Soil amendments
   b. Mulch, maturity certification

2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

C. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

D. Sample Warranty: For special warranty.

1.10 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before expiration of required maintenance periods.

1.11 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants. Submit resumes for Landscape Project Manager, Foreman/Site Supervisor showing the following:

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
2. Experience: Five years' experience in landscape installation.
3. Installer's Field Supervision: Require Installer to maintain an experienced English speaking, full-time supervisor on Project site when work is in progress.
4. Pesticide Applicator: State licensed, commercial.

B. Provide quality, size, genus, species, and variety of plants indicated. Provide only healthy, vigorous stock, grown in a recognized nursery acceptable to the Landscape Architect and BPCPC and free from disease, insects, eggs, larvae and other defects. Provide plants in strict compliance with the recommendations of the following:
1. ANSI Z 60.1 American Standard for Nursery Stock, latest edition.
2. American Association of Nurserymen, Horticultural standards.
3. American Joint Committee on Horticultural Nomenclature, Standardized Plant Names, 1942 edition.
4. International Society of Arboriculture.

5. Selection of plants purchased under allowances is made by Landscape Architect, who tags plants at their place of growth before they are prepared for transplanting.
6. Landscape Architect, Battery Park City Parks Conservancy staff member or Resident Engineer retains right to reject any plant at any time due to transportation damage, disease, loose rootball or lack of correct maintenance practices while plants are being maintained on site.

C. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.

1. Shrubs: Measure with branches or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container-grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip..

D. Pruning: Unless otherwise noted, pruning of plants before, during or after installation shall be prohibited except to remove dead or broken branches and limbs. Confer with Landscape Architect before any

pruning. Plants pruned without permission from the Landscape Architect are subject to rejection and replacement.

E. Inspection: The Landscape Architect will inspect plant materials at place of growth before planting for compliance with requirement for genus, species, variety, size and quality. Landscape Architect retains right to inspect plant materials further for size and condition of balls and root systems, insects, injuries, and latent defect and to reject unsatisfactory or defective material at any time during progress of work even if previously inspected and approved. Remove and replace rejected pants immediately from Project site at no change to the Owner.
   1. Selection: All plants shall be tagged in the nursery by the Landscape Architect prior to digging of plants. The Landscape Architect shall place seals on selected plant at the nursery. Seals shall remain on plants until acceptance of work.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if applicable.

B. Bulk Materials:

   1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
   2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
   3. Accompany each delivery of bulk materials with appropriate certificates.

C. Do not prune shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

D. Handle planting stock by supporting the rootball or container

E. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.

F. Apply anti-desiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.

   1. If deciduous shrubs are moved in full leaf, spray with anti-desiccant at nursery before moving and again two weeks after planting.

G. Deliver plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist. Plants shall not be stored on asphalt or any other pavement without a minimum of 3” mulch layer over pavement.
   1. Set balled stock on ground and cover ball with soil, mulch, sawdust, or other acceptable material.
   2. Do not remove container-grown stock from containers before time of planting.

3. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

1.13 FIELD CONDITIONS

A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

B. Digging Season: Plants shall be delivered freshly dug. Plants dug the previous season shall not be accepted. When it is anticipated that planting will occur outside of the digging seasons, storage shall conform to the requirements of this Specification.
1. Spring Dig: Plants shall be dug as early as determined by nursery owner and no later than bud break.

C. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.
Trees and Shrubs

	Spring Season	Fall Season
Perennials and Grasses	April 30 to June 15	Sept. 15 to Nov 1
Deciduous (container)	March 15 to June 15	Sept. 15 to Nov1
Deciduous (Balled and burlapped)	March 15 to June 15	Sept. 15 to Nov1

D. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

1.14 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period. Provide written warranty agreeing to remove and replace work that exhibits defect in materials or workmanship for the specified periods. “Defects” is defined to include, but is not limited to death, unsatisfactory growth, disease, insect infestation, abnormal foliage density, abnormal size abnormal color failure to thrive and other unsatisfactory characteristics.

1. Failures include, but are not limited to, the following:

   a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner.
   b. Structural failures including plantings falling or blowing over.
   c. Faulty performance of tree stabilization and tree grates

2. Warranty Periods: From date of Substantial Completion.

   a. Trees: 12 months.

b. Shrubs: 12 months.
c. Ground Covers, Perennials, Ornamental Grasses and Other Plants: 12 months.

3. Include the following remedial actions as a minimum:

a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
c. A limit of one replacement of each plant is required except for losses or replacements due to failure to comply with requirements.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL-GENERAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Planting Schedule indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
1. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.

B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Landscape Architect, with a proportionate increase in size of roots or balls.

C. Hardiness: Provide plant stock certified to have been grown within hardiness Zones 2 through 6 as established by the Arnold Arboretum, Jamaica Plan Massachusetts. Plants without this certification will be rejected.

D. Root-Ball Depth: Furnish shrubs with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

E. Root-Ball Handling: All plants balled and burlapped shall be moved with the root systems as solid units with balls of earth firmly wrapped with untreated biodegradable eight-ounce burlap. Firmly held in place by stout cord and drum lacing. The diameter and depth of the rootballs of earth must be sufficient to encompass the fibrous ad root feeding system necessary for the healthy development of the plant. NO plant shall be accepted with the ball of earth surrounding its roots has been badly cracked or broken preparatory to or during the process of planting or after the burlap, stave, ropes or platform required connection with its transplanting have been removed. The plants and balls shall remain intact during all operations. Burlap for containing rootballs shall be untreated, made from biodegradable natural fibers. Inspect root crown for girdling roots. Plants with girdling roots will be rejected.
1. Root flare of all plants shall be clearly visible prior to planting. Carefully avoid damage to roots while removing soil overburden from the rootball. Adventitious roots shall be removed with sharp pruners.
a. Root flares more than 2” below grade at source shall be cause for rejection. The Landscape Architect may request a larger diameter rootball to compensate for a buried root

flare, as the soil overburden shall be removed prior to planting which effectively reduces the size of the root ball. This will be at no additional cost to the Owner.

F. Container Stock: Container stock shall have a full container of well-developed root system. Plants loose in the container are not acceptable. The surface of the root zone shall be free of circling or kinked roots. When removed from the container, the rootball shall be free from numerous circling roots. Large matted roots at the side or bottom of the container will not be accepted. Container grown plants may be accepted for balled and burlapped material if approved by Landscape Architect.

G. Labeling: Label each plant of each variety, and size, with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant.

H. Select stock for uniform height and spread, and number the labels to assure symmetry in planting.

I. Handling of Plants: Plants delivered by truck and plants requiring overnight storage on site shall be properly wrapped and covered to prevent wind-drying and desiccation of branches, leaves and buds; plant balls shall be firmly bound, unbroken, reasonably moist to indicate watering prior to delivery and during storage, and tree trunks shall be free from fresh scare and damage in handling.

2.2 MULCH

A. Milled Leaf Mulch: Provide partially decomposed, minimum six-month-aged, finely shredded leaf mulch that is free of weeds, excessive fine particles and stringy material. Provide leaf mulch approved by Landscape Architect.

2.3 MISCELLANEOUS PRODUCTS

A. Anti-desiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

B. Burlap: Untreated biodegradable eight-ounce burlap.

C. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance and covered completely to be protected from the wind.
3. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
4. Uniformly moisten excessively dry soil that is not workable or which is dusty.

B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Landscape Architect and replace with new planting soil to the extend directed by the Landscape Architect or BPCPC.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Preinstallation Examination Required: The contractor shall examine previous work, related work and conditions under which this work is to be performed and notify Landscape Architect in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means contractor accepts substrates, previous work and conditions. The contractor shall not place any plants or planting soil mixtures until all work in adjacent areas is complete and accepted by the Landscape Architect.

D. Planting Soil Mixture Preparation: Refer to Section 311000 Site Clearing for salvaged and maintaining Planting Soil Section 329113 and Soil Preparation-for Planting Soil to makeup volumes lost during storage

E. General: Prepare planting area for soil placement and mix planting soil according to Section 329113 Soil Preparation.

F. Placing Planting Soil: according to Section 329113 Soil Preparation.

G. Lay out individual shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Landscape Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.

H. Mark herbaceous groupings as shown on Planting Plans for approval of Landscape Architect and BPCPC. Final layout of all herbaceous plants will be as per the design Landscape Architect and BPCPC. Contractor shall understand groupings on the Planting Plans may change as per field conditions. No additional cost to the Owner will be allowed for these adjustments.

I. Application of Mycorrhizal Fungi: At time directed by Landscape Architect, broadcast dry product uniformly over prepared soil at application rate as indicated by biological test results performed as per Section 329113 Soil Preparation.

3.3 PLANTING

A. Roots: Do not plant if roots are girdling. Landscape Architect, BPCPC or Resident Engineer retains the right to reject all plants with this condition.

B. Balled and Burlapped Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.
   1. Remove all burlap prior to backfilling pits.
   2. Backfill: Planting soil as per drawings.
   3. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap and rope from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
   4. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
   5. Continue backfilling process. Water again after placing and tamping final layer of soil.

C. Container-Grown Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.

   1. Backfill: Planting soil
   2. Carefully remove root ball from container without damaging root ball or plant.
   3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.

D. Planting Bulbs: Plant bulbs concurrently with ground cover if season of planting permits. The design Landscape Architect and BPCPC shall approve layout of bulbs. Plant bulbs to proper depth for species, place shoots upright. Provide 1 teaspoon of Bonemeal per bulb mixed in the planting hole.

3.4 PLANTING TREES AND SHRUBS

A. Planting Bed Preparation for Shrubs: Create continuous plant bed in planters; do not place plants in pits. Plant soil mixture will be used to back fill the planters
   1. Plant Installation: All Planting Soil salvaged and marked for relocation to original location shall be placed in depths needed to meet proposed grades. Prior to planting, salvaged soils shall be tested for organic content and quantitative biology as per Section 329113 Soil Preparation.
   2. Any newly blended soils required in addition to the salvaged soils shall be placed as per Section 329113 Soil Preparation.
   3. Inspection: At time of planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

4. Staking and Layout: Stake trees and obtain Landscape Architect's acceptance of location and finish grade elevation before planting.
5. Ball Pedestals: Provide a rootball pedestal immediately beneath the ball or root mass so that tree or plant will not settle and will have the relationship to finish grade described below.
6. Obstructions: If obstruction or other conditions detrimental to healthy plant growth are encountered, notify Landscape Architect immediately and request additional instruction. At the Landscape Architect's direction and at no additional cost to Owner, plants shall be relocated to avoid the obstruction.
7. Keep excavations covered or otherwise protected when unattended by Installer's personnel.

B. Backfill Soil: Subsoil and topsoil removed from excavations may not be used as backfill soil unless otherwise indicated.

C. Obstructions: Notify Landscape Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

1. Hardpan Layer: Drill 6-inch diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.

D. Drainage: Notify Landscape Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.

E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.5 SHRUB AND VINE PRUNING

A. Remove only dead, dying, or broken branches according to standard professional horticultural and arboricultural practices Do not prune for shape.

B. Do not apply pruning paint to wounds.

3.6 GROUND COVER AND PLANT PLANTING

A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated on Drawings in even rows with triangular spacing.

B. Use planting soil as indicated on drawings for backfill.

C. Dig holes large enough to allow spreading of roots.

D. For rooted cutting plants supplied in flats, plant each in a manner that minimally disturbs the root system but to a depth not less than two nodes.

E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.7 PLANTING AREA MULCHING

A. Mulch backfilled surfaces of planting areas and other areas indicated.
   1. Organic Mulch in Planting Areas: Apply 2-inch average thickness of organic mulch over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 6 inches of trunks or stems.

3.8 PLANT MAINTENANCE

A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Of particular importance is weeding and mulching. Contractor to review project for weeding needs weekly through the maintenance period.

B. Fill in, as necessary, soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.9 PESTICIDE APPLICATION

A. Apply biological control agents according to authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with BPCPC'S operations and others in proximity to the Work. Notify BPCPC before each application is performed.

B. Pre-Emergent Herbicides (Selective and Nonselective): Apply to tree, shrub, and ground-cover areas according to manufacturer's written recommendations. Do not apply to seeded areas. Apply only with the knowledge and direction of BPCPC.

C. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations. Apply only with the knowledge and direction of BPCPC.

3.10 REPAIR AND REPLACEMENT

A. General: Repair or replace plants that are damaged by construction operations, in a manner approved by Landscape Architect and BPCPC.
   1. Protect all soils to remain during all waterproofing and pavement installations.
   2. Submit details and products to be used during all construction operations and those of proposed repairs or remediation.

3. Perform repairs within 24 hours, if approved.
4. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Landscape Architect.

B. Remove and replace plants that are more than **25** percent dead or in an unhealthy condition immediately or are damaged during construction operations that Landscape Architect determines are incapable of restoring to normal growth pattern.

1. Provide any replacements at same size and form.
2. Species of Replacement Trees: Same species being replaced

3.11 CLEANING AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

C. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

D. After installation and at the direction of the Landscape Architect remove nursery tags, nursery stakes, tie tape, and other debris from plant material, planting areas, and Project site.

E. At time of Substantial Completion, verify that watering devices are in good working order and leave them in place. Replace improperly functioning devices.

3.12 MAINTENANCE SERVICE

A. Maintenance: Provide maintenance by skilled employees of landscape installer. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:

1. Maintenance Period: 12 months after Substantial Completion

END OF SECTION 329300-PLANTS

SECTION 00 0010 - TABLE OF CONTENTS

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SECT. NO. SECTION TITLE REMARKS

DIVISION 32 EXTERIOR IMPROVEMENTS

323116 Welded Wire Fence Panels
323120 Architectural Metal Panels
329113 Soil Preparation
329300 Plants

END OF SECTION 00 0010

SECTION 015639 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for temporary site fencing.
2. Section 311000 "Site Clearing" for removing existing trees and shrubs.
3. Section 329115 “Soil Preparation” for soil backfill.

1.3 DEFINITIONS

A. Caliper: Diameter of a trunk measured by a diameter tape or the average of the smallest and largest diameters at a height 6 inches above the ground for trees up to and including 4-inch size at this height and as measured at a height of 12 inches above the ground for trees larger than 4-inch size.

B. Caliper (DBH): Diameter breast height; diameter of a trunk as measured by a diameter tape or the average of the smallest and largest diameters at a height 54 inches above the ground line for trees with caliper of 8 inches or greater as measured at a height of 12 inches above the ground.

C. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

D. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and defined by a circle concentric with each tree with a radius 12 times the tree's caliper size and with a minimum radius of 96 inches unless otherwise indicated .

E. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site. Attendees to be Landscape Architect, Architect, Engineers, Contractor and BPCA.

1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:
    a. Tree-service firm's personnel, and equipment needed to make progress and avoid delays.
    b. Arborist's responsibilities.
    c. Quality-control program.
    d. Coordination of Work and equipment movement with the locations of protection zones.
    e. Trenching by hand or with air spade within protection zones.
    f. Field quality control.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include plans, elevations, sections, and locations of protection-zone fencing and signage, showing relation of equipment-movement routes and material storage locations with protection zones.
2. Detail fabrication and assembly of protection-zone fencing and signage.
3. Indicate extent of trenching by hand or with air spade within protection zones.

C. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.

1. Species and size of tree.
2. Location on site plan. Include unique identifier for each.
3. Reason for pruning.
4. Description of pruning to be performed.
5. Description of maintenance following pruning.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For arborist and tree service firm.

B. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

C. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

D. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1. Use sufficiently detailed photographs or video recordings.

2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

E. Quality-control program.

1.7 QUALITY ASSURANCE

A. Arborist Qualifications: Certified Arborist as certified by ISA .

B. Tree Service Firm Qualifications: An experienced tree service firm with a minimum of 5 years' experience that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.

C. Quality-Control Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work without damaging trees and plantings. Include dimensioned diagrams for placement of protection zone fencing and signage, the arborist's and tree-service firm's responsibilities, instructions given to workers on the use and care of protection zones, and enforcement of requirements for protection zones.

1.8 FIELD CONDITIONS

A. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Moving or parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

B. Do not direct vehicle or equipment exhaust toward protection zones.

C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Backfill Soil: Stockpiled soil mixed with planting soil or Planting soil of suitable moisture content and granular texture for placing around tree; free of stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.

1. Planting Soil: Planting soil as specified in Section 329115 "Soil Preparation (Performance Specification)."

B. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:

1. Type: Shredded hardwood or wood and bark chip .
2. Size Range: 3 inches maximum, 1/2 inch minimum .
3. Color: Natural.

C. Protection-Zone Fencing: Fencing fixed in position and meeting one of the following requirements:

1. Chain-Link Protection-Zone Fencing: Fencing fabricated from high-density polyethylene mesh; with 2 inch by 4 inch by 8 foot long wood posts and #4 rebar post supports with other accessories for a complete fence system.
   a. Height: 72 inches .
2. Gates: Single- swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; leaf width 36 inches .

D. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering and as follows:

1. Size and Text: 18 inches by 18 inches .
2. Lettering: 3-inch high minimum, black characters on red background.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

B. Prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

A. Locate and clearly identify trees, shrubs, and other vegetation to remain . Flagor Tie a 1-inch blue vinyl tape around each tree trunk at 54 inches above the ground.

B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated. Do not exceed indicated thickness of mulch.

1. Apply 4-inch uniform thickness of organic mulch unless otherwise indicated. Do not place mulch within 6 inches of tree trunks.

3.3 PROTECTION ZONES

A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people from easily entering protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.

1. Install to comply with NYCDPR standards.
2. Posts: Set or drive posts into ground as indicated in the NYCDPR Standard Details (2018), sheet 59. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect.
3. Access Gates: Install where indicated ; adjust to operate smoothly, easily, and quietly; free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Architect. Install one sign spaced approximately every 20 feet on protection-zone fencing, but no fewer than four signs with each facing a different direction.

C. Maintain protection zones free of weeds and trash.

D. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete, and equipment has been removed from the site.

1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.4 EXCAVATION

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 312000 "Earth Moving" unless otherwise indicated.

B. Trenching within Protection Zones: Arborist to be present for a trenching activity. Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with pneumatic excavation device, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.

C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction and as required for root pruning.

D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover and wrap with burlap. Keep burlap moist at all times until roots are covered with soil. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 ROOT PRUNING

A. Prune tree roots that are affected by temporary and permanent construction. Prune roots as follows:

1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
2. Cut Ends: Do not paint cut root ends .
3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
4. Cover exposed roots with burlap, keeping burlap moist.
5. Backfill as soon as possible according to requirements in Section 312000 "Earth Moving."

B. Root Pruning at Edge of Protection Zone: Prune tree roots 6 inches inside of the protection zone by cleanly cutting all roots to the depth of the required excavation.

C. Root Pruning within Protection Zone: Clear and excavate by hand or with air spade to the depth of the required excavation to minimize damage to tree root systems. If excavating by hand, use narrow-tine spading forks to comb soil to expose roots. Cleanly cut roots as close to excavation as possible, and cover with moist burlap until covered.

3.6 CROWN PRUNING

A. Prune branches that are affected by temporary and permanent construction. Prune branches as directed by arborist.

1. Prune to remove only injured, broken, dying, or dead branches unless otherwise indicated. Do not prune for shape unless otherwise indicated.
2. Do not remove or reduce living branches to compensate for root loss caused by damaging or cutting root system.
3. Pruning Standards: Prune trees according to ANSI A260.1.

B. Unless otherwise directed by arborist and acceptable to Architect, do not cut tree leaders.

C. Cut branches with sharp pruning instruments; do not break or chop.

D. Do not paint or apply sealants to wounds.

E. Provide subsequent maintenance pruning during Contract period as recommended by arborist.

F. Chip removed branches and stockpile in areas approved by Architect or dispose of off-site.

3.7 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.

1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.

C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

D. Minor Fill within Protection Zone: Where existing grade is 3 inches or less below elevation of finish grade, fill with backfill soil. Place backfill soil in a single uncompacted layer and hand grade to required finish elevations.

3.8 FIELD QUALITY CONTROL

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.9 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner approved by Architect.

1. Submit details of proposed pruning and repairs.
2. Perform repairs of damaged trunks, branches, and roots within 24 hours according to arborist's written instructions.
3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.

B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.

1. Replace trees in accordance with NYC Local Law 3, dated 2010.
   a. Species: As selected by Architect .

2. Plant and maintain new trees as specified in Section 329300 "Plants."

C. Excess Mulch: Rake mulched area within protection zones, being careful not to injure roots. Rake to loosen and remove mulch that exceeds a 4-inch uniform thickness to remain.

D. Soil Aeration: Where directed by Architect, aerate surface soil compacted during construction. Aerate 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch- diameter holes a minimum of 12 inches deep at 24 inches o.c. Backfill holes with an equal mix of augured soil and sand.

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove excess excavated material, displaced trees, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION 015639

SECTION 021000 - GENERAL DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, conditions of the Contract (including General, Supplementary, and Special Conditions), Division 01 Specification Sections and all other Contract Documents apply to work of this Section.

1.2 SUMMARY

A. Section Includes

1. The Contractor shall furnish all tools, equipment, materials, and supplies and shall perform all labor as required for the demolition, salvage, relocation, and removal of electrical and mechanical equipment, structures, bulkhead and facilities as indicated on the Contract Drawings and as specified herein.
2. The Work of this Section shall include, but shall not be limited to, the following items:

    a. Demolition of asphalt pavement, concrete, and other features as required to install new pavements, utilities, equipment and other structures (such as the Steel Sheet Pile bulkhead).
    b. Demolition, salvage, relocation, and removal of existing facilities, equip-ment, structures, pads and utilities as indicated on the Contract Drawings.
    c. Abandonment of existing structures and facilities as specified on the Con-tract Drawings.
    d. All items shown or specified to be demolished on Contract Documents.

B. Related Requirements

1. The following is a list of Specifications which may be related to this Section:

    a. Section 312000 - Earth Moving
    b. Section 311000 - Site Clearing

1.3 DEMOLITION COORDINATION

A. The Contractor shall carefully coordinate the extent of demolition in areas where existing utilities are to be reconnected to new facilities and where existing facilities are to remain operational.

B. While work is being performed, the Contractor shall provide adequate access to all operating equipment for routine operation and maintenance. The Contractor shall erect and maintain fences, warning signs, barricades, and other devices as required for the protection of the Contractor's employees, Battery Park City Authority's personnel and the general public. The Contractor shall remove all such protection when the work is completed or as directed by the Engineer.

C. The Contractor shall coordinate all demolition and construction work with the Engineer.

1.4 SUBMITTALS

A. Submittals for items specified herein shall be submitted by the Contractor and shall be in accordance with the Contract Documents.

1. A copy of this specification section, with any addendum updates included, and all referenced and applicable sections, with any addendum updates in-cluded, shall be submitted with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identi-fied paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. The submittal shall be accompanied by a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

B. Submittals shall be provided to confirm that materials to be used comply with in-formation specified herein.

C. Demolition and equipment removal procedures shall be submitted to the Engineer for review and approval at least fourteen (14) calendar days prior to beginning work. The procedures shall provide for safe conduct of the Work, careful removal and disposition of materials and equipment, protection of facilities property which are to remain undisturbed, coordination with existing facilities to remain in ser-vice, and timely disconnection of utility services. The procedures shall include a detailed description of the methods and equipment to be used for each operation, and the sequence of operation.

D. Deactivating Existing Facilities. The Contractor shall advise the Engineer in writing not less than fourteen (14) calendar days in advance of the time of any necessary deactivation of existing facilities or equipment which are to be removed, abandoned, modified, or connected to the new work.

1.5 REPAIR OF DAMAGE

A. Any damage to remaining equipment, structures to remain, and other existing fa-cilities to remain, as caused by the Contractor's operations shall be repaired at the Contractor's expense.

B. Damaged items shall be repaired or replaced with new materials as required to re-store damaged items or surfaces to a condition equal to and matching that existing prior to damage or start of work of this Contract.

1.6 PROTECTION OF EXISTING UTILITIES AND WORK

A. Before beginning any cutting, excavation/trenching or demolition work, the Con-tractor shall carefully survey the existing work and examine the Contract Draw-ings and Specifications to determine the extent of the Work. The Contractor shall take all necessary precautions to prevent damage to existing facilities which are to remain in place and in operation.

B. The Contractor shall be responsible for any damages to existing facilities, which are caused by the operations of the Contractor. Damages to such work shall be re-paired or replaced to its existing condition at no additional cost to the Battery Park City Authority.

C. The Contractor shall carefully coordinate the Work of this Section with all other work and construction and shall provide shoring, bracing, and supports, as required.

D. The Contractor shall protect all aboveground and subsurface utilities within the limits of the demolition; in particular, removal of subsurface soils and dewatering may affect the bearing soils of nearby utility structures – these work will be coordinated with the Engineer to assess and provide input on the effect of the excavation of soils or dewatering (where warranted) and measures to protect these structures, at no additional expense to Battery Park City Authority and the Client.

E. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under any part of this Contract.

F. The Contractor shall remove all temporary protection when the Work is complete or when so authorized by the Engineer.

G. The Contractor shall carefully consider all bearing loads and capacities for place-ment of equipment and material on site. In the event of any questions as to whether an area to be loaded has adequate bearing capacity, the Contractor shall consult with the Engineer prior to the placement of such equipment or material.

1.7 BURNING

A. The use of burning at the project site for the disposal of refuse, debris, and waste materials resulting from demolition and site clearing operations will not be permit-ted.

1.8 ELECTRICAL DEMOLITION

A. All electrical demolition work shall at all times be conducted by the Contractor in a safe and proper manner to avoid injury from electrical shock to the Battery Park City Authority's personnel and Contractor's personnel.

B. Intermediate and final electrical systems shall meet the requirements of the New York City Electrical Code. Electrical equipment to be shut off for a period of time shall be tagged and locked-out. At no time shall live electrical wiring or connec-tions or those which can become energized be accessible to Contractor, Battery Park City Authority, or other personnel without suitable protection and warning signs.

PART 2 - EXECUTION

2.1 DEMOLITION

A. The Contractor shall remove the existing bulkhead after installation of the new steel sheet pile bulkhead.

B. Disposal of all materials shall be performed in compliance with all applicable local, State, and Federal codes and requirements. No trace of these structures shall remain prior to placing of backfill in the areas from which structures were removed.

C. The Contractor shall note that the Contract Drawings used in this Contract to indicate demolition are based on Contract Drawings of the existing facilities. The Contract Drawings have been included to clarify the scope of work, although the Contractor must rely on his/her own inspection to determine the true arrangement and location of items.

D. Contract Drawings identify the major equipment, utilities and structures and facilities to be demolished. Auxiliary systems such as water, auxiliary equipment, drainage, electrical wiring, controls, and instrumentation are not necessarily shown. In association with the major electrical equipment demolition, the following work shall also be performed at no additional cost to the Battery Park City Authority.

1. All exposed electrical conduits, raceways, and conductors associated with demolished or relocated equipment, devices, and instruments shall ultimately be removed. Reuse of existing exposed conduits is not acceptable except where explicitly shown on the Contract Drawings. All resulting holes in structures from any demolition activity shall be repaired.
2. Connection to existing underground conduits, demolition, and repair of surfaces shall meet all of the applicable requirements of Division 16 - Electrical.
3. All electrical supports for demolished equipment including concrete pads, baseplates, mounting bolts, instrumentation supports and brackets, and support hangers shall be removed. Any damage to the existing structure shall be repaired as specified herein.
4. The area and equipment shall be thoroughly cleaned, repaired, and touched up such that little or no evidence of the previous equipment installation remains.

E. Wiring demolition shall be performed by licensed Electricians. Before removing or cutting wiring, check to be sure that it is wiring intended to be cut or removed, and label wiring which is to remain. Labels shall be fully documented on wiring diagrams, interconnection diagrams, elementary diagrams, and conduit and wire schedules. Wire bundles shall be rolled up and placed "out of the way" to the extent practicable.

F. Where existing materials and equipment are removed or relocated, remove all materials no longer used such as studs, straps, conduits, and wires. Remove or cut off concealed or embedded conduit, boxes, or other materials and equipment to a point at least 3/4 inch below the final finished surface.

G. Asphalt and/or concrete pavement shall be removed as necessary to perform the specified work. The limits of removal shall be neatly sawcut and dust mitigation shall be performed by the Contractor.

H. When the required improvements have been constructed, new concrete and/or asphalt pavement shall be constructed as specified.

I. Where cobblestones and/or decorative pavers are present within the limits of the excavation, these items shall be removed carefully and stored at the appropriate facility where it is not degraded or compromised. These items shall be installed similar to their original condition, style and orientation.

J. Where existing pipes and electrical conduits, supports, or hangers are removed from existing structures, the Contractor shall fill all resulting holes in the structures and repair any resulting damage such that the finished rehabilitated structure shall appear as a new homogeneous unit with little or no indication of where the new and old materials join.

K. The holes, gaps and or open joints in utility vaults or structures shall be sealed or filled with non-shrink grout to be watertight and reinforced as required, or as shown on the Contract Drawings.

L. At all locations where the surface of the seal or grout will be exposed to view, the seal or non-shrink grout shall be recessed to approximately 1/2-inch back of the exposed surface and the recessed area filled with cement mortar grout.

M. Perimeter work fence and gates shall be maintained at all times to ensure security.

2.2 SALVAGED MATERIA

A. Existing materials and equipment to be salvaged shall remain the property of the Battery Park City Authority. Salvage to be reinstalled in the Work shall be refurbished as shown or specified before reinstallation.

B. Salvaged material shall be carefully removed and handled in such a manner as to avoid damage and shall be cleaned prior to their delivery.

2.3 DISPOSAL

A. The Contractor shall be responsible for the removal from the job site and disposal of all demolition refuse and debris not specifically identified for salvage by the Battery Park City Authority. In addition, the Contractor shall be responsible for disposal of all items associated with equipment to be demolished such as fuel, antifreeze, oil etc. The Contractor shall in doing so comply with all applicable laws, codes, ordinances and regulations, and shall obtain and pay for all necessary permits. Demolition materials removed from the site for legal disposal and not specifically identified for salvage by the Battery Park City Authority shall be the property of the Contractor.

END OF SECTION 021000

SECTION 031000 - CONCRETE FORMWORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide design, supply, installation and removal of forms wherever necessary to confine concrete and shape it to required dimensions. Provide special formwork or form liners for concrete with smooth or special finishes. Provide all required bracing, shoring and reshoring.

1.2 RELATED SECTIONS

A. Concrete Reinforcement.....Section 032000

B. Cast-in-Place Concrete.....Section 033000

1.3 REFERENCES

A. References and industry standards listed in this Section are applicable to the Work. Unless more stringent criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

American Concrete Institute (ACI) standards, latest editions.

1. ACI 301 Specifications for Structural Concrete for Buildings.
2. ACI 347 Guide to Formwork for Concrete.

1.4 DESIGN REQUIREMENTS

A. The design and engineering of the formwork, as well as its construction, is the responsibility of the Contractor.

B. Design formwork in accordance with ACI 347 and Section BC 1906 of the 2014 NYC Building Code.

1.5 SUBMITTALS

A. Product Data - Submit manufacturers' information for the following:

1. Overlaid plyform formwork or form liners
2. Ties, each type and where to be used
3. Form-release agent. Form-release agent to be submitted for review only.

B. Samples

Submit 12” x 12” samples of the following items:

1. Overlaid plyform formwork or form liners

C. Shop Drawings

1. Prepare and submit formwork shop drawings and calculations prepared and sealed by a Professional Engineer licensed in the State of New York for review when required by Section BC 1906.3 of the 2014 NYC Building Code.

D. Quality Control Submittals

1. Contractor Qualifications: Provide proof of Formwork Installer qualifications specified under “Quality Assurance”.

1.6 QUALITY ASSURANCE

A. Qualifications

1. Company specializing in performing the Work of this Section shall have three years minimum experience.
2. Person responsible for inspection of formwork shall be a qualified person as defined in Section BC 3302.1 of the 2014 NYC Building Code.

B. Regulatory Requirements

1. Building Code: Work of this Section shall conform to all requirements of the NYC Building Code. Where more stringent requirements than those contained in the Building Code are given in this Section and ACI 347, the requirements of this Section and ACI 347 shall govern.
2. Industrial Code Rule #23 of the Department of Labor, paragraphs 23.10.1 to 23-10.5 inclusive.
3. ACI 347.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protection

1. Protect formwork materials before, during and after installation.
2. Protect installed work and materials of other trades.

B. Replacement

1. Repair or replace damaged formwork as approved by the Owner/Developer.
2. Repair overlaid plyform formwork as per manufacturer's instructions. Replace pieces when number of manufacturer recommended reuses is up or when finish deteriorates.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Rough Formwork Shall be Commercial Douglas Fir, DFPA: 5/8" thick minimum or modular metal units.

B. Overlaid Plyform Formwork
1. Plywood with thermosetting phenolic resin or urethane coating bonded to it to provide a flat matte finish. Shall be equal to B-Matte Formguard by Simpson Timber Company.

C. Smooth Form Finish Form liner

1. Shall be equal to #340 Smooth Face by Greenstreak.
2. Nails and staples used to attach form liner to formwork are to be Type 304 stainless steel.

D. Left-in-Place Forms: Galvanized per ASTM A653, coating designation G90, and not less than 20 gage.

E. Release Agent

1. VOC compliant material such as those of the Cresset Chemical Company for coating forms. Shall be compatible with material or finish to be subsequently applied and free of deleterious effects on final surfaces. Form oils shall not contain castor oil. Release agents shall not discolor concrete where concrete is to be exposed to view.

F. Form Sealers: Shall be guaranteed by manufacturer to be non-staining and to not impair the bond of paint, waterproofing or other required surface coatings.

1. Sealer for lumber surfaces and plywood edges shall be clear polyurethane.
2. Sealer for board forms shall be penetrating, non-staining and not leave a surface coating.

G. Form Ties

1. Form ties for exposed concrete shall be adjustable.
2. Form ties for exposed concrete and concrete to receive membranes shall be a break-off type and leave no metal closer than $1^{1}/_{2}$-inch to the surface.
3. Form ties for concrete stated in 2 above shall be free of devices which leave holes or depressions larger than 7/8"-inch back of exposed surface.
4. Wire ties not permitted.
5. Ties shall have a minimum capacity of 3000 pounds.

PART 3 - EXECUTION

3.1 PREPARATION OF FORMWORK SURFACES

A. Clean all surfaces of forms and embedded items of any accumulated mortar or grout from previous concreting and other foreign material before concrete is placed in them. Clean, repair and patch reused forms as required to return them to acceptable condition. Repair or replace any formwork as required.

B. Before placing either reinforcing steel or concrete, cover the surfaces of the rough or overlaid plyform formwork (when used) with an approved form release agent that will effectively prevent absorption of moisture, prevent bond with the concrete, and which will not stain the concrete surfaces. Coat steel forms with a non-staining, rust-preventative releasing agent. Material shall be carefully applied at the amount recommended by the release agent manufacturer to obtain the desired finish. Do not apply oil or release agents on formwork for concrete to receive coatings such as membrane waterproofing, plaster, or additional concrete (such as at construction joints). Follow manufacturer's recommendations for alternatives. For the overlaid plyform formwork, release agent should be a chemically reactive agent compatible with the factory treatment. Do not allow excess form coating material to stand in puddles in the forms nor allow coating to come in contact with hardened concrete against which fresh concrete is to be placed.

3.2 CONSTRUCTION AND DETAILS

A. Contractor shall be solely responsible for the design, construction, erection, removal, safety and adequacy of all concrete formwork, falsework, shoring, reshoring and the like. Design, erect, support, brace, and maintain formwork to support vertical and lateral, static and dynamic loads that might be applied, until such loads can be supported by the concrete structure. Design formwork to be readily removable without impact, shock, or damage to cast in place concrete surfaces and adjacent materials.

B. Adequately support and substantially brace formwork to hold lines, shape, alignment, plumbness and position.

C. Formwork shall be tight jointed to prevent leakage of mortar from the concrete.

D. Place chamfer strips in the corners of forms to produce beveled edges (chamfers) on permanently exposed surfaces (such as exposed columns). Do not provide beveled edge for interior corners of such surfaces and where members are flush with partitions or walls, unless required by Drawings or specified elsewhere.

E. Set slab-forms with camber of 1/4-inch per 10 feet of span to maintain tolerances. For two way slabs the lesser span dimension shall govern.

F. Provide positive means of adjustment (wedges or jacks) for shores and struts to take up all settlement during concrete placing operations. Fasten wedges used for final adjustment of forms prior to concrete placement in position after final check. Securely brace forms against lateral deflection.

G. Provide mud sills where shores rest on compressible materials.

H. Provide temporary openings to permit cleaning and inspection. Provide ample time for proper inspection before placement of concrete.

I. Provide "Rough Form Finish" for surfaces not exposed to view. Use plywood or metal forms coated with a release agent.

J. Provide "Smooth Form Finish" for surfaces exposed to view. Use dress, square-edged lumber with form liner or overlaid plyform forms with applicable release agent. Do not exceed manufacture's recommendations for number of re-uses for the form liner or overlaid plyform. Arrange the forms or form liner in an orderly and symmetrical fashion, keeping the number of seams to a practical minimum. Items indicated as “Architectural Concrete” or Architectural Finish” shall use specially designed formwork to attain the desired finish and shall have a CS 1 surface finish as developed by the Cresset Chemical Company, or other special finish specified. Other exposed concrete shall have CS3 or better surface finish.

K. Provide openings in formwork to accommodate work of other trades. Form holes for pipes, pipe sleeves, electric outlets, electric conduits, etc. as required. Construct wood forms for wall forms to facilitate loosening, if necessary, to counteract swelling of forms.

L. Provide runways for moving equipment with struts or legs, which shall be supported directly on the formwork or structural member without resting on the reinforcing steel.

M. Provide for rebates, offsets, sinkages, keyways, moldings, blocking, bulkheads, anchorages, embeds, reglets, grooves keys, pockets, ground nailers, projections and other built-in work prior to placement of concrete. Install reglets as per manufacturer's instructions.

N. Install dovetail slots, concrete inserts, and other metal fabrications. Secure to inside forms and space as shown on Drawings.

O. At construction joints, contact surface of the form sheathing for flush surfaces exposed to view shall overlap the hardened concrete in the previous placement by not more than 1". The forms shall be held against the hardened concrete to prevent offsets or loss of mortar at the construction joint and to maintain a true surface.

P. Form accessories to be partially or wholly embedded in the concrete, such as ties and hangers, shall be of a commercially manufactured type. Use of non-fabricated wire is not permitted. Construct form ties so that the ends or end fasteners can be removed without causing appreciable spalling at the faces of the concrete. After the ends or end fasteners of the form ties have been removed, terminate the embedded portion of the ties not less than 2 diameters or twice the minimum dimension of the tie from the formed faces of concrete to be permanently exposed to view, except that in no case shall this distance be less than 3/4". When the formed face of the concrete is not to be permanently exposed to view, form ties may be cut off flush with the formed surfaces.

Q. Carefully check all forms before placement of concrete.

R. Notify the Engineer of Record if openings are required but not shown on the Drawings, who will issue instructions accordingly.

S. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only.

T. Provide form ties at spacing as required to hold formwork readily and eliminate visible deflection and building of formwork surfaces as well as safely resist all applied loads. Ties shall be coated with an approved bond breaker.

U. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

V. For concrete exposed to view locate ties in level and plumb lines in an arrangement acceptable to the architect.

W. Provide square exposed corners and edges as indicated on architectural drawings, using wood, metal, or PVC strips fabricated to produce uniform smooth lines and tight edge joints.

3.3 REMOVAL OF FORMS AND SHORING

A. Remove forms in such a manner as to assure the complete safety of the structure as required by Section BC 1906.2 of the 2014 NYC Building Code. In no case remove forms or shoring supporting the weight of concrete in beams, slabs or structural members until the members have reached the minimum compressive strength specified on the Drawings or as permitted by the Engineer of Record.

B. Contractor shall be solely responsible for proper and safe removal of forms, shoring, and removal of reshoring. Contractor shall do cost of tests and/or calculations needed to determine such techniques, timing and sequences without expense to Owner, Architect or Engineer.

C. Formwork for columns, walls, sides of beams, and other parts not supporting the weight of the concrete may be removed as soon as the concrete has hardened sufficiently to resist damage from removal operations and as required by D below. For temperatures not less than 50 deg F this shall be a minimum of 36 hours after placement. Provide effective curing and protection.

D. Unless reshoring is used, formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than the time period specified in ACI 347, paragraph 3.7.2.3 unless concrete has attained 75 percent of specified compressive strength at an earlier time. Determine compressive strength of in place concrete by testing field cured cylinders representative of concrete location or members. The Contractor shall pay the cost of such testing.

E. When repair of surface defects or finishing is required at an early age, remove forms as soon as the concrete has hardened sufficiently to resist damage from removal operations.

F. Remove top forms on sloping surfaces of concrete as soon as the concrete has attained sufficient stiffness to prevent sagging. Perform any needed repairs or treatment required on such sloping surfaces at once and follow it with the specified curing.

G. Loosen wood forms for wall openings as soon as this can be accomplished without damage

H. Contractor shall replace or repair, at Engineer's direction, any and all work damaged by improper removal or reshoring operations.

3.4 TOLERANCES

A. Construct formwork so that concrete surfaces will conform to the tolerance limits listed in ACI 117.

B. Establish and maintain in an undisturbed condition and until final completion and acceptance of the project sufficient control points and bench marks to be used for reference purposes to check tolerances.

C. Regardless of the tolerances listed, do not extend any portion of the concrete work beyond the lot or street line.

3.5 INSPECTION

A. Under the requirements of Section BC 1906 of the 2014 NYC Building Code, formwork, including shores, braces, and other supports shall be inspected by a qualified person engaged by the Contractor. The qualified person shall make inspections prior to placement of steel to verify correct sizes of members formed and subsequently periodically after placement and during placement of concrete to detect incipient problems. Maintain a record of all inspections.

B. Under the requirements of Section 1704.4 of the Building Code, the Owner/Developer will assign a Special Inspector to inspect formwork for size of members and to verify in-situ concrete strengths prior to removal of formwork and shores from beams and slabs.

C. During and after concrete placement, check elevations, camber, and vertical alignment of formwork systems using tell-tale devices.

D. Keep a record of all inspections, the name of the persons making them, and the name of the foreman in charge of formwork at the site. Submit to the Owner/Developer's representative on the site a copy of the inspection records prior to each concrete placement.

END OF SECTION -031000

SECTION 032000 - CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide and install all reinforcement, stud rails, reinforcing supports and associated items required for cast-in-place.

1.2 RELATED SECTIONS

A. Concrete Formwork.....Section 031000

B. Cast-in-Place Concrete.....Section 033000

1.3 REFERENCES

References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

A. American Society of Testing and Materials (ASTM) standards, latest editions.

A82 Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

A185 Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete Reinforcement.

A1064 Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.

A615 Standard Specifications for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

A706 Standard Specifications for Low-Alloy Steel Deformed and Plain Bars for Concrete reinforcement

A767 Standard Specifications for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement

A775 Standard Specifications for Epoxy-Coated Reinforcing Steel Bars

A780 Standard Specifications for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

B. American Concrete Institute (ACI) standards, latest editions.

ACI 301 "Specification for Structural Concrete for Buildings."

ACI Detailing Manual SP66 (Includes ACI 315 & 315R)

ACI 318-11 "Building Code Requirements for Reinforced Concrete".

C. "Placing Reinforcing Bars - CRSI-WCRSI Recommended Practices", latest edition. Concrete Reinforcing Steel Institute.

D. "Structural Welding Code - Reinforcing Steel" D1.4 - American Welding Society (AWS).

1.4 DESIGN REQUIREMENTS

A. Detailing requirements for reinforced concrete structures shall meet the structural integrity requirements as set in Section BC 1916 of the 2014 NYC Building Code.

1.5 SUBMITTALS

A. Product Data

Submit manufacturers' information for the following:

1. Steel welded wire fabric
2. Steel welded wire reinforcement.
3. Supports
4. Mechanical connectors

B. Shop Drawings

1. Submit shop drawings to the Engineer for acceptance in accordance with the requirements of the Contract Documents. Engineer shall have ten business days to review submittal packages from day after submittal arrives in Engineer's office until day that submittal is sent returned by Engineer. Submit drawings gradually and not all at the same time so that sufficient time is allowed for checking and approval.
2. At least two weeks prior to the first shop drawing submittal Contractor shall provide Engineer with a comprehensive list of all shop drawing submittals, and a schedule indicating when all submittals are to be sent to Engineer. If Contractor deviates from this schedule, Engineer shall be allowed additional time to review shop drawings
3. Shop drawings shall conform to the highest standards of the construction industry. Include enough plans, elevations, sections and details at adequate scale to completely describe all work to be provided. All detailing work shall be in accordance with ACI 315 and shall be not less complete than examples given in ACI SP 04. Improperly prepared and incomplete shop drawings will be disapproved without review.
4. Submit shop drawings to Engineer in coordinated packages so that all required information is in hand at time of review. Prior to resubmission of shop drawings, all changes from prior issue shall be clearly circled and identified. Do not fabricate before shop drawings have been reviewed and returned to Contractor marked "No Exceptions Taken" or "Make Corrections Noted" only.
5. Contractor shall coordinate and cross check for accuracy, completeness and correct relationship to the work of other sections, each shop drawing prepared for the work of this Section, including each shop drawing prepared by accepted subcontractors. Show and dimension holes required for passage of work of other sections through

cast in place concrete. Engineer's review of shop drawings does not relieve Contractor from these responsibilities.

6. Prior to sending submittals to Engineer, Contractor and Construction Manager (if applicable) shall coordinate and cross-check for accuracy and completeness each shop drawing prepared for work of this Section with the approved Construction Documents and Specifications. Shop drawings shall bear the stamp of Contractor and Construction Manager indicating that this review has been performed. Engineer will not review submittals for which Contractor and Construction Manager have not performed this review.
7. Reinforcing detail drawings shall include, but not be limited to the following:

    a. Setting plans, wall elevations, detailed bending diagrams, cutting lists and other information so as to completely demonstrate the location, spacing, size, length, bending, shape of all reinforcing steel, and position and length of all splices.
    b. The yield strength and ASTM designation of all reinforcing.
    c. All control, expansion and construction joints including keys and waterstops.
    d. Cover for reinforcing, indicated and shown on every shop drawing.
    e. Wall reinforcing detailed on wall elevations, not on plans.
    f. All openings, depressions, trenches, sleeves, embedded inserts and any other project requirements affecting reinforcing details and placing.
    g. Type, size and location of all metal and plastic accessories required for the proper assembling, placing and support of the reinforcement.
8. Reinforcing steel shop drawings must provide all information, sections, details and marks so that reinforcing steel can be easily placed without the use of any other drawings or information. Reproduction of Structural Drawings, in entirety or part, for use as shop drawing is not permitted.
9. Detail reinforcing steel for curbs, pads, trenches, openings and the like from information given in Landscape Architectural, Civil, and other Contract Documents.
10. Provide all reinforcement shown or scheduled in the Drawings, including that required by typical details and general notes, but not less than required by ACI Code minimums.
11. Detailing of reinforcement shall consider the arrangement, shape and size of individual bars, including hooks and lap splices, so as to preclude interference between bars, and embedded items and to provide clear spacing and concrete cover as required by ACI 318. Provide placing sequence information when required to properly install reinforcement in the field. Provide enough sections and enlarged details, whether they are given on Structural Drawings or not, to fully illustrate placement locations.
12. Fieldwork drawings shall be submitted for review of and acceptance for all work required to accommodate field conditions.
13. Shop drawings will be checked for size of material and spacing by the Engineer of Record, which shall not render the Engineer responsible for any errors in construction dimensions, quantities, bends, etc. that have been made in preparation of the shop drawings. The Contractor shall assume full responsibility for the correctness of quantities, dimensions and fit.

C. Quality Control Submittals

1. Certificates

a. Submit to Testing Agency and Engineer certified copies of mill test reports for all steel reinforcement, including bars, welded wire fabric, stud rails, prestressing bars and strands.

2. Contractor Qualifications**:** Provide proof of Installer and Detailer qualifications specified under “Quality Assurance”.

1.6 QUALITY ASSURANCE

A. Qualifications

1. Rebar Installer: Company specializing in performing the Work of this Section shall have three years minimum experience on successful projects of similar size and type.
2. Rebar Detailer: Company shall be specialized in the detailing of reinforcing bar shop drawings with a minimum of three years of experience on successful projects of similar size and type.

B. Regulatory Requirements

1. Building Code

Work of this section shall conform to all requirements of the NYC Building Code. Deliveries will be rejected unless:

a. All reinforcing bars are identifiable as to point of origin, grade of steel, and size.
b. All bundles or rolls of cold drawn steel wire reinforcement are securely tagged to identify the manufacturer, the grade of steel, and the size.

Where more severe requirements than those contained in the Building Code are given in this Section and ACI 318, the requirements of this Section and ACI 318 shall govern.

2. Industry Standards

Details of Concrete reinforcement not covered herein shall be in accordance with "Building Code Requirements for Reinforced Concrete" (ACI 318) and "Details and Detailing of Concrete Reinforcement" (ACI 315), latest editions and the Concrete Reinforcing Steel Institute Manual on "Placing Reinforcing Bars" (CRSI).

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store in location to prevent rusting, etc.

B. Protect reinforcement before, during, and after installation.

C. Insure proper identification after bundles are broken.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Reinforcing Bars

1. All reinforcing bars, except those to be welded, shall be of deformed type of new billet steel conforming to current requirements of ASTM A615, and where not noted shall be Grade 60. No rail or re-rolled steel will be permitted. Reinforcement to be welded shall conform to the requirements of ASTM A706.
2. Grade or yield strength of reinforcing bars is indicated on Drawings.

B. Welded Steel Wire Fabric

1. Wire Fabric shall conform to the requirements of ASTM A185.
2. Required net area, placement details, and other requirements are indicated on Drawings.

C. Supports for Reinforcement

1. Supports for reinforcement supported by formwork or deck shall consist of metal bolsters and chairs of adequate strength, size, and number. Provide CRSI Class C supports (plastic tipped) for formed concrete surfaces and Class A (bright basic) for metal deck.
2. Support for reinforcement of footings/pile-caps shall consist of the above supports or precast concrete block, 4" square, having a compressive strength equal to that of the concrete being placed.

D. Mechanical Tension Splices for Reinforcing Bars: Cadweld Rebar Splices or Lenton Couplers by Erico Products, Inc., BarGrip by BarSplice Products Inc., or equivalent accepted by Engineer.

E. Mechanical Compression Splices for Reinforcing Bars: Speed-Sleeve Splices by Erico Products, Inc. or equivalent accepted by Engineer.

F. Shear Reinforcement: Studrails by Decon

G. Structural Macro Fibers: ASTM C 1116, minimum of 2 inches (50mm) length, aspect ratio of 50 to 90, minimum toughness rating of R10, 50 = 60 (approximate) according to ASTM C 1018. Manufacturer: The Euclid Chemical Company, “Tuf-Strand SF” or GCP Applied Technologies “Strux 90.40”.

2.2 FABRICATION

A. Fabricate reinforcing bars in accordance with fabricating allowances given in ACI 315 and accepted shop drawings.

1. Partially embedded reinforcement shall not be bent or re-bent without the express written acceptance of the engineer. Offset bars shall be bent before placing.

PART 3 - EXECUTION

3.1 PLACEMENT

A. General

1. Place reinforcement in accordance with CRSI "Placing Reinforcement Bars" and Section BC 1907.5 of the 2014 NYC Building Code.
2. Unless otherwise permitted, welding of crossing bars (tack welding) for assembly of reinforcement is prohibited.
3. Avoid cutting or puncturing vapor barrier during placement.
4. Clean reinforcement of loose rust and mill scale, earth, ice and other bond inhibiting materials.
5. Accurately position as shown on accepted shop drawings. Support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

B. Supports

1. Support and fasten together all reinforcement to prevent displacement by construction loads or placing of concrete. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces. Tie wire ends shall not fall within required clear concrete cover.
2. Provide supports specified in Article 2.01.
3. Provide Continuous High Chair Upper (CHCU) or Continuous Support (CS) for welded wire fabric in the metal deck and place every four feet (4') parallel to the supporting beams.
4. Lifting of bars and welded wire fabric into position during placement of concrete is not permitted.
5. Where the concrete surface will be exposed to the weather in the finished structure, the portions of all accessories within 1/2" of the concrete surface shall be non-corrosive or protected against corrosion.
6. Neither top nor bottom bars shall be allowed to sag below tolerances specified herein.
7. For #8 bars and smaller, separate adjacent layers of parallel bars with short length of #8 bars, securely tied to the layers. For #9 bars and larger, separator bar shall be of the largest bar size separated.

C. Cover

1. Provide minimum protective cover given in Section 1907.7 of the 2014 NYC Building Code if not indicated on Drawings.
2. Place reinforcement to obtain at least minimum coverages for concrete protection as required.

D. Splices

1. All splices not shown on the Project Drawings shall be shown on the shop drawings and approved by the Engineer of Record.

2. Provide welded splices where indicated on Drawings. All welding shall conform to AWS D1.4. At these locations, only reinforcement conforming to ASTM A706 shall be used.
3. Provide mechanical connectors where indicated on Drawings. Install in accordance with splice device manufacturer's recommendations.
4. For welded wire reinforcing in slabs on ground lap adjoining pieces at least one full mesh plus two inches and lace splices with wire.

E. Embedment Lengths

All embedment lengths not shown on the Project Drawings shall be shown on the shop drawings and approved by the Engineer of Record.

3.2 TOLERANCES

A. Fabricate bars in accordance with the fabricating tolerances given in ACI 315. Place reinforcing bars in accordance with the tolerances given in Section 1907.5.2 of the 2014 NYC Building Code, ACI 318 Chapter 7, or provided herein, whichever is more stringent.

1. Bars shall be placed to the following tolerances:

a. Clear distance to formed surfaces + ¼-inch
b. Minimum spacing between bars + ¼-inch
c. Top bars in slabs and beams:

1) Members < 8” deep + ¼-inch

2) 8” < Members < 24” deep + ½-inch

d. Crosswise of members: spaced evenly within 2-inch
e. Lengthwise of members: + 2-inch

B. Move bars as necessary to avoid interference with other reinforcement, conduits, or imbedded items. If bars are moved more than one bar diameter, or enough to exceed the above tolerances, the resulting arrangements are subject to approval by the Engineer of Record.

3.3 FIELD QUALITY CONTROL

A. Under the requirements of Section BC 1704.4 of the 2014 NYC Building Code, the Owner/Developer will assign a Special Inspector to inspect the size and placement of reinforcement. A record will be made of all inspection of reinforcement at the bending bench and in place.

B. Do not proceed with the completion of wall forms until all reinforcement has been approved and recorded by the Special Inspector.

C. Do not proceed with concreting until all reinforcing in place has been approved and recorded.

D. Promptly correct all reinforcement displaced during pouring of concrete.

E. Protect reinforcing steel and mesh from scaling, oil, grease and distortion. Reinforcing steel and mesh that has rusted to the extent of scaling will be rejected and may be placed in the work only after proper cleaning and approval by the Testing Agency. Damaged reinforcement shall not be used.

3.4 CLEANING

A. Steel reinforcement shall be free of all rust, scale, oil, paint, grease, loose mill scale, and all other foreign matter that will prevent bonding of concrete and steel just prior to pouring of concrete.

END OF SECTION 032000

LIST OF SUBMITTALS

SUBMITTAL	DATE SUBMITTED	DATE APPROVED
Product Data:		_____
1. Welded wire fabric		
2. Welded wire reinforcement		
3. Supports		
4. Mechanical connectors		
Shop Drawings:		_____
1. Reinforcement layout		
Certificates:		_____
1. Reinforcing bars		
2. Welded wire fabric		
3. Welded wire reinforcement		
Qualifications:		_____
1. Rebar Installer		
2. Rebar Detailer		
Sustainability:		_____
1. Contractor's Sustainable Materials Form (see Section S01352) with materials cost information.		

* * *

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Drawings, conditions of the Contract (including General, Supplementary and Special Conditions), Division 1 Specification Sections and all other Contract Documents apply to work of this section.

B. Extent of cast-in-place concrete is indicated on the Drawings, including layout and sizes of members, type and strength of concrete, reinforcing and accessories.

C. Furnish material, equipment, labor, and services required to provide for cast-in-place concrete.

D. Structural work includes but is not limited to footings, piers, pile caps, mats, pits, steel encasement, walls, beams, sleeves and openings, depressions and drops.

E. Additional work includes but is not limited to contraction and control joints, keys, sitework, and installation of miscellaneous inserts, waterstops, vapor barriers, and other items listed herein. Also included is finishing of concrete exposed to view, designing and testing of concrete mixes, and submittals as listed in 1.08.

F. All materials, equipment, labor and services required to complete the work. Allow ample time and facility for the Work of other Divisions to be installed.

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

Products to be installed include, but are not limited to, the following:

A. Anchor bolts and other anchors cast into concrete.....Section 051200

1.3 RELATED SECTIONS

A. Concrete Formwork.....Section 031000

B. Concrete Reinforcement.....Section 032000

1.4 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's sustainable requirements. The Contractor shall ensure that the requirements related to these goals, as defined in this Section, are implemented to the fullest extent. Substitutions or other changes to the work shall not be proposed by the Contractor or their sub-contractors if such changes compromise the stated Sustainable Design Performance Criteria.

B. Sustainability requirements included in the Section are as follows:

1. Meet established minimum recycled content for concrete.

2. Documentation of Recycled materials.

3. Documentation of Regional materials.

1.5 REFERENCES

References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

A. Conform to the requirements of the New York City Building Code.

B. American Society of Testing and Materials (ASTM) standards, latest editions.

C31 Standard Practice for Making and Curing Concrete Test Specimens in the Field.

C33 Standard Specifications for Concrete Aggregates.

C39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

C42 Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

C78 Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Three-point Loading)

C94 Standard Specification for Ready-Mixed Concrete.

C127 Standard Test Method for Density, Relative Density (Specific Gravity) and Absorption of Course Aggregate.

C131 Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angles Machine.

C138 Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.

C143 Standard Test Method for Slump of Hydraulic Cement Concrete.

C150 Standard Specification for Portland Cement.

C172 Standard Method of Sampling Freshly Mixed Concrete.

C173 Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

C192 Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.

C231 Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

C260 Standard Specifications for Air-Entraining Admixtures for Concrete.

C309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

C330 Standard Specification for Lightweight Aggregates for Structural Concrete.

C387 Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.

C494 Standard Specification for Chemical Admixture for Concrete.

C496 Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.

C567 Standard Test Method for Density of Structural Lightweight Concrete.

C685 Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.

C882 Standard Test Method for Bond Strength of Epoxy-Resin Systems used with Concrete by Slant Shear

C1315 Standard Specification for Liquid-Forming Compounds Having Special properties for Curing and Sealing Concrete

E96 Standard Test Methods for Water Vapor Transmission of Materials

E154 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs

E329 Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials used in Construction

E1643 Standard Practicew for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs

E1745 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs

C. American Concrete Institute (ACI) standards.

ACI 117 Standard Tolerances for Concrete Construction and Materials.

ACI 211.1 Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.

ACI 211.2	Standard Practice for Selecting Proportions for Structural Lightweight Concrete.
ACI 212.3R	Chemical Admixtures for Concrete.
ACI 214R	Evaluation of Results of Tests Used to Determine the Strength of Concrete.
ACI 301	Specifications for Structural Concrete for Buildings.
ACI 302.1R	Guide for Concrete Floor and Slab Construction.
ACI 304R	Guide for Measuring, Mixing, Transporting and Placing Concrete.
ACI 304.2R	Placing Concrete by Pumping Methods
ACI 304.5R	Batching, Mixing and Job Control of Lightweight Concrete
ACI 305R	Hot Weather Concreting.
ACI 306R	Cold Weather Concreting.
ACI 308	Standard Practice for Curing Concrete.
ACI 309R	Guide for Consolidation of Concrete.
ACI 311.4R	Guide for Concrete Inspection.
ACI 318-11	Building Code Requirements for Reinforced Concrete (With modifications per Section BC 1908 of the 2014 NYC Building Code).
SP-66(04)	ACI Detailing Manual

D. American Association of State Highway and Transportation Officials

T318 Water Content of Freshly Mixed Concrete Using Microwave Oven Testing

1.6 DEFINITIONS

A. Exposed to view

Situated so that it can be seen from eye level from a public location. A public location is that which is accessible to persons not responsible for operation or maintenance of the building.

B. Normal weight concrete

Concrete for which density is not a controlling attribute, made with aggregates of the types covered by ASTM C33 and usually having unit weights in the range of 135 to 160 lb/ft^3.

1.7 DESIGN REQUIREMENTS

A. Performance Characteristics:

1. All concrete shall adhere to the durability and minimum strength requirements set forth in Section BC 1904 of the Building Code.
2. Concrete strengths shall be as shown on the drawings and drawing notes.

1.8 SUBMITTALS

A. Product Data

Submit manufacturers' information for the following:
1. Admixtures
2. Curing compounds
3. Hardener
4. Bonding & Repair Agents
5. Beam clips
6. Vapor barrier
7. Vapor retarder
8. Waterstop
9. Joint Fillers

B. Samples

Submit samples of the following items:
1. Vapor Barrier
2. Vapor Retarder
3. Beam clips
4. Waterstop

C. Concrete Mix Design

Submit proposed concrete mix designs for each type of concrete as required in Part 2.03 of this Section for acceptance by the Engineer at least three weeks prior to the start of any concrete work. Reports shall be signed and sealed by a Professional Engineer licensed in the State of NY and experienced in the design and testing of concrete mixes. The reports shall be made on the mix design submittal form included at the end of this specification, or with a similar format.

1. Reports for each mix shall include:

a. Source and type of each cement, including results of chemical and physical tests, if requested by Engineer.
b. Complete identification of source of supply for each type of aggregate.
c. Results of tests of aggregates for compliance with specified requirements, if requested by Engineer.
d. Scale weight of each aggregate.
e. Absorbed water in each aggregate.
f. Brand, type and amount per cubic yard of each admixture used (including synthetic fiber reinforcement).

g. Amount of free water used per cubic yard.
h. Proportions of each material per cubic yard.
i. Gross weight per cubic foot.
j. Measured slump.
k. Water/cementitious materials ratio, by weight. Submit strength vs. water/cementitious materials ratio curve based upon compressive tests, and indicating water/cementitious materials ratio to be used.
l. Total air content, by percent.
m. Water soluble ion chloride content, percent by weight of cement, if maximum is specified in this Section.
n. Compressive strength at seven and 28 days, from not less than two cylinders at seven days and not less than four at 28 days, for at least four different water/cement ratios.
o. Complete standard deviation analysis or trial mix test data.
p. For mixes with a design strength of more than 4000 psi, results of at least 4 cement cube strength tests.

2. If requested by Engineer, submit manufacturer or supplier's certificates of conformance to applicable standards for each ingredient.

D. Deviations

Requests for deviations from the Drawings or Specifications shall be submitted on Contractor's letterhead. Acceptance of shop drawings including deviations not detected during shop drawing review will not relieve Contractor from responsibility to conform strictly to the Contract Documents. Deviations will be allowed only where permitted by Engineer in writing. Proposed deviations must be accompanied by documented and physical evidence, which will establish that its quality equals or exceeds the quality specified.

E. Protective Measures

Submit hot and cold weather concreting procedures prior to start of any work. Including cold weather heating systems, enclosures, insulation, curing procedures and the like. Procedures shall be reviewed at a preconstruction conference.

F. Quality Control Submittals

1. Certificates

a. Building Department form TR3, signed and sealed by the licensed concrete laboratory and concrete producer.
b. Admixture manufacturer's certificate stating that the chloride content of the admixture will not exceed 0.05% by weight.
c. Concrete laboratory license number and certification of meeting ASTM E329 standards.
d. Concrete producer's certificate stating the plant and trucks are NYSDOT approved.
e. Concrete producer's Computer Batch Ticket in accordance with Section BC 1905.8.2 of the 2014 NYC Building Code must be presented at site before concrete is placed for every load of concrete delivered.

2. Manufactures' Instructions:
   Waterstop manufacturer's instructions for proper installation of waterstop, including manner in which splices are to be made.

3. Contractor Qualifications:
   Provide proof of Installer and Producer qualifications specified under “Quality Assurance”.

H. Survey

Submit signed and sealed copies of surveys conducted by a Licensed Land Surveyor showing elevations of all finished slab surfaces.

I. Mock-up

Provide mock-up as indicated under Quality Assurance.

J. Sustainable Submittals:

1. Submit Contractor’s Sustainable Materials Form with complete information on recycled content for cementitious materials provided under the work of this section. Include cost of cementitious materials and percentage, by weight, of cementitious materials that have post-consumer or pre-consumer recycled content.
2. Submit documentation of recycled content in cementitious materials – product data, mix design information, or manufacturer’s statement.
3. Submit Contractor’s Sustainable Materials Form with complete information on regional content for concrete provided under the work of this section. Include cost of all concrete materials and distance in miles to point of materials extraction and manufacture.
4. Submit documentation of regional materials – product data, mix design information, or manufacturer’s statement.

1.9 QUALITY ASSURANCE

A. General

Contractor shall examine all Contract Documents and note any discrepancies or items requiring close coordination or time schedules; assume responsibility of same and administer action such that the proper solution will result.

1. Contractor's material control procedures shall be effective and shall assure that all work fulfills the requirements of applicable provisions of the Contract Documents.
2. Contractor shall maintain sufficient staff to assure that all data and drawings for work of other sections is transmitted to detailers to allow proper detailing of holes, penetrations and the like and to assure proper execution of the work in the field.
3. Perform quality control functions required to achieve and to document that work conforms to the Contract Documents. Proved a reasonable number of copies of quality control reports and make all documents available up on request to the Architect, Owner and Engineer.
4. Contractor and Construction Manager shall coordinate and schedule the work of this section with the work of other sections of this specification in order to optimize quality and to avoid delay in job progress.
5. Prior to starting work the contractor shall cooperate and coordinate with each trade affected by the work of this section. Contractor shall report unsatisfactory or nonconforming conditions to the Engineer in writing prior to the start of work.
6. Construction loads shall not exceed the superimposed load which the member, with necessary supplemental support, is capable of carrying safely and without damage. The amount, method of distribution, and proposed supplemental support is the sole responsibility of the contractor.

B. Qualifications

1. General: Provide at least one person who shall be thoroughly familiar with the Construction Documents and other applicable requirements, trained and experienced in the necessary skills, and who shall be present at the site and direct all work performed under this section. Use an adequate number of skilled workmen to ensure installation in strict accordance with the approved design.
2. Concrete Installer: Company specializing in performing the Work of this Section shall have three years minimum experience on successful projects of similar size.
3. Concrete Producer: Company specializing in the production of concrete shall be certified by the National Ready Mixed Concrete Association (NRMCA) and shall have certification by either a New York City Agency or the NYS Department of Transportation. The plant shall use NYSDOT approved trucks and drivers shall be certified by the NRMCA.
4. Concrete Laboratory: Concrete laboratory providing design mixes shall be New York City licensed and shall meet the requirements of ASTM E329.

C. Regulatory Requirements

1. Building Code: Work of this Section shall conform to all requirements of the NYC Building Code and all applicable regulations of governmental authorities having jurisdiction including safety, health, noise, and anti-pollution regulations. Where

more severe requirements than those contained in the Building Code are given in this Section, the requirements of this Section shall govern.

2. Industry Standards: The ACI Standards listed under references apply to Work of this Section. Where more severe requirements then those contained in the Standards are given in this Section or the Building Code, requirements of this Section or the Building Code shall govern. The Contractor shall keep a copy of ACI SP-15 - "Field Reference Manual" at the site.
3. Recommendations or suggestions in the codes and references listed in this Article and under “References” shall be deemed to be mandatory unless they are in violation of the Building Code.

D. Certifications

1. Cast-in-Place Concrete shall conform to the material acceptance, certification, and inspection requirements of Sections BC 1704.4 and BC 1905 of the 2014 NYC Building Code.
2. Cement and aggregate shall be acquired from the same source for all work. If a change in suppliers is required, a new mix submittal must be produced with the new material and submitted for approval.

E. Cold Weather

When casting concrete in cold weather, plans to protect the concrete shall be made in advance and in accordance with ACI306.1 and all necessary material and equipment shall be on site well in advance of concrete placement. The contractor is responsible for ensuring the proper planning for cold weather concreting.

F. Pre-Concrete Conference

At least 35 days prior to the start of the concrete construction schedule, conduct a meeting to review the proposed mix designs and to discuss the required methods and procedures to achieve the required concrete quality. The contractor shall send a pre-concrete conference agenda to all attendees 20 days prior to the scheduled date of the conference.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Materials and products shall be delivered to the site in the manufacturer's original and unopened containers and packaging bearing labels as to type of material, brand name and manufacturer's name. Delivered materials shall be identical to accepted samples.

B. Materials and products shall be handled in a workmanship like manner per manufacturer's specifications. Storage shall be under cover in dry, weathertight, ventilated and clean locations off the ground.

C. Storage of ingredients for concrete:

1. Cement shall be stored in weathertight containers.
2. Aggregate stockpiles shall be arranged and used in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of like aggregates. To ensure that this condition is met, any test for determining conformance to requirements for cleanliness and grading shall be performed on

samples secured from the aggregates at the point of batching. Frozen or partially frozen aggregates shall not be used.

3. Stockpiles of natural or manufactured sand shall be allowed to drain to ensure a relatively uniform moisture content throughout the stockpile.
4. Unless predampening is not considered desirable by the manufacturer or is considered impractical by the Engineer, dry lightweight aggregates shall be predampened as necessary. To prevent excessive variations in moisture content, predampened aggregates shall be allowed to remain in the stockpiles for a minimum of 12 hours before use.
5. Admixtures shall be stored in a manner that will avoid contamination, evaporation, or damage. For admixtures used in the form of suspensions or nonstable solutions, agitating equipment shall be provided to ensure thorough distribution of the ingredients. Liquid admixtures shall be protected from freezing and from temperature changes which would adversely affect their characteristics.

D. Delivered materials which are damaged or otherwise not suitable for installation, shall be removed from the jobsite and replaced with acceptable materials.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Adequately protect concrete placed during rain, sleet, or snow, or when the mean daily temperature falls below 40°F or rises above 90°F as provided in Article 3.05.

1.12 PROJECT SITE CONDITIONS

A. The Contractor shall report in writing to the Engineer any discrepancies between the design drawings and the existing site conditions.

B. The Contractor shall field verify all information related to existing conditions such as: Surrounding structures, underground utilities and any other conditions that may exist.

C. The Contractor shall survey surrounding structures to obtain information such as: Elevation of existing footings, bearing walls, water supply, sewage, utility piping and other utilities installations which may interfere with the construction.

D. The Contractor shall obtain the pertaining information described above before starting a particular phase of work.

E. Examine the substrata and the conditions under which the concrete is to be installed, and notify the Engineer in writing of unsatisfactory conditions. Do not proceed with the work until the unsatisfactory conditions have been corrected.

F. All concrete work shall be properly protected during casting against freezing, excessive heat, acid rain or any other environmental destructive agent. Completed work shall be covered temporarily, permanently or as required. Protect adjacent finish materials against spatter during concrete placing.

G. The Contractor shall comply with any and all federal, state and local environmental code requirements.

H. Descriptions of, or limitations on, sequences of construction given in the Contract Documents are intended to assist the Contractor. Descriptions or limitations given are not by any means intended to fully describe construction limitations, sequence or techniques, nor preclude use of other methods if accepted by Engineer in writing. Whether or not Contractor follows the limitations and descriptions given herein, Contractor remains fully responsible for both the stability and the safety of the work; adherence to the limitations described herein does not relieve the Contractor from that responsibility.

1.13 DEFICIENT WORK

A. Deficient work or any work failing to strictly conform to the Contract Documents shall be removed and replaced, or repaired if accepted by Engineer, at no cost to the Owner, Architect or Engineer.

1. Contractor shall prepare appropriate details and procedures to bring such work into conformance with the Contract Documents and submit to Engineer for review and acceptance. Contractor shall, through the Owner, reimburse the Engineer for time and expense incurred reviewing proposal procedures and details in accordance with the Engineer's current fee schedule.
2. Nonconforming work may be rejected by Owner, Architect or Engineer at any time, regardless of prior acceptance in shop drawings, prior inspection, inclusion in inspection or test reports, or inclusions in certificates of payments.

B. Deficient work shall include, but not be limited to:

1. Low cylinder strength, as defined by this Specification.
2. Excessive or deficient air content.
3. Slump not in accordance with this Specification.
4. Spalling, honeycombing, surface defects, cracking, improper consolidation or the like.
5. Unauthorized cutting, construction joints, cold joints and so forth.
6. Workmanship not in accordance with the Drawings, with this Specification, with accepted samples, or with referenced codes or standards.
7. Incorrect forming, finishing or treating of concrete surfaces.
8. Exceedance of tolerances.
9. Evidence of improper curing and the like.
10. Higher than specified water content and/or w/cm ratio as determined by Microwave testing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Lightweight Aggregate

1. Northeast Solite Corporation,
2. Norlite Corporation,

B. Admixtures

1. Euclid Chemical Company, Cleveland, OH 44110
2. Master Builders,
3. Sika Chemical Corporation,
4. Anti Hydro Company,
5. Chem Masters,
6. GCP Applied Technologies
7. St. Lawrence Cement Company,
8. BASF

C. Curing Compounds

1. Euclid Chemical Company, Cleveland, OH 44110
2. Master Builders,

D. Waterstops

1. BBZ USA-Greenstreak, St. Louis, MO 63122
2. Sika Corp, Lyndhurst NJ 07071
3. DeNeef Construction Chemicals, Waller, TX 77484

E. Vapor Barrier

1. Stego Industries, San Juan Capistrano, CA 92675
2. Reef Industries, Houston, TX 77075
3. W.R. Meadows, Hampshire, IL 60140-0338

F. Vapor Retarder

1. Stego Industries, San Juan Capistrano, CA 92675
2. Reef Industries, Houston, TX 77075
3. W.R. Meadows, Hampshire, IL 60140-0338

G. Bonding Agent

1. Sto Concrete Restoration Division, Atlanta GA
2. Sika Corp, Lyndhurst NJ
3. Euclid Chemical Company, Cleveland, OH 44110

H. Densifier/Sealer

1. Euclid Chemical Company, Cleveland, OH 44110
2. Curecrete Chemical Company, Inc., Springville, UT 84663

2.2 MATERIALS

A. Cement

Shall conform to ASTM C150 and shall be of the non air-entrained types, from a single supplier:

1. Unless otherwise specified or approved by the Engineer of Record, cement shall be Type I or II.
2. Type II shall be used for exterior pavements.
3. Cement shall not contain ingredients that would result in more than two percent air being entrained in the concrete.
4. For concrete mixes with a design strength of more than 4ksi, cement shall have a minimum 28 day cube strength of 4000 psi when tested in accordance with ASTM C109.

B. Admixtures

1. General
   a. The use of admixtures shall comply with the requirements of Section BC 1903.6 of the 2014 NYC Building Code.
   b. The final soluble chloride content in concrete, percent by weight of cement, due to the addition of admixtures and other ingredients shall not exceed 0.05 at 28 days. All admixtures shall be non-corrosive.
   c. The amount of cement required by the Building Code may be reduced by 40% as per the code with the use of slag cement that has been reviewed and approved by the Owner.
   d. All admixtures shall be added at separate intervals of the mix cycle.
2. Air-entraining admixture: Shall conform to ASTM C260.

3. Water-reducing admixture: Shall conform to ASTM C494, Type A or D, and contain no more chloride ions than found in drinking water.

4. High range, water-reducing admixture (super- plasticizer): Shall conform to ASTM C494, Type F or G, and contain no more chloride ions than found in drinking water.
5. Water reducing, accelerating admixture: Shall conform to ASTM 494, Type C or E, and contain no more chloride ions than found in drinking water.
6. Water reducing, retarding admixture: Shall conform to ASTM C494, Type D, and contain no more chloride ions than found in drinking water.
7. Slag cement: ASTM C989, Grade 100 or 120. Shall be GranCem slag cement as manufactured by the St. Lawrence Cement Company.
8. Fly Ash: ASTM C618, Class F except that maximum carbon content shall not exceed three percent and maximum percentage retained on the #325 screen shall not exceed 25 percent. Fly ash shall be from a single, domestic source.
9. Corrosion inhibiting, calcium nitrite based compound; "Eucon CIA" by the Euclid Chemical Company, "DCI Corrosion Inhibitor" by GCP Applied Technologies, "Rheocrete CNI" by BASF Admixture Systems.
10. Microsilica; "MSA" by the Euclid Chemical Company, "Force 10,000" by GCP Applied Technologies, or "Rheomac SF" by BASF Admixture Systems.

C. Water: Shall be clean potable water free of injurious foreign matter conforming to the requirements of Section BC 1903.4 of the Building Code.

D. Aggregates:
Fine and coarse aggregates shall be regarded as separate ingredients. Each size of coarse aggregate, as well as the combination of sizes when two or more are used, shall conform to the appropriate grading requirements of the applicable ASTM specifications. Maximum size of coarse aggregate shall conform to paragraph 3.3.2 of ACI 318.

1. Aggregates for normal weight concrete shall conform to ASTM C33 and be of Size No.67 and/or No.8.
2. Aggregates for lightweight concrete shall conform to ASTM C330 and be of sizes 3/4" to No.4, 1/2" to No.4, and/or 3/8" to No.8. Lightweight coarse aggregate shall be rotary kiln product of expanded shale or slate and conforming to the requirements for normal weight coarse aggregates.
3. Fine aggregate shall be clean, hard, light colored sand.
4. Pea gravel aggregate shall be as given above except course aggregate shall be ASTM C33 size #8.
5. Aggregates for slab on grade shall conform to the recommendations of ACI 302.1R Chapter 4.

E. Curing Compounds

1. Non-strippable

a. Clear Curing and Sealing Compound (A.I.M. Regulations - VOC Compliant, 350 g/l): Liquid type membrane-forming curing compound, clear styrene acrylate type, complying with ASTM C1315, Type I, Class A, 25% solids content minimum. Moisture loss shall be not more than 0.40 Kg/m^2 when applied at 300 sq. ft./gal. Manufacturer's certification is required.
b. Curing Compounds shall be "Super Diamond Clear VOX" by The Euclid Chemical Company or "Masterkure 100W" by Master Builders.

2. Strippable

a. Clear Curing Compound: Liquid type membrane-forming curing compound, complying with ASTM C309.
b. Curing Compounds shall be "Kurez DR Vox, Kurez W Vox by The Euclid Chemical Company or "Masterkure N-Seal VOC" by Master Builders.

F. Curing Materials

1. Sheet materials shall conform to ASTM C171 and be non-bleeding and non-staining. Burlap cloth shall be made from jute or kraft and conform to AASHTO M182, using at least 2 layers.

G. Bonding Agent

1. Epoxy/acrylic resin that will not form a vapor barrier with the concrete with the following properties:

a. Bond strength of 1800 psi in 2 hours when tested in accordance with ASTM C882.
b. Flexural strength of 2000 psi in 28 days when tested in accordance with ASTM C78.
c. Tensile strength of 600 psi in 28 days when tested in accordance with ASTM C496.

2. Bonding agent shall be "CR246 Sto Bonding and Anti-corrosion Agent" by Sto Concrete Restoration Division, Armatec 110 by Sika Corp, Corr-bond by Euclid Chemical Company, SBR Latex by Euclid Chemical Company, Daraweld-C by GCP Applied Technologies or equivalent accepted by Engineer.

H. Densifier/Sealer

1. The densifier/sealer compound shall be a VOC compliant, non-yellowing, siliconate-based sealer that penetrates concrete surfaces and increases abrasion resistance and provides a “low-sheen” surface that is easy to clean. The compound shall contain a minimum solids content of 20%, of which 50% is siliconate.
2. Densifiier/Sealer shall be “Euco Diamond Hard” by The Euclid Chemical Co. or “Ashford Formula” by Curecrete Chemical Co.

I. Vapor Barrier

1. Vapor Barrier shall meet the following properties:

a. Minimum 15-mil polyolefin geomembrane.
b. Water Vapor Barrier – ASTM E1745, Class A
c. Permeance Rating – ASTM E1745/E96 or E1249/E96: 0.018 perms or lower
d. Puncture Resistance by ASTM E1745: Class A, minimum 2300 grams

e. Tensile Strength by ASTM E1745: Class A, minimum 45 lbf/in

2. Accessories

a. High density polyethylene tape with pressure sensitive adhesive
b. Pipe boot for piping and conduits constructed from vapor barrier and tape

3. Shall be:

a. Stego Wrap 15 mil Vapor Barrier by Stego Industries
b. Griffolyn 15 mil Green by Reef Industries
c. Perminator 15 mil by W.R. Meadows

J. Vapor Retarder

1. Vapor retarder shall be polyolefin type material, 10-mil thick minimum, with a perm rating of less than 0.1 when tested in accordance with ASTM E1745/E96, procedure A, and shall be resistant to decay when tested in accordance with ASTM E154 and meet ASTM E1745 Class A.

2. Shall be:

1. Griffolyn 10 mil Green by Reef Industries
2. Stego Wrap 10 mil Vapor Retarder by Stego Industries
3. Perminator 15 mil by W.R. Meadows

K. Waterstops

1. Concrete Joints

a. Water-swelling acrylate ester resin, hydrophilic rubber, or polyurethane type capable of expanding and contracting over multiple number of wet-dry cycles without reduction in its expansion ratio. If concrete surface is very uneven, provide paste type indicated in 2 below.
b. Shall be Duroseal Gasket Waterstop by BBZ USA-Greenstreak, Swellseal 8 by DeNeef, SikaSwell Profile by Sika Corp., or Waterstop-RX by Volclay Provide approximately 1" x 3/4" chemical resistant type. Attach to concrete and membranes with manufacturer's recommended adhesive or paste type waterproofing.
c. PVC type shall be 6" wide dumbell or serrated type made from virgin PVC; Style 748 or 679 by Greenstreak, Type R6-316 by Vinylex, or equivalent accepted by Engineer.

2. Steel, pipe and metal penetrations
a. Water-swelling acrylate ester or polyurethane paste type capable of expanding and contracting over multiple number of wet-dry cycles without reduction in it expansion ratio. Paste is a thixotropic grade material capable of being placed on uneven surfaces.
b. Shall be Duroseal Paste by BBZ USA, Swellseal Mastic by DeNeef, or SikaSwell S by Sika Corp. Provide chemical resistant type. Provide a minimum of 3/8" by 1/2" bead of material.

L. Reed Clips for Concrete Encased Structural Steel
   1. Expansible reed clips shall consist of 12-gage longitudinal wires and 12-gage clips 9" on center, which place the wires 3/4" to 1" from the flanges.
   2. Provide the following types, depending on member sizes:

      a. 4" wide, expansible to 8"
      b. 8" wide, expansible to 12"
      c. 12" wide, expansible to 16"
      d. 16" wide, expansible to 24"

   3. Shall be Expansible Reed Clips by Equipment Distributing Corporation.

M. Granular Fill: Under slabs on grade shall be well a graded run of bank sand and gravel with maximum size of 1-1/2", between 30% and 50% passing a #4 sieve, between 10% and 25% passing a #50 sieve and not more than 5% of particles by weight passing a #200 sieve. Imported material, if required, shall consist of a well graded mixture of sand and durable, hard limestone. The Contractor shall provide laboratory gradation tests (i.e., before and after laboratory compaction tests) and compaction tests (ASTM D 1557) prior to delivery for evaluation and approval by the geotechnical engineer.

N. Gravel or Crushed Stone: Under slabs on grade shall be hard, clean, natural rock, free of dust or other contaminants, and graded to requirements of ASTM C33, size #67.

O. Bond Breaker: Under fill and topping slabs shall be 4 mil thick polyethylene sheet.

P. Styrofoam: Shall conform to ASTM C578, Type VI; Styrofoam 40 High Load by the Dow Chemical Company or equivalent approved by the engineer.

Q. Expansion Dowels
ASTM A36 bars, hot-dipped galvanized and provided with a suitable expansion shield securely positioned and end filled with a readily compressible material assuring adequate expansion space beyond.

R. Neoprene Pads
Shall conform to AASHTO Standard Specification, Division II, Chapter 18 ASTM D2240, grade 50 Durometer hardness.

S. Premolded Joint Filler
Non-extruding bituminous-type preformed expansion joint filler conforming to ASTM D1751.

U. Semi Rigid Joint Filler
For contraction and construction joints in slabs on grade a two (2) component 100% solids compound, with a minimum shore A hardness of 80. Provide “Euco 700” or “QWIKjoint 200” by The Euclid Chemical Company or Masterfill CJ by BASF Admixture Systems.

V. Penetrating Sealer

Clear solvent based or water based silane or siloxane penetrating sealer; Euco-Guard 100, 200 or Vox by the Euclid Chemical Company, Sikaguard 701W by Sika, Masterseal SL by BASF Admixture Systems, or equivalent accepted by Engineer.

W. Polymer Repair Mortar
Polymer and microsilica modified cementitious based compound; “Thin Top Supreme, Concrete Top Supreme” (Horizontal repairs) by the Euclid Chemical or “Sikatop 121 or 122” (Horizontal repairs) by Sika Chemical, or “Verticoat/Verticoat Supreme by The Euclid Chemical Company (Vertical or Overhead) or “Sika 123” by Sika Chemical (Vertical or Overhead) by Sika Chemical. These patching mortars may be used when color match of the adjacent concrete is not required. Prior approval by the Engineer is required.

X. High Strength Repair Mortar
A flowable high strength, microsilica modified repair mortar for large horizontal placements or form and pour applications; Eucocrete by Euclid Chemical.

Y. Underlayment Compound
Free flowing, self-leveling, pumpable cementitious base compound, Flo-Top or Super Flo-Top by The Euclid Chemical Company, Ardex by Ardex Company, or Underlayment 110, by BASF Admixture Systems.

Grade

2.3 MIXES

A. General

1. Contractor shall employ a consultant , acceptable to the Engineer, hereinafter called the "Concrete Consultant", to prepare concrete mix designs from representative samples of the materials to be used to produce the concrete for each "type" of concrete required. A new “type” of concrete exists whenever there are changes to source or type of ingredient, source or type of cement, design strength, proportioning, or placing methods.
2. The Concrete Consultant shall design or verify mixes for each "type" of concrete in accordance with the trial mixture method or field experience method of ACI 318 Article 5.3. Test results of trial mixes shall be submitted to Engineer for acceptance prior to concreting. Each mix shall clearly state the location where mix is to be used.
3. The proportion of ingredients shall be selected by the Concrete Consultant to produce proper placeability, durability, strength, and to produce a mixture which will work readily into the corners and angles of forms and around reinforcement by methods of placement and consolidation employed on the work, but without permitting materials to segregate or permitting excessive free water to collect on surface. Comply with recommendations of ACI 211.1, 211.2 and 302.1R.
4. When a source, type, kind or brand of each constituent has been established and approved for the project mixes, it shall not be changed throughout the duration of the concreting. Batch all constituents including admixtures at the central batch plant.

B. Method of Proportioning

1. Proportion, batch, and mix concrete in accordance with Section BC 1905. The licensed concrete laboratory is responsible running the mix and signing the TR3 for filing with the Building Department. Proportion concrete mix in accordance with Section BC 1905.3.
2. Mix designs are specific to material used, concrete producer, and method of placement. Each mix design must be reviewed by the Engineer of Record and accepted prior to placement along with accompanying TR3 signed by the lab and concrete producer.
3. The recycled content in the concrete mix shall be 40% of the cementitious content or a minimum of 6% of the dry weight.

C. General Mix Requirements

1. Concrete mixes shall be designed to provide for all of the requirements given in this Specification and on the Drawings even if strength or any other criteria must be exceeded to meet another criteria.
2. Strength requirements given on the Drawings shall be based on 28-day compressive strength (56 days for concrete containing 40% alternate cementitious material - slag) for Type I and II cement and 7-day for Type III, unless a different test age is specified.
3. Concrete to be exposed to deicing salts, to brackish water, or to salt laden air in service shall have a maximum water-to-cement ratio, by weight, of 0.40, a minimum strength of 5000 psi, a minimum cement content of 650 pounds per cubic yard, air entrainment, Type II cement, and a maximum water soluble chloride ion content of 0.15 percent by weight of cement.
4. All concrete required to be watertight shall have a maximum water-to-cement ratio, by weight, of 0.40 and a minimum strength of 5000 psi.
5. Provide pea gravel aggregate concrete for all sections thinner than 6 inches, and where required due to congestion of reinforcing steel.
6. Concrete mixes to be exposed to earth or weather shall have a maximum water soluble chloride ion content of 0.30 percent by weight of cement.
7. All normal weight concrete subject to freezing and thawing shall contain 4½% minimum to 6 1/2% maximum total air content. The allowable tolerance shall be plus or minus 1 ½% of the air content indicated in the mix design.

D. Normal Weight Concrete

1. Unless otherwise specified, proportion and produce normal weight concrete to have a maximum slump of 4” or less. A tolerance of up to 1" above the indicated maximum shall be allowed for individual batches provided the average for all batches or the most recent 10 batches tested, whichever is fewer, does not exceed the maximum limit. The slump shall be determined by ASTM C143. Concrete containing High Range Water Reducer shall have a slump not exceeding 9”, unless other wise approved by the Engineer of Record. The concrete shall arrive at the job site at a slump of 2" to 3", be verified, and the HRWR admixture added to increase the slump to the approved level.

2. All normal weight concrete subject to freezing and thawing shall be air-entrained, provide the following air content for the grading size of coarse aggregate as follows:

   a. No.8.....$7^{1}/_{2}$%
   b. No.67.....6%

   Tolerance on air content as delivered shall be +1.5%.

3. Normal weight concrete shall have a maximum water-to-cement ratio, by weight, of 0.40 and a minimum strength of 5,000 psi unless otherwise noted.

E. Admixtures

1. Concrete mixes with admixture dosages exceeding 64 ounces per cubic yard of concrete shall have free water content of concrete mix reduced by aqueous portion of admixtures in order to adhere to water to cementitious ratio requirements.
2. A water reducing admixture or high-range water reducing admixture shall be used in all mix designs.
3. A high range, water reducing admixture shall be used when any of the conditions below apply. Self-Consolidating concrete shall have a slump/flow of 20” to 30”.

   a. Water to cementitious ratio is 0.45 or less, architectural concrete, self-consolidating concrete, and synthetic fiber concrete.
   b. Concrete is to be pumped.
   c. When requested by the Contractor and accepted by the Engineer in concrete mix design.

4. An air-entraining admixture shall be used in all mix designs for concrete subject to freezing and thawing.
5. A water reducing, retarding admixture shall be used when concrete is to be placed during hot weather as defined by ACI 305R.
6. Fly ash shall be used as an admixture for all lightweight concrete to be pumped.
7. A non-corrosive accelerator shall be used when concrete is to be placed during cold weather as defined by ACI 306.1.
8. Synthetic macro fiber reinforcement shall be used where called for on the Drawings and when requested by Contractor and accepted by the Engineer. Unless noted otherwise on the Drawings, or otherwise recommended by the manufacturer, dosage rate shall be 1-1/4 pounds per cubic yard.

2.4 SOURCE QUALITY CONTROL

A. Tests

1. The Owner Testing Laboratory will review and/or check test proposed materials for compliance with the Specifications prior to construction.
2. The Testing Laboratory will perform field tests as work progresses as listed in "Field Quality Control".

B. Inspection

1. Testing Laboratory

a. The Owner will engage a Licensed Concrete Testing Laboratory, meeting the requirements of ASTM C1077 and ASTM E329, to inspect batching of the concrete, at the Authorities discretion, and perform all field tests. The Laboratory will perform the following services:

1) Review and/or check-test the Contractor's proposed materials for compliance with the Specifications.
2) Review and/or check-test the Contractor's proposed mix design.
3) Secure production samples of materials at plants or stock-piles during the course of the Work and test for compliance with the Specifications.
4) Perform tests during construction as required by Section BC 1905.6.2 of the 2014 NYC Building Code. The Laboratory will obtain samples at the mixer and when directed by the Engineer at the point of placement by the following methods:

a) Secure composite samples in accordance with ASTM C172. Each sample shall be obtained from a different batch of concrete on a random basis, avoiding any selection of the test batch other than by a number selected at random before commencement of concrete placement.
b) Mold and cure specimens from each sample in accordance with ASTM C31 and perform strength tests.

b. The Owner may assign a qualified concrete technician to be stationed at the batch plant depending on the size of the project or evidence of poor concrete breaks. At least one qualified concrete technician will be stationed at the site to obtain the test specimens.
c. The Laboratory will be responsible to and under the supervision of the Special Inspector.

2. Special Inspector

a. The Owner will assign, under the requirements of Section BC 1704.4 a Special Inspector who will supervise the testing of the materials and the inspection of concrete construction. The Special Inspector is responsible for any required filing with the Building Department, as well as maintaining a log book of the concrete work.
b. The Special Inspector will check that all required tests are made and the results submitted and shall have the right to order the Contractor to make such changes of the mix of concrete as required to produce concrete of the necessary strength provided that it satisfies the drawings, specifications and building code. Any changes to the mix shall be submitted to the engineer for approval. The Special Inspector will also report to the Building Department Superintendent any deviation from the requirements of the Code, as indicated by records of inspection and reports of tests.

3. Notifications

   a. Notify the Owner in writing at least forty-eight hours in advance of each concrete placement. The Owner will notify the Testing Laboratory immediately to order out the necessary concrete technicians to cover the work.
   b. Once the concrete technicians are ordered out and a cancellation follows, the Contractor will be charged Four Hundred Fifty Dollars for each technician so ordered to appear, unless a cancellation order is issued to the Laboratory by 3 PM the day before the concrete placement.
   c. During the placement of the concrete, notify the Owner immediately of any delay at the concrete plant or at the job site. Where the Owner decides to provide a technician at the plant, do not mix concrete or add admixtures unless the Technician is present. Do not add admixtures to be added at the site unless the Technician is present.
   d. The Testing Agency shall report directly to the Owner and Engineer the results of all testing and inspection by means of daily written reports. When any test or inspection reveals deficient or nonconforming work the Testing Agency shall notify the Owner and Engineer immediately by means of a written report specially and clearly marked and identified to show deficient areas of work.

4. Contractors Responsibility for Quality Control

   a. The Contractor will receive a copy of all reports prepared by the Laboratory and/or Special Inspector. Copies of the daily concrete reports prepared by the Special Inspector will be available for reference.
   b. The Contractor will therefore be afforded an opportunity to review all reports and mix data and submit to the Special Inspector and Engineer any recommendations in changing the mixes provided they conform to the Code and Specifications. Any testing required because of changes in materials or proportions of the mix requested by the Contractor, as well as any extra testing of concrete or materials occasioned by the failure to meet Specification requirements shall be at the Contractor's expense. The Contractor, at any time, can arrange to have independent tests made at own expense by an approved laboratory and submit the reports and recommendations to the Special Inspector and Engineer of Record.
   c. The tests and inspections or waiving of tests and inspections by testing agency, as provided in the Code, do not in any way relieve the Contractor of responsibility to construct the Work in accordance with the Drawings and Specifications and to use safe, standard methods of construction at all times, safeguarding the public, workmen, and structure. The Contractor shall be solely responsible for the physical control of the materials and concrete mixes, and shall see that such mix designs, tests, and controls are in accordance with the Code and Specifications.
   d. It shall be the Contractor's complete responsibility to adjust, alter, and/or correct any controls necessary in materials and/or concrete operation based upon tests and inspections made by the Owner or the Contractor's independent tests. If, during the course of the concrete operations, a lower water content or more cement is needed per cubic yard above that used in the approved design mix, provide same at no additional cost to the Owner.

e. If the Contractor requests any deviation from the Specifications and Drawings, or makes or causes to be made any change of construction from Drawings and Specifications, and such request requires the time and investigation of the Engineer of Record, pay all costs incurred by the Owner relating to such time and investigation.

f. Where additional tests are deemed necessary by Engineer due to failure to pass tests, the cost of additional testing will be deducted from payments to Contractor.

g. If, due to errors by the contractor or failure to perform his work in accordance with the Contract Documents, the Engineer must perform additional design or drafting work or review proposed solutions, the Contractor shall, through the Owner, reimburse the Engineer in accordance with the Engineer's current fee schedule, plus out of pocket expenses incurred.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to placement of concrete, verify that the concrete cover over the reinforcement is that specified on Drawings.

B. Verify that anchor bolts, reinforcement, and all other embedded items are provided and held securely, positioned accurately, and will not be a detriment to concrete placement.

C. Examine all adjoining work on which this Work is in anyway dependent for proper installation and workmanship. Report to the Engineer and Owner any condition that prevents the performance of this Work.

3.2 PROTECTION

A. Protect concrete members on grade and the subgrade from freezing before and after installation. Provide blankets and other items necessary.

B. Protect adjacent finish materials and previously poured concrete against spatter during concrete placement.

C. Provide and maintain barricades and safeguards around openings, etc. to protect workmen from injury and to comply with all Building Code, OSHA, and other authorities having jurisdiction regulations.

3.3 PREPARATION

A. Remove ice, excess water, trash, and rubbish from forms.

B. Remove hardened concrete from inner surfaces of conveying equipment and all formwork, reinforcement, and dowels.

C. Prepare previously placed concrete to be in contact with new concrete in the manner described under "Construction Joints".

D. Prepare existing concrete to be in contact with new concrete by roughening and cleaning the surface and applying a bonding agent. Surface must be free of laitance. Concrete must be placed after agent cures and within 20 hours of applying bonding agent. If time elapses, apply a new application in accordance with the directions of the manufacturer.

E. In case a conflict arises between concrete as poured and other Work that requires cutting into concrete beams, columns, walls, or slabs, submit requests to the Engineer of Record, who will issue instructions accordingly. Cutting of concrete is otherwise prohibited.

F. Do not place concrete on frozen ground.

G. Contractor is solely responsible for the protection, shoring, bracing, stability and underpinning of existing structures either on or adjacent to the site. Details and extent of such work shown on the Drawings are suggestions only; Contractor is to determine requirements and methods. All of the above operations shall be done under the supervision of a qualified Professional Engineer licensed in the state of NY.

H. Contractor shall examine all existing surfaces, structures and the like which the work must attach to, clear or abut. Notify Engineer in writing of any conditions, which will delay or be detrimental to work. Start of work shall represent acceptance by Contractor of existing conditions as suitable for completing work as specified.

I. Contractor shall verify, by measurements at the site, all existing dimensions, which affect the work of this Section. Field dimensions varying from those on the design drawings or accepted shop drawings shall be brought to the Architect's and Engineer's attention in writing.

3.4 JOINTS AND EMBEDDED ITEMS

A. Construction Joints

1. Shall be made and located only as shown or indicated on the Drawings or accepted shop drawings. Conform to ACI 318, Article 6.4. All construction joints not shown or indicated on the Drawings shall be submitted in writing for acceptance.
2. Place construction joints perpendicular to main reinforcement and continue reinforcement across joints. Provide longitudinal keys at least $1^1/_2$" deep in walls, slabs and between walls and footings. Accepted bulkhead designs for this purpose may be used for slabs. Drawings indicate keys or roughened surface at interface of walls and footings.
3. Use butt joints for unreinforced slabs on grade with Diamond Dowels for proper load transfer.
4. Thoroughly clean concrete surface of oil, grease, and other contaminants and remove all laitance prior to placement of adjoining concrete. Roughen surface of the concrete in an approved manner that will expose the aggregate uniformly to a 1/4" amplitude and will not leave laitance, loosened particles of aggregate, or damaged concrete at the surface. Dampen surface immediately prior to placement.
5. Provide waterstops in construction joints as indicated on drawings and specifications. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during the progress of work. Fabricate field joints in waterstops in accordance with manufacturer's instructions.

6. Where overlay finishes, such as pavers or terrazzo, are to be provided, locate construction joints accurately below or behind expansion joints in the finish material.
7. Do not exceed maximum distance between construction joints noted in the Drawings or this Specification. If no criteria is given, do not space greater than 40 feet for walls, 100 feet in any direction for formed slabs, or 40 feet for slabs on grade.
8. Construction joints designated to be specially roughened, or joints of new concrete connecting to existing concrete, shall be bush hammered to 1/4-inch minimum roughness amplitude and thoroughly cleaned. Apply specified bonding agent where noted or specified.
9. Joints in slabs on grade, subjected to hard wheeled traffic shall be filled with the specified semi-rigid joint filler. The installation shall be made in strict accordance with the instructions from the manufacturer. The surface must be level with the concrete shoulders.
10. Properly install all embedded items where required.
11. Construction joints shall be made in accordance with Section BC 1906.8 of the Building Code.

B. Contraction (Control) Joints in Slabs-On-Ground

1. Construct in pattern as shown or noted on Drawings.
2. Inserts shall be laid into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of inserts. After concrete has cured, remove inserts and clean groove of loose debris.
3. Saw cuts shall be made as soon as possible after slab finishing and may be done without dislodging aggregate.

    a. Maximum joint spacing shall be 36 times the slab thickness unless otherwise noted on the drawings. The Soff-Cut saw shall be used immediately after final finishing and to a depth of 1-1/4-inch. A conventional saw shall be used as soon as possible without dislodging aggregate and to a depth of 1/4 slab thickness.
    b. Use load plate baskets under saw cuts where designated on the plans for load transfer.

4. Joints, in slabs on grade, subjected to hard wheeled traffic shall be filled with the specified semi-rigid joint filler. The installation shall be made in strict accordance with the instructions from the manufacturer. The surface must be level with the concrete shoulders.

C. Isolation Joints in Slabs On Grade

1. Provide at points of contact between slabs on grade and vertical surfaces where shown or called for on drawings. Provide joint filler and sealant as specified.

D. Waterstops

1. Provide waterstops at all joints and all penetrations of type indicated in Part 2 of this Section. All surfaces onto which material is placed shall be clean and smooth. Do not let materials come in contact with water by covering waterstop, forms, or other means necessary. Provide minimum clearance from edge of concrete as per manufacturer's recommendations, typically 3".
2. Provide maximum practical lengths for each piece so that the number of end joints will be held to a minimum.
3. Make joints in such a manner that they develop effective watertightness fully equal to that of the continuous material. All joints to be lapped as per manufacturer's instructions.
4. Use manufacturer's adhesive or swelling paste type for applying gasket type to previously poured concrete and/or waterproofing membrane. Surface onto which waterstop is placed shall be smooth.
5. Provide swelling paste type at all pipe penetrations, conduits, drains, steel members, and other areas where items penetrate the concrete foundation system and at uneven concrete surfaces.
6. If water penetrates joints in which waterstops are placed at contract locations or at cracks and cold joints, the Contractor shall remediate the crack with injection material recommended by the Owner and approved by the Engineer that will provide a 5-year labor and material guarantee against water seepage at no cost to the Owner.

E. Other embedded items

1. Place all fence sleeves and shoes, pipe sleeves, inserts, anchors, anchor bolts, and other embedded items required for the Work of other Divisions or for their support prior to concreting. Install Link-seal Watertight Sleeves by Thunderline Corp. through foundation walls and other locations where watertight construction is required and where indicated on Drawings as per manufacturer's instructions. Coordinate with other trades, all Drawings, and manufacturer for sizes, location, and quantity.
2. Provide ample notice and opportunity for items of other Division to be introduced and/or furnished for installation before concrete is placed. Coordinate the Work of the other Divisions so all items are placed in their proper location.
3. Set metal pipe sleeves, sockets, shoes, etc. into concrete to receive fence posts or any other items, all as indicated on details.

F. Placement of Embedded Items

Position expansion joint material, waterstops, and other embedded items accurately and support against displacement. Fill voids in sleeves, anchor slots, and inserts temporarily with readily removable material to prevent the entry of concrete into the voids.

3.5 MIXING AND PLACING CONCRETE

A. General

1. Notify Owner at least 48 hours in advance of each concrete placement. Do not place concrete without approval of the Special Inspector.

2. Do not allow rainwater to increase mixing water nor damage surface finish.
3. When placing concrete in cold weather (air temperature below 40°F), concrete shall contain either an accelerating admixture or use Type III cement.

B. Mixing

1. Batch, mix, and transport ready-mixed concrete in accordance with the appropriate sections of ASTM C94 and Section BC 1905.8.2 of the 2014 NYC Building Code. Truck mixers and agitators shall meet the requirements of the Truck Mixers Manufacturer's Bureau or shall comply with Section 8.1.2 of ASTM C94 and shall be NYSDOT approved. All trucks shall have working revolution counters and site gages. Batch all other concretes in accordance with subsection 4.3.1 of ACI 301 only if permitted by the Engineer of Record and Special Inspector.
2. Batch ready-mixed concrete only in plants that are are NRMCA certified and NYSDOT approved. Only plants that are NYSDOT approved with current certification meeting the requirements for certification of the NRMCA for automatic batching and automatic recording will be permitted. Concrete shall be batched by the use of automation.
3. Unless otherwise approved by the Engineer of Record, concrete shall be deposited within $1^1/_2$ hours or 300 revolutions of the mixing drum, whichever comes first, after introduction of water to the cement or cement to the aggregate. When the ambient temperature rises above 90°F, the time shall be decreased to 1 hour.
4. Batch lightweight concrete using the saturated weight of aggregate, which shall take into account the internal and surface moisture content.
5. Tempering and control of mixing water

    a. Mix concrete only in quantities for immediate use. Concrete that has started to set shall not be retempered, but shall be discarded. After the introduction of initial mixing water for the batch, no additional water shall be added at the site.
    b. For concrete containing HRWR (Superplasticizer), if loss of slump occurs, HRWR may be redosed at the site as long as a "flash set" has not occurred. Redosage procedures must be discussed and approved by the Engineer and the admixture manufacturer at the Pre-Concrete Conference.

6. Weather Conditions

    a. Cold weather (Air Temperatures below 40°F)

        1) Concrete shall have either an accelerating admixture or use Type III cement. Do not use calcium chloride, salt, materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.
        2) The temperature of concrete delivered at the site shall conform to the temperature limitations given in Section 5 of ACI 301.
        3) If water or aggregate is heated above 100°F, combine the water with the aggregate in the mixer before cement is added. Cement shall not be mixed with water or with mixtures of water and aggregate having a temperature greater than 100°F.
        4) Detailed requirements are given in ACI 306R.

b. Hot Weather (Air Temperatures above 90°F)

1) Cool the ingredients before mixing, or substitute flake ice or well-crushed ice of a size that will melt completely during mixing for all or part of the mixing water if, due to high temperature, low slump, flash set, or cold joints are encountered. Water equivalent of ice must be calculated to total amount of mixing water.
2) Detailed requirements are given in ACI 305.

7. Admixtures - General

a. Add all admixtures prior to mixing unless otherwise specified or directed.
b. Air-entraining admixtures and other chemical admixtures shall be charged into the mixer as solutions and shall be measured by means of an approved mechanical dispensing device. The liquid shall be considered a part of the mixing water. Admixtures that cannot be added in solution may be weighed or may be measured by volume if so recommended by the manufacturer. The accuracy of measurement of any admixture shall be within +3 percent.
c. If two or more admixtures are used in the concrete, add them separately to avoid possible interaction that might interfere with the efficiency of either admixture or adversely affect the concrete. Do not charge admixtures into the mixer in such a manner that they will come in direct contact with the cement.
d. Use of accelerating admixtures or Type III cement shall not relax cold weather placement requirements.
e. Use of retarding admixtures in hot weather must be approved by the Special Inspector. Use of such admixtures will not relax hot weather placement requirements.
f. Where using high-range, water-reducing admixture shall be added at the jobsite or at the initial batching, in accordance with the manufacturer's instructions.
g. Where synthetic macro fiber reinforcement is used, fibers shall be added when concrete is batched. Follow manufacturer's instructions and standard ASTM C94 practices.

8. Hand-Mixed concrete shall not be used without written acceptance by Engineer. When permitted, such concrete shall be mixed only in watertight containers. Each ingredient shall be measured dry and sand and cement shall be mixed prior to adding coarse aggregate. Water shall be added slowly so as to provide an even mixture

C. Placing

1. General: Place concrete in accordance with ACI 304R, ACI309R ACI 318, and Sections BC 1905.9 and BC 1905.10 of the 2014 NYC Building Code.

a. Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work; cooperate in setting such work.

Moisten wood forms immediately before placing concrete where form coatings are not used.

b. Forms and other surfaces to receive fresh concrete shall be clean and free of frost, dirt and any other debris immediately prior to and during concrete placing.

c. Apply temporary protective covering to lower 2 feet of finished walls adjacent to poured floor slabs and similar conditions, and guard against spattering during placement.

2. Conveying

a. Handle concrete from the mixer to place of final deposit as rapidly as practicable by methods that will prevent separation or loss of ingredients and in a manner that will assure that the required quality of concrete is obtained.

b. Conveying equipment shall be approved and shall be of a size and design such that detectable setting of concrete shall not occur before adjacent concrete is placed. Conveying equipment shall be cleaned at the end of each operation or workday. Conveying equipment and operations shall conform to the following additional requirements:

1) Truck mixers, agitators, and non-agitating units and their manner of operation shall conform to the applicable requirements of ASTM C94.

2) Belt conveyors shall be horizontal or at a slope which will not cause excessive segregation or loss of ingredients. Concrete shall be protected against undue drying or rise in temperature. An approved arrangement shall be used at the discharge end to prevent apparent segregation. Mortar shall not be allowed to adhere to the return length of the belt. Long runs shall be discharged into a hopper or through a baffle.

3) Chutes shall be metal or metal-lined and shall have a slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20' long and chutes not meeting the slope requirements may be used provided they discharge into a hopper before distribution.

4) Pumping or pneumatic conveying equipment shall be of suitable kind with adequate pumping capacity. Pneumatic placement shall be controlled so that segregation is not apparent in the discharged concrete. The loss of slump in pumping or pneumatic conveying equipment shall not exceed 2". Pumping is permitted only if a pump mix is approved. Concrete shall not be conveyed through pipe made of aluminum or aluminum alloy.

3. Depositing: Detailed recommendations are given in ACI 304R.

   a. General

      1) Deposit concrete continuously, or in layers of such thickness that no concrete will be deposited on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, locate construction joints at points as provided for in the Drawings, shop drawings, or as approved. Should cold joints form, cease operations. Submit detailed drawings showing remedial measures for acceptance. Drilled dowels or anchors or chipped keyways may be required by the Engineer.
      2) Carry out placement at such a rate that the concrete that is being integrated with fresh concrete is still plastic. Do not deposit concrete that has partially hardened or has been contaminated by foreign material.
      3) Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
      4) Place concrete on metal deck in a manner that uniformly distributes the material over the metal deck in order to avoid overloading the deck joints.
      5) Remove temporary spreaders in forms when the concrete placing has reached an elevation rendering their service unnecessary. They may remain embedded in the concrete only if made of metal or concrete and if prior approval has been obtained.
      6) Placing of concrete in supported elements shall not be started until the concrete previously placed in columns and walls is no longer plastic.
      7) Deposit concrete as near as practical to its final location. Minimize lateral movement of fresh concrete. Placement procedures shall not allow concrete to drop thru successive reinforcing grids, nor strike cages in columns or layers in walls.

   b. Segregation: Deposit concrete as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. Do not subject concrete to any procedure that will cause segregation. Free drop of concrete shall not exceed 8 feet for columns or 4 feet for other elements. Self-Consolidating Concrete may be dropped further when approved by the engineer. Canvas or rubber elephant trunks may be used to limit free drop.

   c. Consolidation

      1) Consolidation of concrete and the use and type of concrete shall be in accordance with ACI 309R.
      2) Where a surface mortar is to be the basis of the finish, the coarse aggregate shall be worked back from the forms with a suitable tool so as to bring a full surface of mortar against the form, without the formation of excessive surface voids.

3) Consolidate all concrete by vibration so that the concrete is thoroughly worked around the reinforcement, around embedded items and into corners of forms, eliminating all air or stone pocket or weakness. Internal vibrators shall be the largest size and most powerful that can be used in the Work, as described in Table 5.1.5 of ACI 309R, with a minimum frequency of 7000 revolutions per minute and shall be operated by competent workmen. Overvibrating and use of vibrators to transport concrete within forms is not permitted. Insert and withdraw vibrators at many points, from 18" to 30" apart. At each insertion, the duration shall be sufficient to consol-idate the concrete but not sufficient to cause segregation, generally from 5 to 15 sec duration, and shall reach the bottom of the pour. Keep a spare vibrator on the job site during all concrete placing operations.

4) Self-Consolidating Concrete may not require vibration if successful placement is demonstrated on site.

4. Cold Weather Concrete Placement and Protection: Detailed requirements are given in ACI 306.

When the mean daily temperature of the atmosphere is less than 40°F during concreting, or within 72 hours there after (or the air temperature is not greater than 50°F for more than one-half of any 24-hr period for a period of 3 consecutive days), follow the procedures outlined in ACI 306R to protect the concrete. Provide a cold weather concreting plan as well as list of equipment and material (e.g. thermometers, blankets) to be used to the Special Inspector. Temperature of the plastic concrete shall be no lower than 55°F and not more than 80 ^{o}F at point of placement. Heat all forms, reinforcing steel, subgrades and surfaces to receive concrete above the freezing point and keep them completely free of frost, snow, and ice. Protection shall consist of insulating boards, blankets, or heated enclosures. Underside of slabs shall be heated during placement and protection period. Initial protection period shall be as indicated in tables 5.1 and 5.3 of ACI 306R. Maximum temperature drop of concrete surface after protection is removed shall follow table 5.5 of ACI 306R. Protect concrete work from physical damage or reduced strength, which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306.1 and as herein specified.

5. Hot Weather Placement and Protection: When the mean daily temperature of the atmosphere is over 90°F during concreting, follow the procedures outlined in ACI 305R to protect the concrete.

a. All concrete, at the time it is actually deposited in the forms, shall have a temperature not lower than 50°F but never above 90°F.

b. Reduce concrete mixing time as required and specified herein to avoid quick stiffening of the concrete.

c. Cover reinforcement with water-soaked burlap to cool steel so its temperature will not exceed the ambient air temperature immediately before concrete placement.

d. Dry surfaces that are to receive concrete should be wet down with fog spray before commencing placement of concrete and the temperature of such surfaces should not exceed the temperature of the concrete being placed.

6. Concrete shall not be placed during rain, sleet or snow, nor shall rain, sleet or snow be permitted to fall upon uncured surfaces.

3.6 FINISHING OF SURFACES AND REPAIR OF SURFACE DEFECTS

A. General

1. Remove forms as soon as practicable. Refer to Section 031000 and Section BC 1906.2 of the 2014 NYC Building Code.
2. Repair surface defects, including tie holes and cracks, immediately after form removal. Patches shall be of quality to match the specified finish.
3. Remove oil, grease, compounds, and other contaminants from surfaces and areas to be repaired, those receiving coatings (ie. plaster, waterproofing, paint, and membranes of any kind).
4. Provide finishes specified below immediately after form removal.
5. Provide curing and protection.

B. Repair of Surface Defects

1. Remove all honeycombed and other defective concrete down to sound concrete. If chipping is necessary, the edges shall be perpendicular to the surface or slightly undercut. Undercut all cracks a minimum of 1" x 1". No featheredges will be permitted. Dampen the area to be patched and an area at least 6" wide surrounding it to prevent absorption of water from the patching mortar. A bonding grout shall be prepared using a mix of approximately 1 part cement to 1 part fine sand passing a No. 30 mesh sieve, mixed to the consistency of thick cream, and then well brushed into the surface.
2. The patching mortar shall be made of the same materials and of approximately the same proportions as used for the concrete, except that the coarse aggregate shall be omitted and the mortar shall consist of not more than 1 part cement to $2^1/_2$ parts sand by damp loose volume. Substitute white Portland cement for a part of the gray portland cement on exposed concrete in order to produce a color matching the color of the surrounding concrete, as determined by a trial patch. If the material color cannot be matched properly, the Contractor shall use a specialty repair mortar of the Engineer of Record's choice at the Engineer's discretion. The quantity of mixing water shall be no more than necessary for handling and placing. Mix the patching mortar in advance and allowed to stand with frequent manipulation with a trowel, without addition of water, until it has reached the stiffest consistency that will permit placing.
3. After surface water has evaporated from the area to be patched, brush the bond coat well into the surface. When the bond coat begins to lose the water sheen, apply the premixed patching mortar. The mortar shall be thoroughly consolidated into place and struck off so as to leave the patch slightly higher than the surrounding surface. To permit initial shrinkage, leave it undisturbed for at least 1 hr before final finishing. Keep the patched area damp for 7 days. Do not use metal tools for finishing a patch in a formed wall that will be exposed.

C. Repair of Tie Holes and Formed Surfaces

1. Remove ties, nails, and other form accessories below the concrete surface when the surface is exposed to view, the elements, or for surfaces to receive waterproofing or dampproofing. For surfaces not exposed to view or the above-mentioned conditions, remove metal to the surface. Refer to Section 031000.
2. Undercut surfaces of holes. After cleaning and thoroughly dampening the holes, fill them solid with the patching mortar. The mortar shall match the color of the existing concrete for concrete exposed to view as specified in paragraph B.2 above.
3. Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect or Engineer. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discoloration that cannot be removed by cleaning. Flush out form tie holes, fill with dry pack mortar, or precast cement cone plugs secured in place with bonding agent.
4. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.

D. Repair of Unformed Surfaces

1. Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness using a template having required slope.
2. Repair finished unformed surfaces that contain defects, which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate to reinforcement, spalling, pop outs, honeycomb, rock pockets, and other objectionable conditions.
3. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days, but without exposing the reinforcing.
4. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Use the specified underlayment or repair topping.
5. Repair defective areas, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4" clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
6. Repair isolated random cracks and single holes not over 1" in diameter by dry pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry pack, consisting of one part Portland cement to 2 1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry pack after bonding compound has dried. Compact dry pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.

E. Formed Finishes

1. Rough Form Finish

a. Provide for concrete not exposed to view and not covered with a material applied directly to the concrete, unless otherwise indicated under "Finishing" below.
b. Formwork material given in Section 031000.
c. Repair surface as indicated in B. and C. above.
d. Chip or rub off fins exceeding 1/4" in height.

2. Smooth Form Finish

a. Provide for concrete exposed to view, concrete receiving sheet membrane waterproofing or other covering material applied directly to the concrete, or as indicated under "Finishing" below. Areas exposed to view shall have a CS 3 or better finish as developed by the Cresset Chemical Company.
b. Formwork material is given in Section 031000.
c. Repair surfaces as indicated in B. and C. above.
d. Chip or rub off fins completely and grind smooth.
e. Provide smooth rubbed finish unless otherwise indicated below.

E. Unformed Finishes

At top of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

F. Finishing

1. Smooth Rubbed Finish

a. Provide for smooth form finish except for those items listed in 2 below.
b. Produce on newly hardened concrete no later than the day following form removal.
c. Wet the surfaces and rub with a No. 16 carborundum brick or other equal abrasive to obtain a smooth, even surface of uniform appearance without applying any cement or other coating.
d. Obtain the final finish by thoroughly rubbing with a No. 30 carborundum brick. The surface shall be wet for a period of 3 days. The Owner shall be the sole judge of whether the finish is proper.

G. Acceptance of Concrete Finish

If the finish produced is not acceptable to the Owner, the Contractor shall be responsible for all costs incurred to produce an acceptable finish by whatever means determined by the Owner.

3.7 SLABS

A. Placement

1. Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints (if required), until the placing of a panel or section is completed. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners. To obtain good surfaces and avoid cold joints, the size of finishing crews shall be planned with due regard for the effects of concrete temperature and atmospheric conditions on the rate of hardening of the concrete.
2. Mixing and placing shall be carefully coordinated with finishing. Do not place concrete on the subgrade or forms more rapidly than it can be spread, straightedged, and darbied or bull floated. Provide leveling, floating, troweling, etc. at the correct time interval after poring to prevent dusting and a non-durable surface as specified in ACI 302.1R. These operations must be performed before bleeding water has an opportunity to collect on the surface.

B. Leveling and Finishing

1. General

   a. Carefully provide slab depressions as required for the finishes indicated on the Drawings.
   b. Where floor drains or floor slopes are indicated, slope slabs uniformly to provide even fall for drainage.
   c. Follow detailed recommendations for finishing given in ACI 301, Section 5, and ACI 302.1R.
   d. Protect finishes from contamination from time of placing until time of acceptance, placement of topping, etc.
   e. Remove defects of sufficient magnitude to show through floor coverings or that do not meet tolerances by grinding.

2. Finishes

   a. Surfaces which receive bonded applied cementitious applications such as full-set vitreous ceramic tile, concrete fills and toppings, cementitious membrane waterproofing: Strike off and level to the proper elevation, plane surface to tolerances for floor flatness (F_F) of 15 and floor levelness (F_L) of 13. Slope surfaces uniformly to drains where required. After the topping has stiffened sufficiently to permit the operation, float the surface to a uniform sandy texture. The surface shall then be broomed to a texture as approved by the Architect.
   b. Surfaces that are exposed or painted finishes such as at auditorium floors and stairs, unless specified otherwise: After floating, begin first trowel finish operation using a power driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surfaces by final hand troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled

to tolerances of FF 20 FL 17. Grind smooth surface defects, which would telegraph through applied floor covering system. Apply densifier/sealer to slabs exposed or painted, except for those specified below to have no finish. Apply two coats in accordance with the manufacturer's instructions at the proper time.

c. Surfaces that are to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand bed terrazzo, and as otherwise indicated: After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power driven floats, or both. Consolidate surface with power driven floats, or by hand floating if area is small or inaccessible to power units. Check and level surface plane to tolerances of FF 18 FL 15. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

d. Surfaces with no finishes: Areaways, pipe and duct, and crawl spaces; Level and wood float surface level or toward drains if required.

e. Pavements: Finish surface to a true smooth plane and texture with a toothed roller or float with a wood float. Score concrete pavement in squares of approximately 5'-0" and/or as shown on Drawings. Each rectangular slab shall have all edges neatly rounded with proper tools and be bounded on all sides by a troweled border about 1" in width.

f. Concrete ramps, sloped walks, and elsewhere as indicated: After completion of float finishing, and before starting trowel finish, uniformly spread 25 lbs. of dampened non slip aggregate per 100 sq. ft. of surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as herein specified. After curing, lightly work with a steel wire brush, or an abrasive stone, and water to expose non slip aggregate. Immediately following first floating operation, uniformly distribute approximately 2/3 of required weight of dry shake material over concrete surface, and embed by means of power floating. Follow floating operation with second shake application, uniformly distributing remainder of dry shake material at right angles to first application, and embed by power floating. After completion of broadcasting and floating, apply trowel finish as herein specified. Cure slab surface with curing compound recommended by dry shake hardener manufacturer. Apply curing compound immediately after final finishing.

g. Non-oxidizing Metallic Floor Hardener: All slabs in areas noted on the drawings, shall receive an application of the non-oxidizing, metallic floor hardener applied at the rate of 1.5 lbs/ft^2. Immediately following the first floating operation, uniformly distribute approximately 2/3 of the required weight of the non-oxidizing metallic floor hardener over the concrete surface, by mechanical spreader, and embed by means of power floating. The hardener shall be floated in and the second application made. The surface shall be floated again to properly bond the hardener to the base concrete slab. The surface shall then be troweled, at least twice, to a smooth dense finish. After completion of broadcasting and floating, apply trowel finish as herein specified. Cure slab surface with curing compound

recommended by hardener manufacturer. Apply curing compound immediately after final finishing.

h. Liquid Densifier/Sealer: All interior slabs subject to hard-wheeled vehicular traffic, and so noted on the drawings, shall be treated with the specified liquid densifier/sealer. Spray, squeegee or roll on liquid densifier to clean, dry concrete surface. The liquid should be scrubbed into the surface with a mechanical scrubber. Keep the surface wet with the densifier during the application process. When the product thickens, but not more than 60 minutes after initial application, the surface shall then be squeegeed or vacuumed to remove all excess liquid.

C. Slabs on Grade

1. General

a. Aggregate base and crushed stone base material and preparation is part of Work of Section 312000.
b. Where pavements to remain are damaged or destroyed as a result of the Work, patch, repair, or replace as required. Color to match existing.
c. Subgrade and/or aggregate base/crushed stone base shall be free of frost before concrete placing begins.
d. Control Joints:

1) Primary Method: Soff-Cut System method, by Soff-Cut International, Corona, CA (800)776-3328. Finisher must have documented successful experience in the use of this method prior to this project. Install cuts within 2 hours after final finish at each saw cut location. Use 1/8 inch thick blade, cutting $1^{1}/_{4}$ inch into slab.
2) Optional Method (Where Soff-Cut System Method Equipment is Not Available): Properly time cutting with the set of the concrete. Saw-cut control joints within 12 hours after finishing. Start cutting as soon as the concrete has
hardened sufficiently to prevent aggregates being dislodged by the saw. Complete cutting before shrinkage stresses become sufficient to produce cracking. Use 1/4" thick blade, cutting 1/4 slab depth.

2. Slabs where vapor barrier required

a. Provide vapor barrier for all interior slabs on grade except for pipe and duct and crawl spaces.
b. Install vapor barrier in accordance with manufacturer’s instructions and ASTM E1643. Just prior to concrete placement, check vapor barrier for punctures and repair as specified below.

1) Unroll vapor barrier with the longest dimension parallel to the direction of pour.
2) Lap barrier over footings and seal to foundation walls.
3) Overlap joints 6” and seal with pressure sensitive tape.
4) Seal all penetrations with pipe boots.

5) No penetration of the barrier is allowed except for reinforcing steel and permanent utilities.
6) Repair damaged areas by cutting patches of vapor barrier, overlapping damaged areas 6", and taping all four sides with pressure sensitive tape.

c. Pour slab to required thickness after installation of reinforcement.
d. Conduit, drains, piping and other items shall be placed prior to installation of the vapor barrier.

3. Slabs where vapor retarder required

a. Provide vapor retarder for all slabs on grade of pipe and duct and crawl spaces.
b. Place vapor retarded over compacted base, providing 6" minimum lap at ends. Install vapor retarder in accordance with manufacturer's instructions. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged areas 6.
c. Pour slab to required thickness after installation of reinforcement.

4. Slabs where no vapor barrier required

a. Dampen subgrade or aggregate/crushed stone base immediately prior to placement of concrete.
b. Pour slab to required thickness after installation of reinforcement.

5. Pavements, Areaways

a. Provide 4" thick concrete slab unless otherwise indicated.
b. Provide 6x6-W2.9xW2.9 WWF placed $1^{1}/_{2}$" from top surface.
c. When a flagpole is indicated on the ground, form a paved circle around the flagpole as indicated. The pavement in this area shall have a slope of 2" away from the pole.

6. Driveways

a. Provide 7" thick concrete slab.
b. Provide 4x4-W4xW4 welded wire reinforcing placed 2" from top surface.

3.8 MISCELLANEOUS CONCRETE WORK

A. Provide trap-pits, curbs, walls, retaining walls, ramps, athletic field work and other miscellaneous concrete items.

B. Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel troweling surfaces to a hard, dense finish with corners, intersection, and terminations slightly rounded. If the curb is part of a beam, the form shall be removed as specified in the section for beams.

3.9 PATCHING AND BONDING TO EXISTING CONCRETE

A. Provide bonding agent whenever new concrete is to be poured against existing concrete, whenever the time between concrete pours is longer than that allowed for proper bond, and wherever bonding agent is indicated on the Drawings to be applied.

B. Remove loose concrete from surface to be bonded with new concrete and clean. Remove rust from reinforcement and structural steel by power chipping and power driven brushes.

C. Apply bonding agent in accordance with manufacturer's specifications. Pour concrete as soon as bonding agent has cured and within 20 hours after application. If the 20-hour period has elapsed, then the bonding agent must be reapplied.

3.10 CURING AND PROTECTION

A. General

1. Begin curing concrete as soon as free water has disappeared from concrete surface after placement and finishing. Protect all freshly deposited concrete from rain, premature drying and excessively hot or cold temperatures and maintain it with minimal moisture loss at a relatively constant temperature for the period of time necessary for the hydration of the cement and proper hardening of the concrete. Detailed procedures are given in ACI 308 and Section BC 1905.11 of the 2014 NYC Building Code.

2. Cure floor surfaces in accordance with ACI 308.
3. Do not apply curing compounds to surfaces receiving waterproofing, adhesives, membranes or additional concrete unless approved by adhesive or material manufacturer or compound is removed in an approved manner. As an alternate, provide wet curing.
4. All exposed interior slabs, not receiving a liquid densifier, and troweled slabs receiving mastic applied adhesives or “shake-on” hardeners shall be cured with the specified curing and sealing compound. Exterior slabs, sidewalks, curbs, and architectural concrete, not receiving a penetrating sealer, shall be cured with the specified curing and sealing compound. Maximum coverage shall be 400 ft^2/gallon on steel troweled surfaces and 300 ft^2/gallon on floated or broomed surfaces for curing/sealing compound.

B. Procedure

1. Concrete surfaces not in contact with forms:

   a. Ponding or continuous non-manual sprinkling.
   b. Absorptive mat or fabric, sand, or other covering kept continuously wet. Place to provide coverage of concrete surfaces and edges, with 4” lap over adjacent covers.
   c. Cover concrete surfaces with moisture retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   d. Curing compounds conforming to ASTM C1315 or where bond and adhesion of mortar, adhesive or other finish material will be adversely affected use strippable curing compound conforming to ASTM C309.

e. Treat slabs, ramps, curbs and columns and walls two feet up from top of slabs with penetrating sealer in areas that will be exposed to deicing salts in service. Follow manufacturer's instructions for dosage and procedures.

2. Concrete surfaces in contact with forms:

a. Minimize moisture loss from forms exposed to heating by the sun by keeping forms wet until they are removed.
b. After form removal, cure with one of the methods listed in 1 above.

3. Being final curing immediately following initial curing and continue curing until a total of 7 days has elapsed during which the temperature of the air in contact with concrete has remained above 50°F, in accordance with ACI 301 procedures. Prevent rapid drying during and at the end of the curing period.
4. Remove all curing compounds with cleaners recommended by curing compound manufacturer.

C. Cold Weather Curing

1. Concrete must be protected from water loss. This shall be accomplished by the application as soon as possible without harm to the concrete surfaces of either (a) exhaust steam, or vapor-resistant paper or polyethylene film, or (b) curing compounds. In all other respects, curing shall conform to applicable provisions of this Section. Concrete temperature shall be maintained between 50°F and 70°F. Comply with ACI 306.1
2. Protection of concrete in cold weather shall continue long enough to ensure the strength required, but not less than 72 hours. The temperatures shall be kept sufficiently above freezing. Protection from freezing for the first 24 hours does not ensure the strength required.
3. The surface temperature of the concrete shall be monitored especially at corners and edges of concrete. Use thermometers or any other equipment approved for this type of work. The Contractor shall provide all the equipment necessary to protect and monitor the curing of concrete. After the concrete has cured and the above requirements are no longer necessary, the temperature shall be decreased slowly and gradually as required by ACI 306.1. Under no circumstances are sudden changes of temperature in the concrete allowed. Heating units shall be vented. The concrete shall be protected from drying when heated locally by the heating locally by the heating equipment.
4. The heating enclosures, if used, must be strong, windproof and weatherproof.
5. Concrete shall not be exposed to carbon dioxide (CO2) gas or any other pollution resulting from the use of heating equipment. The temperature shall not exceed those shown in ACI 306.1.
6. The use of urethane foams as insulation shall be avoided if possible or done with caution, as it generates highly noxious fumes when subject to fire.

D. Hot Weather Curing

1. During the period June 1 to October 1 or when hot weather conditions require it, maintain continuous water curing for a minimum period of twenty-four hours. Provide for windbreaks, shading, and other necessary provisions.

2. After 24 hours, curing shall be by one of the methods specified under B above. In all other respects, curing shall conform to applicable provisions of this Specification. Upon termination of the specified moist curing, every effort should be made to reduce the rate of drying by avoiding air circulation.
3. Comply with ACI 305R.

E. Protection from mechanical injury: Protect concrete from mechanical disturbances during curing period as described under "Protection and Cleaning".

F. Penetrating Sealer: Apply at a rate of 125 square feet per gallon. Sweep and power wash concrete surface before application. Do not apply until time period specified in manufacturer's instructions.

3.11 FIELD QUALITY CONTROL

A. Tests: Method of tests shall in all cases comply in detail with the latest applicable ACI and ASTM requirements as well as the NYC Building Code and be performed by an ACI Concrete Field Testing Technician Grade 1 or equivalent. Tests to be performed by the Owner's Testing Laboratory during construction are as follows:

1. Compliance of materials to Specifications tested from production samples.
2. Testing Agency may inspect and test materials and work at the source before shipment as well as at the site before, during or at any time after installation. Deficient or incomplete work or materials shall be corrected or replaced, as directed by the Engineer, without additional costs or delays to the Owner.
3. Determination of the slump of the concrete for each sample taken and whenever consistency of the concrete appears to vary using ASTM C143. When a high-range, water reducing admixture is being used, slump tests shall be made before and after the admixture is added. The Special Inspector will reject any concrete that does meet the slump requirements.
4. Determination of water content of freshly mixed normal weight concrete utilizing the procedure of AASHTO T318. Concrete that does not meet the maximum water to cement ratio or the proportions given in the approved design mix will be immediately rejected regardless of slump.
5. Strength tests on the specimens in accordance with ASTM C39:

    a. The frequency of conducting strength tests of concrete shall be in accordance with Section BC 1905.6.2 of the 2014 NYC Building Code, with additional cylinders taken for an additional strength test and one cylinder for a 7-day break. Strength tests shall be performed for each 50 cubic yards, or portions thereof, of concrete placed in any one day's concreting. Specimens will be stored at the site in the insulated curing box provided by the Contractor. Each group of specimens is considered one strength test. One cylinder will be broken at 7 days for information.

        1) Portland cement concrete: A strength test shall be performed at 28 days for acceptance. The remaining cylinders for the additional strength test will be tested only if the 28-day breaks are low or durability of the concrete is in question.
        2) Portland cement concrete with 40% alternate cementitious material: A strength test will be performed at 28 days to

determine if the strength has been made and/or if the strengths are sufficient to continue work, even if not at the required design compressive strength. Depending on temperature, concrete strength can be attained at 28 days even though the strength is considered a 56-day strength. If the first cylinder tested indicates the strength has not been met, the remaining cylinders of the test will be broken at a later date. One set of strength test will be done at 56 days.

b. If one specimen in a test manifests evidence of improper sampling, molding, or testing, it shall be discarded and the average strength of the remaining cylinders shall be considered the test result. Should all specimens in a test show any of the above defects, the entire test shall be discarded.

c. When intermediate conveyance is used to place the concrete, one additional set of cylinders shall be taken for each 150 cubic yards or fraction thereof for each type of concrete placed in any one day's concreting. These test cylinders shall be separate and distinct from those made in the mixer and shall be made in the same batch and cured and tested in the same manner as samples taken from the mixer.

d. Test reports shall include name of Testing Agency and project, date of concrete placement, type of concrete, exact location of concrete batch in structure and results of 7 and 28 day tests and shall be specially marked to clearly identify any and all results falling below specified strength.

6. Determination of air content and unit weight of normal weight concrete sample for each strength test in accordance with ASTM C173 or C231 and ASTM C138. Test every time compressive strength cylinders are taken. The results of such tests shall be included in the Testing Agency's written reports.

7. Determination of air content and unit weight of lightweight concrete sample for each strength test in accordance with ASTM C173 or C231 and ASTM C567. Test every time compressive strength cylinders are taken. The results of such tests shall be included in the Testing Agency's written reports.

8. Determination of temperature of concrete sample for each strength test. When the air temperature is below 40 degrees F or above 80 degrees F, test at discharge from every truck. The results of such tests shall be included in the written reports.

9. Tests for water soluble ion chloride content shall be made in accordance with ASTM C114 for concrete that has a maximum chloride ion content specified in this Specification. Test every time compressive strength cylinders are taken. The results of such tests shall be included in the Testing Agency's written reports.

10. For concrete with a design strength of more than 4 ksi, cement samples shall be taken directly from the hopper at the batching plant and tested in accordance with ASTM C109. Samples shall be taken randomly, in quantities directed by the Engineer, throughout the project at each shipments of bulk cement and at additional times as directed by the Engineer.

B. Inspections

1. Refer to "Source Quality Control" for responsibility and procedure.

2. The Contractor shall cooperate in the making of all tests by the Laboratory Technician by:

a. Providing a well-constructed shanty, to be approved by the Owner, located adjoining the Owner's inspector's office. This shanty shall have an area of not less than 50 sq ft, be well lighted, and provided with a table for mixing concrete, shelves for storage of the Laboratory's equipment, molds, etc., one chair, hinged door with suitable lock and complying with all requirements of ACI and ASTM.

b. Providing an insulated curing box of sufficient size and strength to contain all specimens made in any four consecutive working days. The Contractor shall furnish an outlet to provide the necessary temperature in the storage box, pending delivery to the Laboratory of the test cylinders.

c. Protecting the property of the Laboratory to be stored in the shanty and keeping test specimens free from vibration and other disturbances.

d. Providing a microwave of the size specified in AASHTO T318 and a portable generator.

e. Provide a complete set of all current Construction Documents (including a current sketch log) and Specifications.

f. Provide a current set of approved Shop Drawings.

h. Provide concrete placement schedules.

3. Inspections shall include but not be limited to:

a. Control of concrete at the batching plant, including tests of materials for moisture, gradation and cleanliness; and determination and recording of all mixture quantities and water/cement ratios. Verify that quantities and materials conform to the accepted trial mixes, adjusted for moisture content of aggregates.

b. Verification of sizes and thickness of structural members, such as slab and wall thickness, beam and column dimensions, etc. Layout, alignment, plumbness, etc. are the sole responsibility of the Contractor.

c. Inspection of all concrete placing, finishing, and curing operations. Verify that all concrete forms and reinforcing are clean and free of dirt and debris at time of pour and that concrete is properly deposited, consolidated, finished and cured.

d. Inspection of all reinforcing; verifying size, number, spacing, location, splices, support, wiring, etc. of all reinforcing bars, mesh, and stud rails. The location and installation details of reinforcing and prestressing steel shall be inspected for compliance with the approved Construction Documents and ACI 318. Inspections shall be made only with shop drawings bearing the Engineer's stamp and marked "No Exception Taken" or "Make Corrections Noted" only. Refer to Reinforcing Specification.

e. Placement and location of embedded items such as sleeves, inserts, railings, etc. is the responsibility of the Contractor and Construction Manager.

C. Evaluation and Acceptance of Concrete

1. Strength tests on structural concrete will be evaluated according to Section BC 1905.6.3.3 of the 2014 NYC Building Code.
2. When the average strength of the test cylinders, as defined in Section BC 1905.6.3.3 falls consistently below the specified strength (f'c), the Engineer shall have the right to order the Contractor to change the proportions or the water content of the concrete to secure the required strength for the remaining portion of the structure, all at the Contractor's expense. It is the Contractor's complete responsibility to modify the concrete mix design, material controls, and/or concrete operations where necessary to obtain the compressive strength required by the design and Specification.
3. When the average strength of test cylinders for any portion of the structure is less than that required by the design or Specification, or where there is other evidence that the quality of the concrete is below Specification requirements, the adequacy of the concrete will be checked according to the requirements of Section BC 1905.6 either by structural analysis or by core or load tests or by any combination of these procedures. The Engineer of Record will determine which procedures to use:

    a. Structural Analysis Computations (Section BC 1905.6.5.5), which will be performed by the Engineer of Record.
    b. Core Tests (Section BC 1905.6.5.2) - Performed in accordance with ASTM C42.
    c. Load Tests (AC1318 Paragraph 20.3 or Section BC 1713 of the Building Code).

4. Exterior concrete exposed to the elements with low strength test results or other evidence of poor durability will be rejected.
5. Low Strength Tests of Concrete or evidence of poor durability - Results

    a. Pay for additional costs of labor and materials required at the job for all damages resulting from load tests and the taking of cores. Remove and replace concrete work that is not of adequate strength or durability and cannot be made to work by remedial methods acceptable to the Owner at own cost. The Contractor shall be held responsible for all delays and damages to the work of other Divisions that occur as a result of non-conformance.
    b. Pay for all expenses borne by the Owner resulting from low strength test procedures or evidence of poor durability (such as high slump) specified above.

3.12 PROTECTION AND CLEANING

A. General

During the curing period, and thereafter as conditions may require, protect the concrete from damaging mechanical disturbances, particularly excessive load stresses, heavy shock, and excess vibration. Protect all finished concrete surfaces from damage caused by construction equipment, materials or methods, and by rain or running water. Self-supporting structures shall not be loaded in such a way as to overstress the concrete.

B. Floors

Floors that have received their final finish shall be closed to all traffic for at least 48 hours following the completion of troweling. Avoid damage to the floor and repair, clean, and prep floor for finishes.

3.13 ACCEPTANCE OF CONCRETE WORK

A. General

1. Completed concrete work that meets all applicable requirements will be accepted without qualification.
2. Completed concrete work which fails to meet one or more requirements but which has been repaired to bring it into compliance will be accepted without qualification.
3. Completed concrete work which fails to meet one or more requirements and which cannot be brought into compliance may be accepted or rejected as provided in these Specifications or in the Contract Documents. In this event, modifications may be required to assure that remaining work complies with the requirements.
4. Concrete work judged inadequate by structural analysis, core test, results of load test or deemed unacceptable due to appearance or durability concerns shall be repaired, reinforced with additional construction if so directed by the Engineer of Record, or be replaced if so directed by the Engineer at the Contractor's expense.
5. Pay all costs incurred by the Owner in providing additional testing and/or analysis required by this Section.
6. The Owner will pay all costs of additional testing and analysis made at its own request that is not required by this Section or that shows concrete is in compliance with the Contract Documents.

B. Dimensional Tolerances and Measurements

1. Lay out each part of the work in strict accordance with the Contract Documents. Precise measurements and layout are the sole responsibility of the Contractor.
2. Obtain all field measurements required for proper detailing, fabrication and installation of the work. Field verify all dimensions and locations of existing conditions shown on the Contract Documents. Where discrepancies exist, notify Engineer in writing, and by sketch when applicable, of discrepancies and proposed solutions to correct discrepancies.
3. For Formed Surfaces unless otherwise specified or noted on the Drawings, conform to the requirements given below or as given in ACI 117, whichever is more stringent. Variations from grade shall be measured prior to removal of formwork.

    a. Variation from plumb:
        i. In the lines and surfaces of columns, piers, walls, corners and the like:
            a. In any 10 ft. of length 1/4 in.
            b. Maximum for the entire height 1 in.
        ii. For exposed corner columns, control joint grooves, and other conspicuous lines:

a. In any 20 ft. of length 1/4 in.
b. Maximum for the entire height 1/2 in.

b. Alignment:
i. At slab and/or beam, alignment of columns or walls above and below:
a. Maximum offset 1/4 in.

c. Variation from level or specified grades and elevations:
i. In slab, beam and girder soffits and the like:
a. In any 10 ft. length 1/4 in.
b. In any bay or in any 20 ft. length 3/8 in.
c. Maximum for the entire length 3/4 in.
ii. In exposed horizontal grooves, and other conspicuous lines:
a. In any bay or in 20 ft. length 1/4 in.
b. Maximum for the entire length 1/2 in.

d. Sleeves, wall openings and floor openings:
i) Variation in size 1/4 in.
ii) Variation in location 1/2 in.

e. Variation in cross sectional dimensions of columns and beams and in thickness of slabs and walls:
i) Minus 1/4 in.
ii) Plus 1/2 in.

f. Variation in the location of anchors and inserts shown in accepted shop drawings, unless more stringent tolerances are required for work of other Sections:
i) Vertically 3/8 in.
ii) Horizontally 1/4 in.

g. Faces of formed slab edges, turned down spandrels, and parapets shall not deviate from theoretical position or alignment by more than the distance in consideration divided by 500 or by 1/2 inch, whichever is less.

h. Footings:
i) Variations in dimensions in plan:
a. Minus 1/2 in.
b. Plus 2 in.
ii) Misplacement or eccentricity:
a. 2 percent of the footing width in direction of misplacement but not more than 2 in.
iii) Thickness:
a. Decrease in specified thickness 5 percent
b. Increase in specified thickness No limit
iv) Elevation at steel bearing plates:
a. Plus 1/4 in.
b. Minus 1/4 in.

4. Formed surfaces resulting in concrete outlines smaller than permitted by the tolerances of this Section or Section 03100 shall be considered potentially deficient in strength and subject to the provisions of paragraph D below.

5. Formed surfaces resulting in concrete outlines larger than permitted by the tolerances of this Section or Section 03100 may be rejected and the excess material subject to removal. If removal of the excess material is permitted, it shall be accomplished in such a manner as to maintain the strength of the section and to meet all other applicable requirements of function and appearance.

6. Concrete members cast in the wrong location may be rejected if the strength, appearance, or function of the structure is adversely affected or if misplaced items interfere with other construction.
7. Inaccurately formed concrete surfaces exceeding the tolerances of this Section or Section 03100 and which are exposed to view may be rejected and shall be repaired or removed and replaced if required.
8. Slab tolerance from theoretical elevation is 1/2" plus or minus in accordance with ACI 117. Finished slabs exceeding the tolerances, including specified levelness tolerances, may be repaired provided that the strength or appearance is not adversely affected. High spots may be removed with a terrazzo grinder, low spots filled with a structural repair mortars, or other remedial measures performed as permitted. Provide self-leveling cement based materials for large expanses of deficient areas. All materials shall be approved by the Engineer of record and installed by the Contractor at its cost.
9. For tolerances not specifically indicated in the Contract Document, follow requirements of ACI 117.

C. Appearance

1. Concrete exposed to view with defects that adversely affect the appearance of the specified finish may be repaired only by approved methods.
2. Concrete not exposed to view is not subject to rejection for defective appearance.

D. Strength of Structure

1. The strength of the structure in place will be considered potentially deficient if it fails to comply with any requirements that control the strength of the structure, including but not necessarily limited to the following conditions:

    a. Low concrete strength as described under "Field Quality Control".
    b. Reinforcing steel size, quantity, strength, position, or arrangement at variance with the requirements of Section 03200 or the Contract Documents.
    c. Concrete that differs from the required dimensions or location in such a manner as to reduce the strength.
    d. Curing less than that specified.
    e. Inadequate protection of concrete from extremes of temperature during early stages of hardening and strength development.
    f. Mechanical injury as defined under "Protection and Cleaning", construction fires, accidents, or premature removal of formwork likely to result in deficient strength.

2. Structural analysis and/or additional testing may be required when the strength of the structure is considered potentially deficient.
3. Core tests may be required when the strength of the concrete in place is considered potentially deficient.

4. If core tests are inconclusive or impractical to obtain or if structural analysis does not confirm the safety of the structure, load tests may be required and their results evaluated in accordance with Chapter 20 of ACI 318.

3.14 CONCRETE STRUCTURAL REPAIRS

A. Perform structural repairs only where accepted, by Architect, Owner and Engineer, in detailed procedure submitted by Contractor in writing. All other defective areas shall be removed and replaced.

1. Conform to Article 1.7 of ACI 301, "Specification for Structural Concrete for Buildings" and to instructions of Engineer.

END OF SECTION 033000

LIST OF SUBMITTALS

SUBMITTAL	DATE SUBMITTED	DATE APPROVED
Product Data:		_____
1. Admixtures		
2. Curing compounds		
3. Hardener		
4. Densifier/Sealer		
5. Bonding agent		
6. Vapor barrier		
7. Vapor retarder		
8. Waterstop		
9. Beam clip		
10. Joint Fillers		
Samples:		_____
1. Vapor barrier		
2. Vapor retarder		
3. Waterstop		
4. Beam clip		
Design Data/Test Report:		_____
1. Foundation concrete mix		
2. Superstructure concrete mix		
Certificates:		_____
1. TR3		
2. Admixture chloride content		
3. Concrete laboratories certificate		
4. Concrete producer is NYSDOT Approved		
5. Concrete producer's Batch Ticket to field rep.		
Manufacturer's Instructions:		_____
1. Waterstop		
Qualifications		_____
1. Concrete Installer		
2. Concrete producer		
Survey:		_____
1. Slab survey		

Mock Up: _____

1. Smooth Form Finish
2. Architectural Concrete Finish
3. Exterior pavement texture

Sustainable Submittals: _____

1. Contractor's Sustainable Materials Form (see Section S01352).
2. Mfr's printed literature or statement on recycled and regionally extracted and manufactured material content.

CONCRETE MIX DESIGN SUBMITTAL FORM

Project:

City:

General Contractor:

Concrete Contractor:

Contact Name:

Address:

Phone Number:

Main Plant Location:

Miles from Project Site:

Date:

Design Characteristics

Use (describe):

Strength: psi at days

Density: pcf

Air: % Water/cementitious ratio:

Design Mix Information – check one

☐ Based on Standard Deviation Analysis of Trial Mixes or Field Experience.

No. of test cylinders: Avg. Strength: psi

Standard deviation: f'cr: psi

f'cr = f'c + 1.34s or f'cr = f'c' + 2.33s - 500

Refer to ACI 318 Sec. 5.3.1 for standard deviation factor if less than 30 tests

☐ Based on Trial Mix Test Data.

f'cr: psi

f'cr = f'c + 1200 psi, for up to 5000 psi

f'cr = 1.10 f'c + 700 psi, for greater than 5000 psi

Materials

	Type/Source	Specific Gravity	Weight Lbs.	Absolute Vol. Cu. Ft.
Cement				
Flyash				
Microsilica				
Fine Aggregate				
Coarse Aggregate				
Water				
Air				
Other				
Total				27.0 cu. ft.

Admixtures

	Manufacturer	Dosage Oz/Cwt
Water Reducer		
Air Entraining Agent		
High Range Water Reducer		
Non-Corrosive Accelerator		
Other		

Slump before HRWR inches

Slump after HRWR inches

Required Attachment Checklist

☐ Combined aggregate gradation report
Note: 8%-18% aggregate required to be retained on each side sieve except the top size and #100.

☐ Standard deviation analysis summary or trial mixture test data

☐ Admixture compatibility certification letters

SECTION 051200 – STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, conditions of the Contract (including General, Supplementary, and Special Conditions), Division 01 Specification Sections and all other Contract Documents apply to work of this Section.

1.2 WORK INCLUDED

A. Extent of structural steel work is shown on the Drawings, including schedules, notes and details to show size and location of members, typical connections, and type of steel required.

B. Provide all labor, materials, equipment, services and perform all operations required for complete furnishing, fabrication, and erection of all structural steel as indicated on the Drawings, specified in this Section, and required by job conditions.

C. The work shall include but not be limited to the following:

1. Columns, posts, struts and hangers.
2. Base plates and bearing plates.
3. Anchor bolts and plates to be embedded in concrete.
4. Templates for items to be embedded in or attached to concrete.
5. Structural steel support angles, channels, etc. for metal deck.
6. Shop painting, lacquering and galvanizing and field touch-up.
7. Bracing, guying, surveying and plumbing of erected steel.
8. Shoring and temporary bracing.
9. Connections.
10. Shop applied stud shear connectors.
11. Concrete reinforcing bar coupling devices which are to be welded to structural steel.
12. Drilled-in anchors into concrete or masonry to fasten structural steel.
13. Deformed anchor bars stud welded to structural steel.
14. Erection drawings, shop drawings and samples.
15. Protection of work of this Section.
16. Protection of other work from activities under this Section.
17. Submittals.
18. Provisions for other work.
19. All other work shown in the Drawings, specified in this Section or required to make the structural steel work complete.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals – Division 1 Sections.

B. Cast-In-Place Concrete - Section 03300.

1.4 CODES AND STANDARDS

A. Conform to the requirements of the New York City Building Code.

B. The following codes, specifications and standards shall apply to the work. Where conflict among codes, standards, and specifications exist, the one having the most stringent requirements shall govern.

1. Specification for Structural Steel Buildings - AISC 360-10 by the American Institute of Steel Construction ("AISC Specification").
2. Code of Standard Practice for Steel Buildings and Bridges, AISC 303-05 by the American Institute of Steel Construction ("AISC Code"). Sections 6 and 7 apply to the work; the remainder is specifically excluded. Chapter 10 applies to members designated in the Contract Documents as Architecturally Exposed Structural Steel (“AESS”).
3. Specification for Structural Joints Using High-Strength Bolts, August 1, 2014, by the Research Council on Structural Connections of the Engineering Foundation ("RCSC Specifications").
4. Standard Symbols for Welding, Brazing and Nondestructive Examination, AWS A2.4, by the American Welding Society ("AWS A2.4").
5. Structural Welding Code - Steel, AWS D1.1, by the American Welding Society ("AWS D1.1").
6. Structural Welding Code - Reinforcing Steel, AWS D1.4, by the American Welding Society ("AWS D1.4").
7. American Society for Testing and Materials ("ASTM") specifications cited shall be the latest edition listed in the Index of the Annual Book of ASTM Standards.
8. Detailing for Steel Construction, 2009, by the American Institute of Steel Construction.
9. SSPC Steel Structures Painting Manual, by the Steel Structures Painting Council ("SSPC").

C. Work of this Section shall conform to all applicable federal, state and local laws and regulations.

1.5 SUBMITTALS

A. Product Data and Samples: Submit producer's or manufacturer's specifications and installation instructions for the following products to the Engineer for acceptance prior to the start of any work. Include laboratory test reports and other data to show compliance with Specifications, including specified standards. Submit samples where requested by Engineer.

1. High-strength bolts (each size, length and type), nuts, and washers, including manufacturer's certification of conformance for each and every lot. When requested by Engineer, submit samples to Testing Agency for testing prior to start of any work or delivery of materials to job site or stockyards.
2. Shop-applied stud shear connectors.
3. Reinforcing bar coupling devices which are to be shop welded to a structural steel. Submit welded sample for testing when requested.
4. Deformed anchor bars to be stud welded to structural steel. Submit welded sample for testing when requested.
5. Drilled-in anchors.
6. Any other manufactured products specified under Part 2 - Products, or called for on the Drawings.

B. Mill Certificates: Submit certified copies of producer's mill certificates for each piece of steel to be used. Reports shall include chemical and physical properties. See AISC specification section A3.1c.

C. Deviations: Requests for deviations from Drawings or Specifications shall be submitted on Contractor's letterhead. Acceptance of shop drawings including deviations not detected during shop

drawing review will not relieve Contractor from responsibility to conform strictly to the Contract Documents. Deviations will be allowed only where permitted by Engineer in writing. Proposed deviations must be accompanied by documented and physical evidence, which will establish that its quality equals or exceeds the quality specified.

D. Shop Drawings: Submit shop drawings to the Engineer for acceptance in accordance with the requirements of the Contract Documents. Engineer shall have ten business days to review submittal packages from day after submittal arrives in Engineer's office until day that submittal is sent returned by Engineer.

1. At least two weeks prior to the first shop drawing submittal, Contractor shall provide Engineer with a comprehensive list of all shop drawing submittals, and a schedule indicating when all submittals are to be sent to the Engineer. If Contractor deviates from this schedule, Engineer shall be allowed additional time to review shop drawings.
2. Shop drawings furnished under this section shall be not less complete than indicated by the applicable procedures shown in AISC's "Detailing for Steel Construction", 2009. Shop drawings shall be prepared by competent engineering personnel under the supervision of an experienced Professional Engineer registered in the state of New York. As evidence of such, each and every shop drawing shall bear the seal and signature of said Engineer.
3. Submit complete job standards prior to detailing individual members. Standards shall describe all repetitive work. Provide calculations upon request.
4. Submit shop drawings to Engineer in coordinated packages so that all required information is in hand at time of review. Prior to resubmission of shop drawings, all changes from prior issue shall be clearly circled and identified. Do not fabricate before shop drawings have been reviewed and returned to Contractor marked either "No Exceptions Taken" or "Make Corrections Noted" only.
5. Prepare, submit and keep up to date, a complete drawing index, cross-referencing assigned piece mark with the drawing number upon which the piece is detailed.
6. Contractor shall coordinate and cross-check for accuracy, completeness and correct relationship to the work of other sections, each shop drawing prepared for the work of this Section, including each shop drawing prepared by subcontractors. Detail steel work so as not to interfere with the work of other trades. Engineer's review of shop drawings does not relieve Contractor from these responsibilities.
7. Prior to sending submittals to Engineer, Contractor and Construction Manager (if applicable) shall coordinate and cross-check for accuracy and completeness each shop drawings prepared for work of this Section with the approved construction Documents and Specifications. Shop drawings shall bear the stamp of Contractor and Construction Manager indicating that this review has been performed. Engineer will not review submittals for which Contractor and Construction Manager have not performed this review.
8. Prepare erection drawings to show clearly the size and location of each member, and the erection mark assigned to each member. Show each field connection complete with data and details necessary for assembling the structure. Direct attention to the possible need for special guying, bracing or shoring.
9. Prepare anchor bolt, base plate and embedded plate erection drawings with complete dimensions. Provide to the concrete trade in advance of applicable concrete work.
10. Submit, for review and acceptance, field work drawings depicting all field work required to accommodate field conditions.
11. Shop drawings shall include plans, elevations, sections and complete details and be accurately dimensioned. Indicate size and grade of steel for each piece. Detail to accommodate Contractor's field measurements of supporting and adjoining construction. Contractor shall make a complete survey of all existing conditions prior to detailing.

12. Design of structural steel connections to plates or anchors embedded in concrete shall be based on the most severe combination of structural steel, concrete structure, and embedded item location tolerance.
13. Identify the connection used at each location. Connections shall conform to controlling requirements given in the Drawings, specified herein, or required by the New York City Building Code. Proportion connections not completely detailed in the Drawings to resist loads and load combinations required by the Contract Documents or by the New York City Building Code. Provide temporary expansion joints in structural steel work and between the work of this Section and that of other sections providing support or restraint until such time as work is thoroughly stabilized. Close and secure such joints at that time.
14. Indicate clearly the grade, size and number of bolts, the type, number, position and orientation of each washer and the size of each hole, whether slotted or round. Proportion connection details to ensure adequate wrench clearance for correct bolt tensioning sequences. Indicate method of tensioning for all high strength bolts.
15. All welds shall be indicated by using symbols conforming to AWS A2.4 and shall indicate type, size, length, spacing, location, orientation, etc. as applicable. Complete and partial penetration welds shall be indicated by an AWS prequalified joint designation. In addition, for all penetration welds, the complete joint preparation and configuration shall be shown or indicated, including root opening, groove angle, root face, backing bar, etc. as applicable. Bevels shall be graphically detailed in large scale.
16. Welding processes and electrodes shall be indicated on each shop drawing.
17. Detail shear studs, deformed bar anchors, concrete reinforcing bar couplers and other items which are to be shop applied.
18. Show and dimension holes and other work in the structural steel work required for work of other sections. Provide fieldwork drawings for holes not shown in shop drawings.
19. Indicate all structural steel shelves required to support steel deck ends and edges at supporting beams, columns, and other structural steel elements.
20. Detail cleaning and painting requirements, including identification of "no-paint" areas.

E. Work engineered by Contractor: Submit, for record purposes, drawings and calculations as applicable, signed and sealed by a Professional Engineer registered in the state of New York, for all work engineered by the Contractor. Such work shall include all crane and crane-related engineering, shoring and bracing procedures and sequences, and any other areas noted on the Drawings or required by the New York City Building Code.

1.6 INSPECTION AND TESTING

A. General: Owner will engage and pay for the services of an independent Testing Agency acceptable to the Engineer.

1. Contractor shall be responsible for providing the Testing Agency and Engineer with proper notice of the initiation of each phase and portion of work requiring testing or inspection. Written notice of commencement date shall be provided at least 5 working days prior to the start of shop work and the start of fieldwork. Subsequently, Contractor shall give a minimum of 24 hours verbal notice of work, or completion of work as applicable, requiring inspection and/or testing.
2. Contractor shall furnish Testing Agency with a complete set of Construction Documents and Specifications, along with one copy of each accepted shop drawing bearing the Engineer's review stamp, mill test certificate and manufacturer's certification. Provide reasonable office space to Testing Agency at fabrication plants and at the site. Provide Testing Agency

personnel with convenient and safe access to the work and all reasonable assistance necessary to permit effective inspection and testing work.

3. Testing Agency may inspect and test materials and work at the source before shipment, as well as at the site before, during or at any time after installation. Deficient or incomplete work or materials shall be corrected or replaced, as directed by the Engineer, without additional costs or delays to the Owner.
4. The Testing Agency shall report directly to the Owner and Engineer the results of all testing and inspection by means of daily written reports. When any test or inspection reveals deficient or non-conforming work, Testing Agency shall notify Owner and Engineer immediately by means of a written report specially and clearly marked and identified to show deficient areas of work. Furthermore, the Testing Agency shall provide a table of all known members, noting when each piece was shop inspected, field inspected, any deficiencies and when the deficiencies were corrected. This table is to be provided to the Owner and Engineer with the weekly submission of daily reports. The format of this table is to be submitted to the Owner and Engineer for approval before inspection is begun.
5. Performance or waiving of inspection, testing or surveillance by Testing Agency for a given portion of the work will not relieve Contractor from responsibility to conform strictly to the requirements of the Contract Documents.
6. Where additional tests are deemed necessary by Engineer due to failure to pass tests, the cost of additional testing will be deducted from payments to Contractor.
7. If, due to errors by the Contractor or failure to perform his work in accordance with the Contract Documents, the Engineer must perform additional design or drafting work or review proposed solutions, the Contractor shall, through the Owner, reimburse the Engineer in accordance with the Engineer's current fee schedule plus out of pocket expenses incurred.

B. Shop Inspection and Testing: Work performed at fabrication plants shall be subject to inspection and testing as follows:

1. The Testing Agency shall review the fabricator's quality control program and make a written report of such.
2. Each piece of fabricated steel shall be examined for straightness, alignment and proper conformance to details on accepted shop drawings.
3. Mill certificates for all steel shall be examined.
4. Manufacturer's certifications for all bolting materials to be used in the shop shall be checked and lot numbers on containers shall be verified to match certificates.
5. High strength bolts and bolting operations shall be tested and inspected in accordance with part 1.06 E of this Section.
6. Welds and welding operations shall be tested and inspected in accordance with part 1.06 D of this Section.
7. Surface preparation and painting of all steel members where blast cleaning is specified shall be inspected. When requested by the Engineer, dry film thickness of paint layers shall be measured.
8. Stud welding operations shall be inspected and tested in accordance with AWS D1.1 Sections 7.7 and 7.8.

C. Field Inspection and Testing: Work performed in the field shall be subject to inspection and testing as follows:

1. Testing Agency shall verify that all steel pieces and connections are installed completely and properly in the correct location and manner in accordance with accepted shop drawings.

2. Lot numbers on containers of all bolting materials shall be verified to match submitted manufacturer's certifications. Manufacturer and grade markings on all components of bolt assemblies shall be verified.
3. High strength bolts and bolting operations shall be tested and inspected in accordance with part 1.06 E of this Section.
4. Welds and welding operations shall be tested and inspected in accordance with part 1.06 D of this Section.
5. Steel exposed to the weather shall be inspected to verify that paint has been properly touched up at damaged or scratched areas.

D. Welding: Inspection and testing of welds and welding operations shall be performed in accordance with AWS D1.1 Section 6 by the Testing Agency using AWS Certified Welding Inspectors.

1. Testing Agency shall verify:

    a. Welding materials and equipment conform to the Contract Documents and AWS requirements and are used in correct positions and procedures.
    b. Size, length and location of all welds, and correct and appropriate processes are used.
    c. Welds are only made by welders certified by AWS for applicable process and position.
    d. At appropriate intervals, performance of individual welders and preparation and fit-up of joints.
2. All welds shall be visually inspected. Acceptance criteria shall be per AWS D1.1 as applicable.

3. Fifty percent of all full and partial penetration welds, whether made in the shop or field, shall be ultrasonically tested, for 100% of their length, in accordance with AWS D1.1 Section 6 Part C as applicable.

    a. If testing discloses a large ratio, in the opinion of the Engineer, of unacceptable welds, the required percentage shall be increased to 100% by the Engineer.

    b. If, in the opinion of the Engineer, the testing consistently discloses acceptable welds, the percentage of tested welds may be reduced by the Engineer to a minimum of 25%.

4. Fifty percent of all fillet welds, for 100% of their length, shall be tested by dye penetrant (ASTM E165) or magnetic particle (ASTM E709) method. Acceptance criteria shall be per AWS D1.1 as applicable.

    a. If testing discloses a large ratio, in the opinion of the Engineer, of unacceptable welds, the required percentage shall be increased to 100% by the Engineer.
    b. If, in the opinion of the Engineer, the testing consistently discloses acceptable welds, the percentage of tested welds may be reduced by the Engineer to a minimum of 25%.

5. Welds which are not satisfactory or which are found to be defective by the Testing Agency shall be cut out and replaced by a satisfactory weld at no additional cost or delay to the Owner.

E. High Strength Bolting: High strength bolts and bolting operations shall be tested and inspected as specified herein and in accordance with the RCSC Specification, Section 9.

1. Storage and Handling: The Testing Agency shall verify that bolting materials are properly stored and protected and at time of installation, are clean and free of rust and thread damage.

2. Assembly: The Testing Agency shall verify that the proper bolting assembly is installed by checking size and grade of bolt, type and grade of nut, location and number of flat washers, and location, orientation and type of direct tension indicator (if used).
3. Snugging: The Testing Agency shall verify that all bolts in a connection are properly snugged in accordance with RCSC Specification procedures and requirements of this Section before final tensioning of any bolt in a connection.
4. Calibration: The Contractor shall provide a tension-measuring device (Skidmore-Wilhelm or similar), with proper calibration certification, at the jobsite at all times when bolts are being tensioned. At the start of work, when requested by the Engineer, and whenever deemed appropriate by the Testing Agency, installation procedures shall be confirmed by tensioning a representative sample of bolts in the tension measuring device. A representative sample shall consist of not less than three bolts of each size, grade, length and producer being used. Installation procedures shall achieve a tension not less than that given in Table 4 of the RCSC Specification within 10 seconds from a snug tight condition.
5. Twist-off Bolts: Twist-off type bolts shall be inspected by observing installation procedures and by verifying that the splined end of every bolt shank has been properly broken off by the wrench chuck.
6. Direct Tension Indicators: Bolts installed with direct tension indicators shall be inspected by observing installation procedures and by measuring the average residual gap of the DTI on every bolt in accordance with the manufacturer's recommendations.
7. Turn-of-nut Installation: Bolts installed by the turn-of-nut method shall be inspected by measuring torque with a calibrated wrench. At the beginning of work, when deemed appropriate by the Testing Agency, whenever conditions such as lubrication or surface dirt change, and when a new or different manufacturer's material is being used, an inspecting torque shall be established. This shall be done by tensioning 5 bolts of each grade, diameter and manufacturer in a Skidmore-Wilhelm device to a tension not less than 105% of the minimum required and measuring torque with a properly certified calibrated wrench. The high and low values shall be discarded and the middle three averaged to establish an inspecting torque for each grade, diameter and producer. A minimum of 10 percent of the bolts, but not less than 2, in every connection shall be inspected. The Contractor shall provide the Skidmore-Wilhelm device, a calibrated wrenches, scaffolding and laborers as needed to perform such procedures at times requested by the Testing Agency.
8. Verification Procedures: If the Testing Agency reasonably suspects that any bolts may not be properly tensioned, due to relaxation as a result of improper snugging or any other reason, the arbitration inspection method of the RCSC Specification, Section 9(b), shall be used, except that all bolts in the connection in question shall be checked. The Contractor shall provide a Skidmore-Wilhelm device, calibrated wrench, a laborer and scaffolding as required to safely and properly perform such verification.
9. Laboratory Testing: High strength bolting materials shall be randomly tested throughout the project at times and in quantities chosen by the Engineer.

    a. Tension tests of full-size bolts shall be performed to determine the proof load and ultimate tensile strength in accordance with ASTM F606 using Method 1, Length Measurement.

b. Rockwell hardness of bolts shall be determined on the wrench flats after removal of surface material in accordance with ASTM F606. The reported hardness shall be the average of three hardness readings.
c. Rockwell hardness of nuts shall be determined on the bearing face in accordance with ASTM F606.
d. Surface hardness of hardened washers shall be determined in accordance with ASTM F606.
e. In addition the surface hardness, the core hardness of 5/16 inch thick washers shall also be determined in accordance with ASTM F606.
f. Direct tension indicators shall be tested in accordance with ASTM F959.
g. If requested by the Engineer, chemical properties and dimensional tolerances of bolting materials may also be tested.

1.7 QUALITY ASSURANCE

A. General: Contractor shall examine all Contract Documents and note any discrepancies and special construction problems requiring close coordination and exact time schedules; assume the responsibility of same and administer action such that the proper solution will result.

1. Contractor's quality assurance procedures shall be effective and shall assure that all work fulfills the requirements of applicable provisions of the Contract Documents.
2. Contractor shall maintain, on staff, sufficient office, field engineering, and field supervision staff to assure that all data and layout drawings for work of other Sections is transmitted to detailers to allow proper detailing of holes, penetrations, chases, and the like and to assure proper execution of the work in the field.
3. Perform quality control functions required to achieve and to document that work conforms to the Contract Documents. Provide access to Contractor's quality control documents and reports upon request of Owner, Architect, Engineer or Testing Agency. Provide reasonable numbers of photocopies of specific quality control reports on request.
4. Contractor and Construction Manager shall coordinate and schedule the work of this Section with the work of other Sections of this Specification in order to optimize quality and to avoid delay in overall job progress.
5. Prior to starting applicable phases of the work of this Section, Contractor shall cooperate and coordinate with each trade affected by the work of this Section, including areas where work of other Specification Sections joins or relates to work of this Section. Contractor shall report unsatisfactory or nonconforming conditions to Engineer in writing prior to the start of work.

B. Fabrication: The fabricator shall be certified by and use the AISC Quality Certification Program in establishing and administering a quality control program. Such program shall ensure that the work is performed in accordance with the Contract Documents.

C. Erection: The erector shall maintain a quality control program to the extent necessary to ensure that all of the work is performed in accordance with the Contract Documents. The erector shall provide the equipment, personnel and management for the scope, magnitude and specified quality of the work.

D. Qualifications: Throughout the progress of the work of this Section, provide at least one person who shall be thoroughly familiar with the specified requirements, completely trained and experienced in the necessary skills, and who shall be present at the site and shall direct all work performed under this Section.

1. The structural steel detailing firm shall be subject to acceptance by the Engineer. To ensure continuity, there shall be a single structural steel detailing firm. As a minimum requirement for acceptance, the structural detailing firm shall demonstrate experience in detailing of not less than five buildings of the type of this work and shall demonstrate in-house quality control procedures to the satisfaction of the Engineer.
2. Fabricator shall have experience in the fabrication of structural steel for at least five buildings of the type of this work and shall possess all capabilities and qualifications required for AISC Type II Certification.
3. Erector shall have experience in the erection of structural steel of at least five buildings of the type of this work.
4. Welders and welding operators performing work under this Section shall be qualified in accordance with the building code and with applicable AWS requirements for each specific welding procedure and process which the welder will use in this work. When requested by the Engineer, Contractor shall require welders to be retested.
5. Each welding procedure shall be described fully in the shop drawings and shall be designated prequalified under AWS D1.1 or shall be qualified in accordance with provisions of AWS D1.1 prior to use in the work. Each weld shall be visually inspected by the welder performing the work.

    a. Contractor shall comply with AWS D1.1 Section 6.6.

E. Contractor's Responsibilities: The Contractor shall be solely responsible for the items listed below. While the following list is not intended to be a complete listing of all responsibilities, it is provided to bring these items to the specific attention of the Contractor. Engineer's review of shop drawings or other submittals, or performance or waiving of inspection or testing, does not relieve Contractor from these responsibilities.

1. Safety and stability of the work. Construction sequences, whether stated or implied, are intended only to assist the Contractor in coordinating the work of the project.
2. Fabrication procedures and the means, methods, techniques, sequences and procedures of construction.
3. Correctness of dimensions and quantities, for the fitting to other or existing elements, for conditions to be confirmed and correlated at the site, and for the verification of the physical interrelationships of elements of the work.
4. The amount, method of distributing, and proposed supplemental support of loads during construction. Construction loads shall not exceed the superimposed load which the member, with necessary supplemental support, is capable of carrying safely without damage.
5. Obtain all field measurements required for proper fabrication and installation of work covered by this Section. Precise measurements are the responsibility of Contractor.
6. Report unsatisfactory or non-conforming conditions to the Engineer in writing prior to the start of work.

1.8 MEASUREMENTS AND TOLERANCES

A. Measurements: Lay out each part of the work in strict accordance with the Contract Documents. Precise measurements and layout are the sole responsibility of the Contractor.

1. Obtain all field measurements required for proper detailing, fabrication and installation of the work. Field verify all dimensions and locations of existing conditions shown on the Contract Documents. Where discrepancies exist, notify Engineer in writing, and by sketch when

applicable, of discrepancies and proposed solutions to correct discrepancies.

2. Lay out the work from at least 2 pre-established benchmarks and axis lines, individually correct for length and bearing.

B. Tolerances: Structural steel shall be fabricated and erected within the tolerances specified in the AISC Specification and Code, except that more restrictive tolerances, when specifically shown or noted in the Drawings or provided under this Specification, shall take precedence and shall apply to the work.

1. In lieu of the criteria given in Section M.4.4 of the AISC Specification, fit of finished compression splices shall be as follows: at least 65 percent of the contact area shall be in uniform bearing about the centroid of the bearing surface, with no separation greater than 1/32 inch. This requirement also applies to both shop and field connected base plates and bearing plates.

1.9 DELIVERIES, STORAGE AND HANDLING

A. Anchor bolts, embedded plates, anchorage devices, and other items required to be embedded in cast-in-place concrete shall be delivered to the project site at times coordinated by Contractor to allow convenient installation and orderly cast-in-place concrete operations.

B. Include setting drawings, templates, and directions for installation with all anchor bolts and with all other items or devices furnished and delivered to the project site for installation under other sections of this Specification.

C. Structural steel members which are stored on or off the project site shall be supported above ground on platforms, skids or other supports so as to protect steel members from overstress, permanent deformation, corrosion and other damage.

D. Materials shall be delivered to the site in the manufacturer's original and unopened containers and packaging, bearing labels as to type of material, brand name, and manufacturer's name. Delivered materials which are damaged or otherwise not suitable for installation, shall be removed from the jobsite and replaced with acceptable materials.

E. Handling, shipping and erecting of shop painted steel pieces shall not be performed until the paint has dried thoroughly. Protect the paint from damage and keep individual members free from contact with the ground and with each other.

1. Contractor shall furnish members in-place, fully painted, including all touch-up painting required as specified herein, at all locations where painting is required in the drawings by provisions of this Specification, and by the New York City Building Code.

1.10 DEFICIENT WORK

A. Deficient work or any work failing to strictly conform to the Contract Documents shall be removed and replaced, or repaired if accepted by Engineer, at no cost to the Owner, Architect or Engineer.

1. Contractor shall prepare appropriate details and procedures to bring such work into conformance with the Contract Documents and submit to Engineer for review and acceptance. Contractor shall, through the Owner, reimburse the Engineer for time and expense incurred reviewing proposal procedures and details in accordance with the Engineer's current fee schedule.
2. Nonconforming work may be rejected by Owner, Architect or Engineer at any time, regardless of prior acceptance in shop drawings, prior inspection, inclusion in inspection or test reports, or inclusions in certificates of payments.

B. Deficient work shall include, but not be limited to:

1. Bent, twisted or warped pieces.
2. Unauthorized cutting or reaming.
3. Cracking, interior or surface defects.
4. Painted or unpainted surfaces not sufficiently clean to finish coat.
5. Workmanship not in accordance with the Drawings, with this Specification, with accepted samples, or with referenced codes or standards.
6. Exceedance of tolerances.

PART 2 - PRODUCTS

2.01 STEEL

A. Structural steel furnished for each location shall provide the minimum yield point given in the drawings, shall conform to the applicable ASTM steel specification, shall meet the requirements of the New York City Building Code, shall be suitable for use in welded structures and shall meet the requirements both of the drawings and of this Specification. All materials shall be new and of the best commercial quality. Steel produced to modified ASTM specifications shall not be used without the Engineer's prior written acceptance.

2.02 PAINT

A. Shop and field-applied paint where designated in the Drawings, specified herein, and where required by the Building Code shall be selected from the following:

1. Alkyd primer:

    a. Tnemec 10-99 by Tnemec Co.
    b. Kem Kromik Primer by Sherwin-Williams Co.
    c. Dulux 67-Y-834 by Dupont Co.
    d. Carbocoat 150 or Carbocoat 818 by Carboline.
    e. Amercoat 5105 by Ameron International.

2. Zinc-rich primer:

    a. 90-97 Tneme-Zinc by Tnemec Co.
    b. Zinc Clad 5 by Sherwin-Williams Co.
    c. Ganicin 347-Y-937 by Dupont Co.
    d. Carbozinc 859 (class B Slip Critical) Epoxy Zinc-Rich by Carboline.
    e. Amercoat 68HS by Ameron International.

3. Epoxy based:

    a. Series 66 Hi-Build Epoxoline by Tnemec Co.
    b. Tile-Clad II Epoxy by Sherwin-Williams Co.
    c. Corlar 823 HB by Dupont Co.
    d. Carboguard 890 Series or Carobguard 888 by Carboline.
    e. Amercoat 385 by Ameron International.

4. Polyurethane:

    a. Series 73 Endura-Shield III by Tnemec Co.
    b. Hi-Solids Polyurethane by Sherwin-Williams Co.
    c. Imron 333 by Dupont Co.
    d. Carbothane 133 HB or Carobthane 833 by Carboline.
    e. Amercoat 450 series (450HS, 450SA) by Ameron International.

5. Cold galvanizing:

    a. ZRC Cold Galvanizing Compound by ZRC Products.
    b. LPS Cold Galvanize by LPS Laboratories, Inc.
    c. Carbozinc 4195 by Carboline.

6. Color of paint for steel exposed to view shall be selected by the architect.

2.03 WELDING MATERIALS

A. Welding materials shall conform to AWS A5.1, A5.5, A5.17, A5.18, A5.20, A5.23, A5.28 or A5.29. Welding electrodes which have been wet or contaminated by grease or other substances deleterious to welding shall not be used in the work.

B. Welding electrodes for welding of stainless steel to stainless or carbon steel shall be E308L.

2.04 STUDS

A. Stud shear connectors and welding equipment used for installation shall conform to AWS D1.1.

2.05 BOLTING MATERIALS

B. General: Bolts, nuts and washers for a given grade and diameter of bolt shall come from a single domestic manufacturer. For each diameter, only one grade may be used. Bolting materials shall be shipped to the jobsite in the bolt manufacturer's unopened containers with nuts and washers assembled and lot numbers marked on the container.

C. Bolts: Bolts shall conform to ASTM F3125 except where ASTM A307 are specifically permitted in notes or details on the drawings and clearly designated in accepted shop drawings.

1. Bolts shall be cold forged with rolled threads.
2. Type 2 A325, Type 3 A325 or A490 bolts shall not be used.

D. Nuts: Nuts for A325 bolts shall conform to ASTM A563 Grade C, D or DH or ASTM A194 Grade 2 or 2H. Nuts for A490 bolts shall conform to ASTM A563 Grade DH or ASTM A194 Grade 2H. Nuts for A307 bolts shall conform to ASTM A563 Grade A.

E. Washers: Hardened washers shall conform to ASTM F436 and the requirements of the RCSC Specification.

F. Direct Tension Indicators: DTI's shall conform to ASTM F959.

G. Galvanized Steel Bolting Materials: Bolts shall conform to ASTM Type I, nuts shall be ASTM A563 Grade DH or A194 Grade 2H only. Bolts, nuts and washer shall be galvanized under the supervision of the bolt manufacturer in accordance with either ASTM B695 Class 50 or A153 Class C. Nuts must be tapped after hot dip galvanizing or slightly overtapped before wax or equal. The galvanized bolt, washer, nut assembly shall be tested by the bolt manufacturer in accordance with ASTM F3125 and shipped and stored in plastic bags in closed containers. Direct tension indicators for galvanized bolts shall be coated by the DTI manufacturer only, in accordance with ASTM B695 Class 50, and tested by the manufacterer after coating.

H. Stainless Steel Bolting materials: Bolts shall conform to ASTM A193 Grade B8. Nuts shall conform to ASTM A194 Grade 8M.

2.06 GALVANIZING

A. Galvanized steel members shall be hot-dipped galvanized in accordance with ASTM A123 All galvanized steel with coating to be repaired shall be done in accordance to ASTM A780.

2.07 LACQUER

A. Milled Surfaces: Coat with Blue Lacquer by Varcroft Paint Co., or M-2658 Blue Lacquer by U.S. Steel Corp.

2.08 DRILLED-IN ANCHORS

A. Adhesive Anchors: HVU Adhesive Anchors by Hilti, HIT HY 200 by Hilti, Epcon by ITW/Ramset, Ultrabond by U.S. Anchor, or other accepted by Engineer.

B. Expansion Bolts: Kwik-Bolt III Anchors by Hilti, HSL Heavy Duty Sleeve Anchors by Hilti, Trubolt Wedge by ITW/Ramset, or other accepted by Engineer.

2.09 COUPLERS FOR CONCRETE REINFORCING BARS

A. Concrete reinforcing bar couplers, which are to be welded to structural steel, shall be Lenton Half Couplers as manufactured by Erico Products, Grip Twist Coupler by BarSplice Products, or other accepted by Engineer.

2.10 STAINLESS STEEL

A. Stainless steel shall be type 18-8 conforming to AISI Grade 304 or 316.

2.11 DEFORMED ANCHOR BARS

A. Deformed bars to be stud welded to structural steel shall be D2L anchors as manufactured by Nelson Stud Division of TRW or other accepted by Engineer.

PART 3 - EXECUTION

3.01 PREPARATION FOR CONSTRUCTION

A. Adjacent Structures: Contractor is solely responsible for the protection, shoring, bracing and stability of existing structures either on or adjacent to the site. Details and extent of such work shown on the Drawings are suggestions only; Contractor is to determine requirements and methods. All of the above operations shall be done under the supervision of a qualified Professional Engineer.

B. Examination of Field Conditions: Contractor shall examine all existing surfaces, structures and the like which the work must attach to, clear or abut. Notify Engineer in writing of any conditions, which will delay or be detrimental to work. Start of work shall represent acceptance by Contractor of existing conditions as suitable for completing work as specified.

C. Field Measurements: Contractor shall verify, by measurements at the site, all existing dimensions, which affect the work of this Section. Field dimensions varying from those on the design drawings or accepted shop drawings shall be brought to the Architect's and Engineer's attention in writing.

3.02 FABRICATION

A. General: Structural Steel shall be shop fabricated in strict accordance with the shop drawings, certificates, and other submitted data accepted by the Engineer. Workmanship shall be of the best practice of relevant trades and shall be performed by skilled mechanics making use of modern tools and equipment in good condition. To the extent practical, fabrication shall be performed in the shop and not in the field.

B. Straightening and Tolerances: Contractor shall straighten, square, flatten and torsionally align plates and shapes as necessary to provide fabricated elements within allowable tolerances as well as to provide correct alignment, good fit and uniform erection clearance, as applicable.

1. Fabrication tolerances shall not exceed those of the AISC Code.

2. Material straightened prior to fabrication shall be examined carefully for signs of distress and for other defects before being placed in fabrication. Distressed or otherwise defective material shall not be used in the work. Straightening by the use of properly controlled heat will be permissible if done by personnel skilled in heat straightening, using equipment and techniques in accordance with written procedure documents and applicable detail sketches prepared by the fabricator and accepted by the Engineer.

3. Sharp corners, projections, and similar rough or sharp surfaces or edges shall be eased and smoothed by grinding. Fabricated materials containing sharp kinks or bends shall be rejected.

C. Cutting: Except where accepted by the Engineer, cutting shall be by machine. Gas cutting shall provide smooth, uniform, workmanlike surfaces and shall conform to the prescribed line. Minimum 1/2 inch radius of cut shall be provided at all reentrant corners. Gas cut surfaces shall be made uniform and notch-free by chipping, planing, grinding and welding as required.

D. Finished Surfaces: Finishing shall be mean milled to ANSI 500 or smoother. Finished surfaces shall be protected by a corrosion inhibiting substance as provided herein. Plane contact surfaces of grillages and base plates. Mill edges of bearing stiffeners.

E. Bolt Holes: Bolt holes shall be normal size unless specifically accepted by the Engineer. Do not make or enlarge holes by burning. Drill material where thickness exceeds the connector diameter and in all material thicker than 7/8 inch. Remove burrs from drilling operations. Elongated punch and die sets shall be used to punch elongated holes.

F. Miscellaneous:

1. Members shall not be shop or field spliced except where specifically accepted by the Engineer and detailed on shop drawings.

2. Pipes, tubes and built-up box members shall be completely sealed with cap plates unless specifically designated otherwise in the Drawings.

3. Curved members of rolled sections shall be bent to uniform smooth curvature by means acceptable to the Engineer.

3.03 ERECTION

A. General: Erection of steelwork shall be performed by skilled workmen in accordance with the accepted shop drawings and certificates and shall conform strictly to the Contract Documents.

B. Embedded Items: Furnish anchor bolts, embedded plates and any other items specified in this Section which are to be cast into concrete in a timely manner. Provide steel templates and layout drawings with setting instructions and tolerances.

C. Shoring, Bracing and Guying: Contractor shall be solely responsible for stability and safety of the structure during the construction process. This responsibility includes any and all engineering for cranes, methods and sequences of erection, and temporary storage of materials such as metal decking.

1. Provide temporary bracing as required in order to resist safely all imposed vertical and horizontal loads during construction and to maintain correct alignment. Design of temporary shoring, bracing and guying is the Contractor's sole and complete responsibility, including all details of installation and removal, methods, sequence and timing. Remove temporary members and their connections after structure is completed.

2. Anchor bolts as shown in the Drawings are intended for requirements of the fully completed structure. Anchor bolt requirements for erection purposes and loadings shall be determined by the Contractor.

D. Measurements and Tolerances: Contractor shall employ a licensed Surveyor experienced in surveying steel building frameworks and report all discrepancies to the Engineer. Contractor shall not proceed with erection until acceptable corrections have been made. Contractor's steel surveys shall establish permanent bench marks as necessary, shall check elevations of bearing surfaces and locations of anchor devices and shall provide data during the course of the Work and a final survey showing the E-W, N-S and elevation position of the work points of each steel frame, truss and other major member as compared to theoretical location. Such surveys shall be submitted for record at the completion of

steel erection and at times requested by the Engineer.

1. Erection tolerances shall not exceed those of the AISC Code.

E. Compression Splices: Fastening of compression splices and joints shall be performed after the abutting surfaces have been brought uniformly into contact. Bearing surfaces shall be cleaned before the parts are assembled.

1. At least 65 percent of the contact area shall be in uniform bearing about the centroid of the bearing surface, with no separation greater than 0.02 inches, except locally at flange toes or corners which may be separated 0.03 inches without need for corrective measures. These requirements apply to both shop and field connected base plates and bearing plates. The above requirements specifically supersede Section M4.4 of the AISC Specification.

F. Field Modifications and Corrections: Field modifications and/or correction of fabrication or detailing errors shall not be made without the prior acceptance of field work drawings by the Engineer.

1. Bolt holes shall not be cut or enlarged with a gas torch.

2. Field cut beam openings shall only be made where expressly permitted by the Engineer. Openings to be cut with a mechanically guided torch after which all edges are to be ground smooth with proper radii at corners. Required reinforcing is to be placed prior to cutting opening.

3.04 BOLTING

A. General: Bolting procedures shall meet all of the requirements of the RCSC Specification and those given herein.

1. Bolts, nuts and washers, at time of tightening, shall be clean, rust-free and free from thread damage.

2. Impact wrenches shall be of adequate capacity and sufficiently supplied with air to perform the required tightening of each bolt within 10 seconds.

B. Acceptable Methods of Installation: All ASTM A325 and A490 bolts shall be fully tensioned to the minimum values given in Table 7 of the RCSC Specification unless specifically permitted otherwise by the Engineer in writing.

1. Bolts shall be tensioned using one of the following methods, as defined by the RCSC Specification and requirements herein, within the limitations given:

a. Twist-off type bolts, for diameters not exceeding one inch.
b. Direct tension indicators.

c. Turn-of-nut, provided that every bolt in every connection is marked with white or yellow keel after snugging and prior to final tightening ("match marking"). Turn-of-nut may not be used for bolts larger than one inch diameter.

2. ASTM A307 bolts shall be tightened using full manual effort on a suitable wrench. After installation, score threads to prevent nuts from loosening.

C. Snugging: Regardless of the installation method being used, connections shall be properly "snugged" prior to final tensioning of any bolt in the connection. Snug tight is defined as the condition where all plies of the connection are in firm contact. Snugging of bolts shall progress systematically from the most rigid part of the connection to the free edges. Impact wrenches shall be used on larger connections if manual effort on spud wrenches is not sufficient to bring plies together.

D. Twist-off Type Bolt Installation: Connections shall be properly snugged prior to tensioning of any bolt, which breaks the splined tip. A hardened washer shall be provided under the nut.

E. Installation with Direct Tension Indicators: Tensioning methods, number, thickness, location, orientation and type of washers, procedures and measurements shall be in strict accordance with the manufacturer's latest printed instructions.

1. DTI's shall be provided in addition to all other washers required.
2. Impact wrenches used shall be those recommended by the DTI manufacturer for the grade and size of bolt being installed and shall be in good repair and sufficiently supplied with compressed air.
3. Protrusions of the DTI shall bear only against the underside of the bolt head or against a hardened 3/16-inch thick hardened washer, as applicable.
4. Bolts larger than one-inch diameter shall be lubricated with Johnson's Stick Wax 140 on threads and face of turned element prior to tightening.
5. Connections shall be properly snugged prior to final tensioning of any bolt, which flattens the protrusions of the DTI.
6. In calibration procedures, the DTI need only indicate a tension of 100 percent of the minimum specified tension and not 105 percent as required by Section 8.2.4 of the RCSC Specification.

F. Installation by Turn-of-Nut: Installation shall be in strict accordance with the RCSC Specification and the additional requirements given herein.

1. A hardened washer shall always be provided under the bearing face of the turned element (nut or bolt head).
2. Bolts shall be properly snugged and match marked prior to final tensioning of any bolt in a connection.
3. During tightening of bolts, the unturned element shall not be allowed to rotate. The unturned bolt element shall be held without rotation using the correct size spud wrench or other suitable correct size of open end, closed end or socket wrench.

G. Oversized and Slotted Holes: Washers, plate washers and/or continuous bars shall be provided for ASTM A325 and A490 bolts in accordance Section 6 of the RCSC Specification.

H. Reuse of Bolts: ASTM A490 bolts and galvanized ASTM A325 bolts, if completely or partially untorqued, shall not be reused. ASTM A325 bolts may be reused only with specific written acceptance by the Engineer.

I. Field Modifications or Corrections: Unfair holes shall not be enlarged by burning or drifting alone. Enlarge holes where necessary and permitted by flame piercing and reaming or by reaming alone or by other means accepted by the Engineer. Holes after enlargement shall be true round holes normal to the surfaces joined. Increase bolt size to fill enlarged and reamed holes.

J. Galvanized Bolts: Galvanized bolts shall be provided wherever the connection is exposed to the

weather.

1. Bolt threads and the face of the turned element shall be lubricated with Johnson's Stick Wax 140 prior to installation.

3.05 WELDING

A. General: Welding processes and materials shall comply with AWS D1.1 and any additional requirements specified herein.

B. Quality Control and Certifications: Quality of all welds shall conform to AWS D1.1 for the type of weld and specified method of inspection.

1. All welds shall be visually inspected by the welder who made the weld.
2. Welds shall only be made by welders with AWS certification, and any local building code license if required, for the type of weld, welding process and position of the weld being made.
3. Field welds shall be subject to the same acceptance criteria as shop welds.
4. Cracking or incomplete penetration shall be cause for rejection of each weld possessing such defects, regardless of other acceptance or rejection criteria.
5. Base metal containing gross discontinuities, before or after welding, or lamellar tearing after welding, shall be repaired in accordance with accepted procedures or shall be discarded and replaced.
6. The Contractor shall comply with the requirements of AWS Article 6.6.

C. Materials and Processes: Welding materials and processes shall be selected from those specified herein and shall conform to accepted welding procedure specifications.

1. Complete and partial penetration welds shall be made using only AWS prequalified procedures following all requirements for joint preparation, fit up, orientation, etc.
2. Welding electrodes or flux contaminated by deleterious substances or moisture shall not be used and shall be removed promptly from the work location. Low hydrogen electrodes which cannot be used promptly after opening of hermetically sealed containers shall be stored in electric holding ovens at 250ºF (minimum).

D. Preheating: Welding shall be performed on material preheated to a temperature above the dew point, regardless of other preheating requirements.

1. Joints in which material is two inches or more in thickness shall not have the weld interrupted after operation has started, unless at least 2/3 of its size, for its full length, has been completed without an interruption of more than one hour. Welding may be interrupted for longer periods, provided the preheat temperature is maintained for full length of joint for the entire time welding is interrupted.

E. Miscellaneous:

1. Sizes of fillet and partial penetration welds shall equal or exceed minimums required by the AISC Specification regardless of all other requirements.
2. All backing bars shall be continuous across the entire length of the weld.
3. Slag shall be removed from all welds for inspection.

4. Shop stud welding of headed stud shear connectors and deformed anchor bars shall be in accordance with Paragraph 3.07 A of this Section.
5. Exposed exterior structural steel shall have all joints seal welded.
6. Welding of ASTM A6 Group 4 and 5 rolled shapes spliced in tension shall conform to AISC specification Section J1.7.

3.06 FINISHING, PAINTING & GALVANIZING

A. General: Steel work shall be cleaned, painted or galvanized as provided herein. Cleaning and priming shall be done in the shop, intermediate and top coats may be done in the shop or in the field unless otherwise specified.

1. Steel which is to be encased in concrete shall be cleaned to meet the requirements of SSPC SP-2, by wire brush or other means at the option of the contractor. Reclean after erection to the extent required to achieve the original condition.
2. Steel which is to be enclosed and not spray fireproofed shall be cleaned to meet the requirements of SSPC SP-3 and shop sprayed with an alkyd primer, not less than 2.5 mils nor more than 3.5 mils dry film thickness.
3. New steel which is to be exposed to weather shall be cleaned to meet the requirements of SSPC SP-6, shop sprayed with zinc-rich primer not less than 2.5 nor more than 3.5 mils dry film thickness (DFT), intermediate spray coated with epoxy-based paint not less than 4.0 nor more than 6.0 mils DFT, and top coated with polyurethane paint not less than 3.0 nor more than 5.0 mils DFT.
4. Existing steel which will be permanently exposed to weather shall be cleaned to meet the requirements of SSPC SP-3 and coated twice with Carboline Rustbound Penetrating Sealer or Carboguard 954 followed by epoxy-based paint, for a total coating dry film thickness not less than 7.0 mils nor more than 15.0 mils dry film thickness. Test topcoat over existing coatings to verify compatibility. If total system dry film build excess 15.0 mils, including existing paints, then removal of this high thickness must be conducted.
5. New steel exposed to the weather but not painted, and where noted in the Drawings, shall be hot-dip galvanized.

B. Painting: Paint shall be applied thoroughly and evenly without sags or holidays by suitable spray equipment in strict accordance with the paint manufacturer's printed instructions. Provide a dry film thickness within the range specified herein, including around outside corners or other abrupt changes in surface profile.

1. Paint shall be applied only to dry surfaces and only at times when steel surface temperatures are at least 5º F above the dew point and above the minimum temperature recommended by the manufacturer for the particular paint.
2. For alkyd primer, epoxy-based paint and polyurethane, surfaces to be subsequently bolted or welded shall be blocked out for a minimum of 2 inches each direction from edge of bolt holes or welds.
3. For Zinc-rich primer, surfaces to be subsequently welded shall be blocked out. Surfaces to be bolted shall not be blocked if slip-critical Class B zinc-rich primer is utilized (no topcoat).
4. Contractor shall reasonably protect painted surfaces from damage, abrasion and soiling.
5. Sharp edges, such as those created by flame cutting or shearing, shall be broken and rounded prior to surface preparation. Breaking the edge can be accomplished by a single pass of a grinder in order to flatten the edge.

C. Field Touch-Up: Field touch-up shall be provided at all blocked areas and points of damage, including bolts and welds installed after coating.

1. Touch-up for one coat treatment shall be power tool cleaning to SSPC SP-3 and one coat of zinc-rich primer.
2. Touch-up for two coat treatment shall be power tool cleaning to SSPC SP-3, one coat of zinc-rich primer and one coat of epoxy-based paint.
3. Touch-up for three coat treatment shall be power tool cleaning to SSPC SP-3, one coat of zinc-rich primer and two coats of polyurethane paint.
4. Touch-up for galvanized steel shall be power tool cleaning to SSPC SP-3 and painting with cold galvanizing compound.

3.07 MISCELLANEOUS

A. Stud Welding: Use automatic stud welding systems in strict accordance with the manufacturer's instructions to weld all studs and deformed anchor bars installed in the shop. Prepare structural steel surfaces as recommended by the stud shear connector or anchor bar manufacturer. Fillet welding shall be used for repair welding only. All welding ferrules shall be broken and removed to allow visual inspection of the stud welds. All weld repairs to stud welds shall be made to the extent required by AWS D1.1.

B. Drilled-In-Anchors: Drilled-in anchors into concrete or masonry shall be installed in strict accordance with the manufacturer’s instructions. Drilled holes shall be cleaned thoroughly with compressed air blown into the bottom of the drilled hole with a tube.

C. Rebar Couplers: Concrete reinforcing bar couplers welded to structural steel shall be installed in strict accordance with the manufacturer’s instructions and AWS D1.1.

END OF SECTION 051200

SECTION 083919 – FLOOD PANELS AND BARRIERS

PART 1 GENERAL

1.1 SUMMARY

A. The Contractor shall furnish, fabricate and install flood panels and barriers. The flood panels and barriers shall be provided complete with all accessories and fastenings required for a satisfactory installation.

B. An index of the Articles in this Section is given below for convenience:

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1.2 PAYMENT

C. Payment for Work associated with this Section shall be made in accordance with each Job Order that includes such Work, and the Contract.

1.3 REFERENCES

D. FEMA Technical Bulletin 3-93 - Non-Residential Flood Proofing.

E. AWS Structural Welding Code.

F. ASME Liquid Penetrant Inspection Section VIII.

G. SEI/ASCE 24 Floor Resistant Design and Construction.

1.4 DESIGN REQUIREMENTS

H. The Contractor shall supply the fabricated flood barriers and panels as per the Contract Drawings and as follows:

1. Design watertight planks to perform under hydrostatic loads (and hydrodynamic or other loads as specified) to control short-term load pressures indicated. All

water pressure loads and operating loads are transferred to the flood wall structure.

2. Design loads considered shall be in accordance with FEMA Technical Bulletin 3-93 - Non-Residential Flood Proofing and SEI/ASCE 24 Flood Resistant Design and Construction Requirements.

1.5 QUALITY ASSURANCE AND QUALIFICATIONS

I. Shop Inspections

1. Shop inspections may be made by Battery Park City Authority or its representative.

2. The Contract shall give ample notice to the Engineer prior to the beginning of any fabrication, so that the inspection may be made.

3. The Battery Park City Authority and/or its representative may conduct the following quality assurance inspection operations at the manufacturer's facility:

a. Visual inspection of welding, as per AWS D1.6.

b. Visual and dimensional inspection welding of completed work.

J. Manufacturer Experience: The manufacturer shall provide information supporting at least five (5) years of experience in the design and manufacture of the product specified.

1.6 SUBMITTALS

K. The Contractor shall prepare and submit to the Engineer for approval, shop drawings and other material required to substantiate conformance in accordance with Vol. III General Requirement 01330 – Submittal Procedures.

L. Shop drawings shall be sealed and signed by a NYS Registered Professional Engineer.

M. Shop drawings shall include but not be limited to:

1. Dimensioned plans and elevations, sections, connections and anchorage, and parts list.

2. Calculations: Submit calculations, approved by a NYS Registered Professional Engineer, to verify the barrier's ability to withstand the design pressure loading.

3. Certified weld inspection reports.

4. Copies of certified materials test reports, both chemical and physical and test report for susceptibility to intergranular corrosion of the stainless steel material, as applicable.

5. The manufacturer's specifications, load table, installation instructions, setting drawings and templates for location and installation of miscellaneous metal items, appurtenances and anchorage devices.

N. The following samples shall be furnished: Representative samples of bolts, anchors, inserts, gasket types, floor barrier finishes, flood barrier numbering tags

as requested by the Engineer. The Engineer's review shall be for type and finish only.

O. List of material manufacturers with the components provided, including but not limited to mill test reports.

1.7 DELIVERY, STORAGE AND HANDLING

P. Shall be transported, handled and stored without being over-stressed, deformed or otherwise damaged and as per the manufacturer's instructions and recommendations.

Q. Coatings shall be applied in the shop; the units are to be delivered ready for installation.

PART 2 PRODUCTS

1.8 MANUFACTURERS

A. Flood Panels and Barriers shall be manufactured by:

1. Presray Corporation, Wassaic, NY
2. Flood Control International, NY
3. Flood Panel, Jupiter, FL
4. PS Flood Barriers, Grand Forks, ND
5. Hydro Gate, New York, NY
6. Flood Barrier Inc., Miami, FL
7. Or approved equal.

1.9 MATERIALS/EQUIPMENT (FACTORY FABRICATED STACKABLE BARRIER)

B. Flood barrier shall be Model Fastlog STM-SD as manufactured by Presray Corporation, Model FloodLog Flood Barriers as manufactured by Flood Panel, or approved equal.

C. Stop Logs: aluminum channels or planks.

D. Frames: Jamb Extrusion; no sills necessary unless mandated by the manufacturer's engineer. Steel jambs optional for certain conditions.

E. Finish: Stop logs mill-finish aluminum; jambs mill-finish aluminum. Stop log assembly including jambs shall be clear anodized-finish aluminum.

F. Gasket: High-density closed cell neoprene sponge with skin, retained in the stop logs and jambs.

G. Hardware: compression brackets; hold down brackets; turn knobs.

H. Design:

1. Stop logs shall be designed with a minimum 2:1 factor of safety based on material yield strength, and shall provide an effective seal against the design flood level.
2. Frame shall have mounting holes for concrete anchors and bolts (options available include epoxy anchors for block walls, and studs for embedment in concrete).
3. The barrier shall be designed such that it attaches to the wet side of the building envelope and load is transferred from the flood panel or barrier to the existing construction through bearing.
4. Stop logs shall have lifting handles for ease of operation during deployment. Stop logs shall have optional use of installation equipment.
5. Lifting device shall be provided to remove and install the stop logs as specified herein. The lifters shall be extendible so that they will function with different stop log plank lengths. The device shall be oriented in its position by the stop log plank guides and shall be capable of securing and releasing the stop logs with the use of a lanyard from the operating floor.
6. Stop logs shall be stenciled with identification for ease of use in deployment. Bottom logs shall be stenciled

1.10 MATERIALS/EQUIPMENT (FACTORY FABRICATED FLOOD PANEL)

I. Flood barrier shall be Model CG22 as manufactured by Presray Corporation, Flood Panel System/Puddle Panel as manufactured by Flood Panel or approved equal.

J. Materials:

1. Panel: 6061 – T6 aluminum plate.
2. Finish: Bright Aluminum Finish.
3. Gasket: Low compression set type molded (extruded gaskets not acceptable).
4. Hardware
   a. Attachment bolts: stainless steel bolts.
   b. Grab Handles: Welded lift attachments on face of panel.
   c. Design.

K. Flood barrier(s) shall be designed with a minimum 2:1 factor of safety based on material yield strength, and shall provide an effective seal against the design flood level.

L. Panel shall be designed for installation using expansion anchors and bolts.

1.11 FLOOD PANEL AND BARRIER STORAGE

M. The Contractor shall install flood panel and barrier storage containers.

N. Location and details of storage containers shall be coordinated with the Operating Bureau and be submitted to the Engineer for approval prior to installation.

O. Storage shall consist of but not limited to the following:

1. Storage containers with interior racking systems along the interior of the container, capable of withstanding equipment weight.
2. Storage containers shall be compatible with forklift access.
3. Storage locations within storage container shall be labeled clearly to indicate the name and deployment location of the flood barriers.

1.12 SOURCE QUALITY CONTROL

P. The manufacturer shall have and perform quality control operations based on a written quality control program that includes the following:

1. Review and rejection of incoming materials based on certified test reports and visual inspections.
2. Frequency of inspection and inspection requirements.
3. All quality control inspection reports shall be dated and maintained by the flood panel/barrier manufacturer for a minimum period of seven years.
4. All prototype test records for custom flood panels/barriers and all production test records shall be dated and maintained by the flood panel/barrier manufacturer for a minimum period of seven (7) years.
5. All prototype test records for the manufacturer's standard flood panel/barrier designs shall be permanently archived.

PART 3 EXECUTION

1.13 FACTORY TESTING/QUALITY CONTROL

A. Finished assembly or assembly similar in design shall be factory leak tested to verify that it will withstand the design hydrostatic pressure.

B. All welds on flood barrier assemblies that may be potential "leak path" shall be liquid penetrant inspected in accordance with ASME section VIII Div. of Appendix 8.

C. The Contractor shall conduct a full-size test on one pre-engineered modular flood barrier, using the project's design loading criteria and performance criteria. It is acceptable to conduct the test at an offsite facility, providing that similar boundary conditions and criteria stated are followed.

D. Contractor shall correct any deficiencies revealed during testing at no additional cost to the Battery Park City Authority. Additional testing and inspection shall be at the Contractor's expense to demonstrate compliance with the above requirements.

1.14 SITE INSPECTION & FIELD VERIFICATION

E. The Contractor shall verify that the area to receive the barrier is properly prepared and set to the proper elevation.

F. Contract shall meet the requirements of the manufacturer's installation recommendations and approved shop drawings.

G. Do not begin installation until substrates have been properly prepared.

H. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

I. Field Testing:

1. Perform visual dry test for gasket alignment, continuity contact and pre-compression.

2. Construct temporary water barrier and test installed flood barrier.

3. The Contractor shall conduct a full-size test on one of the gates fabricated for the project using the project design hydrostatic and equivalent hydrodynamic load criteria – impact can be ignored for the test.

4. The barrier selected for testing should be representative of the most common conditions present in the final design. It is acceptable to conduct the test at the project site or at an offsite facility using similar boundary conditions.

5. The test leakage rate must be less than or equal to 0.1 gallons of water per minute per linear foot of sealed perimeter.

6. Contractor shall correct any deficiencies revealed during testing at no additional cost to Battery Park City Authority. Additional testing and inspection shall be at the Contractor's expense to demonstrate compliance with the above requirements.

7. Qualified factory representative shall provide eight (8) hours of training for facility Battery Park City Authority personnel. Representative shall complete a Certification of Proper Installation and provide copies to the Battery Park City Authority, Engineer, Contractor, and Manufacturing Facility.

J. Products to be operated and field verified including the sealing surfaces to assure that they maintain contact at the correct sealing points.

K. Verify that hinging and latching assemblies operate freely and correctly.

L. Verify all anchorage is in accordance with manufacture's installation instructions and applicable data sheets.

1.15 INSTALLATION

M. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by the manufacturer for optimum results. Do not install products under environmental conditions outside the manufacturer's absolute limits.

N. Coordinate Work with other operations and installation of adjacent materials to avoid damage.

O. Install in accordance with the manufacturer's installations instructions, approved shop drawings, shipping, handling, and storage instructions, and product carton instructions for installation.

P. Flood panel or barrier shall be installed on the wet side of the building envelope

Q. Flood panel/barrier(s) and their components shall be adjusted for proper alignment and operation.

R. Touch-up, repair or replace damaged installed products or components.

S. Clean all sealing surfaces.

T. Protect installed products until completion of project.

END OF SECTION 083919

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following exterior substrates:

1. Concrete.
2. Steel and iron.

B. Related Requirements:

1. Section 05100 "Structural Steel" for preparation of metal substrates.

1.3 DEFINITIONS

A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

D. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

E. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

F. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
2. Indicate VOC content.

B. Samples for Selection: For each type of topcoat product.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Landscape Architect will select one surface to represent surfaces and conditions for application of each paint system.
   a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
2. Final approval of color selections will be based on mockups.
   a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Landscape Architect at no added cost to Owner.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Landscape Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Sherwin Williams.

B. Approved equal.

C. Products: Subject to compliance with requirements, provide product listed in the Exterior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. Colors: As selected by Landscape Architect from manufacturer's standard full range .

2.3 PRIME COAT

A. Fast-cure polyamide epoxy.

B. Product: Macropoxy 646-100 Fast Cure Epoxy, as manufactured by Sherwin Williams.

C. Finish: Semi-gloss.

2.4 TOP COAT

A. Polyester modified, aliphatic, acrylic polyurethane.

B. Product: Acrolon 218 HS Acrylic Polyurethane as manufactured by Sherwin Williams.

C. Finish: Semi-gloss.

2.5 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Landscape Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

3.3 APPLICATION

A. Paints shall be shop-applied. Touch-up painting on site is authorized.

B. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Landscape Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 EXTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Steel Substrates:

1. Acrylic System :
   a. Prime Coat: Primer, alkali resistant, water based.
   b. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5).

END OF SECTION 099113

SECTION 31 10 00 - SITE CLEARING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This section covers all those measures required during the Contractor's initial move onto the site to protect existing fences, facilities, and associated improvements, and utilities adjacent to the construction areas from damage due to boulders, trees or other objects dislodged during the construction process; clearing, grubbing and stripping.

1.2 RELATED SECTIONS

A. The following is a list of Specifications which may be related to this section:

1. Section 31 20 00 - Earth Moving
2. New York City Building Code (NYCBC), Latest Edition
3. New York City Department of Transportation (NYCDOT)
4. Manual of Uniform Traffic Control Devices (MUTCD), recent edition
5. New York State Department of Transportation (NYSDOT)
6. OSHA Safety and Health Standards for Construction 29 CFR 1926

1.3 REFERENCE

A. The Geotechnical Engineering Report.

1.4 ACTUAL SITE CONDITIONS

A. The Contractor shall determine the actual condition of the site as it affects this portion of the Work.

B. Site preparation shall not damage existing structures or cause obstruction and/or contamination to the property. The Contractor shall repair or replace any damaged property at no cost to the BPCA.

C. While work is being performed, the Contractor shall provide adequate access to all operating equipment for routine operation and maintenance. The Contractor shall erect and maintain fences, warning signs, barricades, and other devices as required for the protection of the Contractor's employees and the BPCA’s personnel at the job site. The Contractor shall remove all such protection when the earthwork operations are completed, or as directed by the Engineer.

1.5 SUBMITTALS

A. Submittals for items specified herein shall be submitted by the Contractor and shall be in accordance with the Contract Documents.

B. A copy of this specification section, with any addendum updates included, and all referenced and applicable sections, with any addendum updates included, shall be submitted with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (□) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. The submittal shall be accompanied by a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

C. Submittals shall be provided to confirm that materials to be used comply with information specified herein.

D. The Contractor shall submit to the Engineer a schedule of proposed disposal locations and written authorization from disposal site owner.

E. The Contractor shall submit Work Plans and Safety Measure Drawings.

F. The Contractor shall submit a pre-construction survey of the area of work including existing topography, above grade structures, and below grade structures and utilities within the area of work.

1.6 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.
3. Provide a Maintenance and Protection of Traffic Plan (MPT) in accordance with the latest NYC and NYS DOT standards for work in the right-of-way.

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by the Engineer.

C. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises as directed by the Owner.

D. Utility Locator Service: Notify utility locator service Dig Safe System and One Call for area where Project is located before site clearing.

E. Do not commence site clearing operations until temporary erosion- and sedimentation-control and tree-protection measures are in place.

F. Tree- and Plant-Protection Zones: Protect according to requirements on the contract drawings and in Section 015639 "Temporary Tree and Plant Protection."

PART 2 PRODUCTS

2.1 SAFETY BARRIERS

A. The proximity of the Work to the Right-of-Way (ROW) and existing structures will require construction of appropriate safety barriers such as temporary fencing, berms, or similar facilities.

B. To minimize disturbance to pedestrians and/or vehicular traffic, safety barriers or fencing shall allow for operation of construction equipment and staging of materials associated with this Work.

C. The Contractor shall prepare a submittal to the Engineer with Contract Drawings that define the proposed safety measures prior to any construction activity.

D. All work shall be performed in conformance with the rules and regulations pertaining to safety as established by NYCDOT and OSHA.

PART 3 EXECUTION

3.1 CLEARING, GRUBBING, AND STRIPPING

A. Where existing utilities interfere with the Work, the Work shall be stopped, and the Engineer and BPCA shall be notified of interferences before restarting the work in accordance with the Contract Documents.

B. All construction areas shall be cleared of structures, concrete or masonry debris, landscaping, trees, logs, upturned stumps, grass, weeds, loose boulders, and any other objectionable material of any kind which would interfere with the performance or completion of the Work, create a hazard to safety, or impair the Work's subsequent usefulness or obstruct its operation.

C. Loose boulders within 10 feet of the top of cut lines shall be incorporated in landscaping or removed from the site. Trees and other natural vegetation outside the actual lines of construction shall be protected from damage during construction.

    a. Within the limits of clearing, the areas below the natural ground surface shall be grubbed to a depth necessary to remove all stumps, roots, buried logs, and all other objectionable material.

D. Cleanouts and connection lines and any other underground structures, debris or waste shall be totally removed if they are found on the site. All objectionable material from the clearing and grubbing process shall be removed and disposed of according to the governing regulations.

E. Additional requirements for excavating or removing existing facilities and soil are shown on the Contract Drawings.

F. Unless otherwise shown or specified, native trees larger than three inches in diameter at the base shall not be removed without the Engineer's approval.

G. The removal of any trees, shrubs, fences, or other improvements outside of the limits of construction as deemed necessary by the Contractor, shall be arranged and authorized by BPCA.

H. Trees and shrubbery adjacent to the trench, pole lines, fences, signs, survey markers and monuments, buildings and structures, conduits, pipeline under or above ground, all roadway facilities and any other improvements or facilities within or adjacent to the work shall be protected from injury or damage, and, if ordered by the Engineer, the Contractor shall provide and install suitable safeguards approved by the Engineer to protect such objects from injury or damage.

I. Serious injuries to trees to remain shall be avoided. No major roots or branches crossing the trench shall be cut if such cutting would seriously injure or imperil the safety of the tree or trench. All limbs, roots or branches, which are cut or broken, shall be trimmed and painted with an approved tree seal. If other objects are injured or damaged by reason of the Contractor’s operations, they shall be replaced or restored, at the Contractor’s expense, to the condition at the time the Contractor entered upon the work.

J. The Engineer shall be notified when site preparation work is completed.

3.2 REGRADING AND SUBGRADE PREPARATION

A. In areas to receive fill, the stripped surface should be scarified to a depth of about 6 inches below the excavated level, conditioned to near optimum moisture content and proof-rolled to the inspection and satisfaction of the Engineer.

B. Any holes remaining after stripping and grubbing shall be backfilled unless they are located within an area designated for further excavation or over-excavation and replacement.

C. Subgrade preparation, backfill material and placement shall be in accordance with Section 31 20 00 - Earth Moving.

3.3 DISPOSAL OF DEBRIS

A. Dispose of removed materials, waste, trash, and debris in a safe, acceptable manner, in accordance with applicable laws and ordinances and as prescribed by authorities having jurisdiction.

B. Burying of trash and debris on the site will not be permitted.

C. Burning of trash and debris at the site will not be permitted.

D. Remove trash and debris from the site daily so that its presence will not delay the progress of the Work.

E. Removed materials, trash, and debris shall become the property of the Contractor and shall be removed from the BPCA's property and disposed of in a legal manner. Location of disposal site and length of haul shall be the Contractor's responsibility.

3.4 UTILITY INTERFERENCE

A. If an existing utility is not indicated on the Contract Drawings but is encountered during the Work, the Contractor shall notify the Engineer and BPCA for further direction.

B. The determination to relocate or reroute conflicting utilities will originate from BPCA and will be reported to the utility owners for acknowledgement and permission.

3.5 RELOCATION AND REPLACEMENT

A. Where existing above-ground items and structures interfere with the Work and require relocation and/or replacement, the Contractor shall replace or relocate the items to as close as their original condition.

END OF SECTION 310000

SECTION 311500 - EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 THE REQUIREMENT

A. The Work specified in this Section includes shoring systems for the support of excavations including, but not limited to, trench and structure excavations. The Contractor shall design, furnish, install, and remove upon completion of the required construction, unless shown otherwise, all systems of supports, including all bracing and associated items to retain the sides of the excavations. The Contractor shall be responsible for the selection of methods, the design, construction and removal of all shoring systems. Shoring shall be required.

B. Design of ground support system and methods should be the sole responsibility of the Contractor. The Contractor's ground support plan must take into consideration the subsurface conditions at the site. The Contractor should independently evaluate ground support systems and make his own selection of appropriate ground support techniques which meet the project requirements. The ground support and dewatering system are interdependent and, as such, the ground support and dewatering systems shall be submitted by the Contractor at the same time for review.

C. The provisions specified hereunder shall be understood:

1. To complement, and not to substitute or diminish, the obligations of the Contractor for the furnishing of a safe place of work pursuant to the provisions of the Occupational Safety and Health Act of 1970 and its subsequent amendments and regulations and for the protection of the Work, structures, and other improvements.
2. To represent a minimum requirement:

    a. For the number and types of means needed to maintain soil stability,
    b. For the strength of such required means, and
    c. For the methods and frequency of maintenance and observation of the means used for maintaining soil stability.

D. Excavation support shall include sheeting, shoring, bracing, and other means and procedures required to maintain the stability of soils

E. Excavation supports shall be provided:

1. Where, as a result of excavation work and an analysis performed pursuant to general Engineering design practice,

    a. The excavated face or surrounding soil mass may be subject to slides, caving, or other type of failure, or

b. The stability and integrity of structures and other improvements may be compromised by settlement or shifting of soils.

2. For trench and pit (shaft) walls as required per New York OSHA.
3. As required per New York OSHA Construction Safety Orders, Article 6 and OSHA 29 CFR 1926 (Occupational Safety and Health Standards- Excavation; Final Rule).

F. The Contractor shall obtain any necessary permits from the New York City, Division of Industrial Safety. The Contractor shall pay all costs in connection with said permits and proof of such permits shall be submitted to the Engineer prior to commencing trench work.

G. Trench shoring and bracing shall conform to provisions in Section 5-1.02A, "Trench Excavation Safety Plans", of the New York Standard Specifications and to the specification herein. If a conflict exists between the New York Standard Specifications and specifications herein, the more stringent shall apply.

H. Related to "Sheeting, Shoring, and Bracing":

1. In accordance with the provisions of the governing body and BPCA
2. Each bidder shall list, in the bid item indicated, the amount included in his/her bid for trench and excavation, adequate sheeting, shoring and bracing, or equivalent method for the protection of life and limb, work that shall conform to applicable New York City Construction Safety Orders. By listing this sum in his/her bid, the bidder warrants that his/her action does not convey tort liability to the BPCA, the BPCA’s officials or employees, the Design Engineer, or the Contractor.

I. Related to " Bidder Responsibility":

1. Carefully study all reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site that have been identified and carefully study all reports and drawings of a Hazardous Environmental Condition, if any, at the Site, that may have been identified.
2. Provide, obtain, and carefully study (or assume responsibility for doing so) all additional, independent, or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and underground facilities) at or contiguous to the Site that may affect cost, progress, or performance of the Work or that relate to any aspect of the means, methods, techniques, sequences, and procedures of construction expressly required by the Project Manual and safety precautions and programs incident thereto.
3. Retain and use the services of one or more registered professional Engineers with expertise in geotechnical Engineering for analyzing the "technical data" contained in the geotechnical report and making recommendations related to means, methods, techniques, sequences, and procedures of construction that may be affected by job site soils conditions. Such means and methods shall include, but shall not be limited to: control of groundwater,

surface water, and excavation drainage, excavation, sheeting, shoring, bracing, backfill, compaction, construction equipment, temporary construction facilities, and other construction-related procedures.

4. Agree at the time of submitting its Bid that no further examinations, investigations, explorations, test, studies, or data are necessary for the determination of its Bid for performance of the Work at the price bid and within the times and in accordance with the other terms and conditions of the Project manual.

J. Related Sections

1. Division 31 Section 312319 - Dewatering
2. Division 31 Section 312000 - Earth Moving

1.2 STANDARDS AND REGULATIONS

Except as modified by the governing codes and by the Contract Documents, comply with the applicable provisions and recommendations of the following:

A. Occupational Safety and Health Administrative Code.

B. Manual of Steel Construction, AISC, 9th Edition.

C. American Society of Testing and Materials (ASTM) standards, latest editions.

D. The Contractor's attention is directed to the provisions for "Shoring and Bracing Drawings"

E. The Contractor, prior to beginning any trench, pit, or structure excavation, shall submit to the Engineer and shall be in receipt of the Engineer's written acceptance of the Contractor's detailed plan showing design of all shoring, bracing, sloping of the sides of excavation, or other provisions for worker protection against the hazard of caving ground during the excavation of such trenches or structure excavation.

F. Plans shall be prepared and sealed by a Civil or Structural Engineer registered in the City of New York.

1.3 DESIGN CRITERIA

A. In all areas, the shoring system, including all the components, shall be designed by the Contractor to support earth pressure (saturated and unstaturated), hydrostatic pressures, utility loads, equipment, applicable traffic and construction loads, and other surcharge loads in such manner as will allow the safe and expeditious construction of the permanent facilities without movement or settlement of the ground and will prevent damage to or movement of adjacent structures and utilities.

B. Shoring systems shall meet the following minimum performance requirements and design criteria.

1. Comply with all governing regulations pertaining to excavation safety (e.g., the most current edition of New York/OSHA construction safety orders, article 6).
2. Be compatible with the surface and subsurface soil and groundwater conditions mapped and encountered and resist lateral earth pressures and hydrostatic pressures (where not dewatered).
3. Protect personnel that enter the excavation.
4. Protect existing utilities, pavements, and structures.
5. Installation of the shoring system must occur in a manner and sequence that does not damage existing structures, pavements, and utilities including through settlement, heave or vibrations.
6. Prevent caving (i.e., raveling, running, or flowing) or lateral movement of excavation walls and associated loss of adjacent ground and adjacent ground surface settlement, even when subjected to construction vibrations.
7. Provide stable excavation walls and bottom (e.g., prevent bottom heave).
8. As permitted by the specifications, allow for removal or abandonment of shoring in a manner and sequence that (1) is in step with the backfilling sequence (i.e., shoring should not be removed ahead of backfilling) and (2) does not damage the finished utility line or structures or existing structures, pavements, and utilities including through settlement, heave or vibrations.
9. Resist lateral earth pressures including those from hydrostatic pressures and lateral loads from vehicular traffic, construction equipment and spoils.
10. Allow construction of thrust blocks in jacking shafts adequate to resist anticipated jacking forces with appropriate safety factors.
11. Special shoring and/or ground improvement, including grout stabilization may be required and designs shall be provided by the Contractor, where excavations are in close proximity to structures, utilities, or unlined drainage to minimize potential excavation-related damage. Special shoring and/or ground improvement designs shall be required where excavations are:

    a. Within an imaginary plane protected downward at an inclination of 2H:1V from the nearest foundation edge or utility line.
    b. Below the depth of flow within adjacent unlined drainageways.
    c. Experiencing flowing, running and/or raveling ground conditions (i.e., soils with little to no stability or support).

12. The Contractor shall design each member to support the maximum loads that can occur during construction. For the purpose of this Section, the design load means the maximum load the support member of the shoring system will have to carry in actual practice.
13. The submittals shall provide Contractor's Shop Drawings and design calculations for each stage of the excavation including installation and removal of the shoring system. The Contractor shall submit all design assumptions and design criteria, as well as references for the design criteria and assumptions used. The strut preloading procedure, including information on the jacking system and calibration data for the hydraulic jacks, shall also be submitted for review.

14. The Contractor shall design the bottom of the support system to be carried to a depth below the main excavation adequate to prevent excessive bottom heave, lateral and vertical movements, and ensure stability of the excavation.
15. Review of the Contractor's plans and methods of construction shall not relieve the Contractor of the sole responsibility of providing an adequate support system to support all load configurations encountered to complete the required work.
16. The struts shall be preloaded to 50 percent of the design load. Preloading shall be accomplished by jacking between the struts and wales. Provisions shall be made for permanently fixing each member, after preloading, with steel shims or wedges welded in place. Wood wedges shall not be allowed.
17. The sequence of excavation, installation, and removal of the shoring and preloading of the struts shall be carried out in a manner that lateral movement and settlement of the soil surrounding the excavations is minimized.
18. The vertical spacing of the struts shall not exceed 10 ft.

C. It is the Contractor's responsibility to review the existing underground utilities to make his own interpretation regarding the ground conditions as described in the referenced report, and to make any other additional surveys and/or borings he believes are necessary to determine the types and extent of bracing and shoring systems required to accomplish the Work. All of the foregoing costs shall be included in the Contractor's total price for performing the Work.

D. Sloped excavations shall not be permitted, unless otherwise approved by the Engineer.

1.4 CONTRACTOR SUBMITTALS

A. Submittals for items herein shall be submitted by the Contractor and shall be in accordance with the Contract Documents.

B. A copy of this specification section, with any addendum updates included, and all referenced and applicable sections, with any addendum updates included, shall be submitted with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph.

C. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. The submittal shall be accompanied by a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

D. Submittals shall be provided to confirm that material to be used comply with information specified herein.

E. Contractor’s Shop Drawings. The Contractor shall submit Contractor’s Shop Drawings of temporary excavation support systems. The Contractor’s Shop Drawings shall be prepared and sealed by a Civil or Structural Engineer registered in the New York City.

1. The Contractor, prior to beginning any trench or structure excavation more than 5 ft deep shall submit to the Engineer a detailed plan showing design of all shoring and bracing of the sides of excavation, or other provisions for worker protection against the hazard of caving ground during the excavation of such trenches or structure excavation. The Contractor's attention is directed to the provisions for "Shoring and Bracing Drawings" in Section 6705 of the New York Labor Code. Plans shall be prepared by a Civil or Structural Engineer licensed in the New York City.
2. The Contractor shall prepare and submit drawings and supporting calculations showing proposed shoring systems. The submittals shall include details, arrangement, and method of construction for the proposed shoring systems including levels of struts and shores, as applicable and permissible depth to which excavation may be carried before such supports are installed. Show full excavation depth load to be carried by various members of the support system, and, if required, the preloads. Design calculations shall include design surcharge loads and calculated deflections of shoring and support members. Drawings and calculations shall be prepared by a Civil or Structural Engineer licensed in the New York City.
3. The Contractor shall submit proposed method of installing shoring including the sequence of driving, template, and driving equipment description. The proposed construction sequence including strut placement and strut and shore removal as related to excavation, construction, and backfilling operations shall be shown.

F. All expenses incurred in performing the Work described in this Section shall be borne by the Contractor.

1.5 JOB CONDITIONS

A. Provision for Contingencies:

1. The Contractor shall provide contingency plans or alternative procedures to be implemented if unfavorable shoring system performance is evidenced.

2. The Contractor shall keep on hand materials and equipment necessary to implement contingency plan or alternate procedures

B. The Contractor shall proceed with caution in areas where utilities are within the shoring and excavation prism. Such utilities shall be exposed by hand excavation or other methods acceptable to the BPCA.

C. If existing utilities interfere with proposed method of support, the Contractor shall modify the support system at his own expense.

1.6 TOLERANCE

A. Location of the necessary shoring shall be within 3 inches of that shown on the Contractor's Shop Drawings.

B. In the areas adjacent to existing facilities, the excavation shoring system shall deflect vertically and/or horizontally no more than 1 inch from its original position.

1.7 RELATED REPORTS

Geotechnical Engineering Report of this project.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All timber and structural steel used for the supporting system, whether new or used, shall be sound and free from defects that may impair their strength.

B. If used, sheet piling shall be of a continuous interlocking type forming a continuous wall. Sheet piling and all accessories shall conform to the requirements of ASTM A328.

C. Trench boxes can also be used in lieu of sheet piling and will need to be installed per manufacturer's specifications .

D. Structural steel members shall be designed in accordance with the Manual of Steel Construction. Timber members shall be designed in accordance with the Uniform Building Code.

PART 3 - EXECUTION

3.1 STEEL SHEET PILING (IF USED)

A. The Contractor shall drive sheet piling in plumb position with each pile interlocked with adjoining piles for its entire length so as to form a continuous diaphragm throughout the length of each run of wall, bearing tightly against original ground.

B. The Contractor shall exercise care in driving to avoid damage to existing utilities so that interlocking members can subsequently be extracted without injury to adjacent fills or existing utilities.

C. The methods of driving, cutting, and splicing shall conform to the Contractor's Shop Drawings.

D. The Contractor shall maintain a sufficient quantity of material on hand for sheeting, shoring, bracing, and other operations for protection of work and for use in case of emergency.

E. Sheet pile driving shall be restricted to the hours between 8:00 a.m. and 5:00 p.m.

3.2 INTERNAL BRACING SUPPORT SYSTEM

A. The Contractor shall provide internal bracing support system including lagging and sheeting, sheet piles, wales, struts, and/or shores.

1. All struts with intermediate bracing shall be provided as needed to enable them to carry maximum design load without distortion or buckling.

2. All web stiffeners, plates, or angles shall be provided as needed to prevent rotation, crippling, or buckling of connections and points of bearing between structural steel members that allow for eccentricities caused by field fabrication and assembly.

B. The Contractor shall install and maintain all bracing support members in tight contact with each other and with the surface being supported. Support system monitoring provisions shall be installed as indicated on the approved Contractor's Shop Drawings.

C. If necessary to control shoring movement, the Contractor shall preload bracing members by jacking struts to 50 percent of the design load. Preload bracing members shall be loaded in accordance with methods, procedures, and sequence as described on the approved Contractor's Shop Drawings. Excavation work shall be coordinated with the installation of bracing and preloading. Steel shims and steel wedges welded or bolted in place to maintain the preloading force shall be used in the bracing after release of the jacking equipment pressure.

1. Procedures that produce uniform loading of bracing members to avoid eccentricities or overstressing and distortion of members of wall system shall be used.

2. Preloading systems shall include a method to measure the amount of preload induced into bracing members to within 5 percent.

D. Excavation shall proceed to no more than 2 ft below the point of the support about to be placed. The support shall be installed and preloaded immediately after installation and prior to continuing excavation.

3.3 REMOVAL OF SUPPORTING SYSTEM

A. The Contractor shall remove all shoring, including sheet piles, wales, struts, lagging and shores from the excavation unless indicated otherwise on the Drawings. Removal of the supporting system shall be performed in a manner that will avoid damage of adjacent construction or facilities. All voids created by the removal of the supporting system shall be immediately filled with well-graded cohesionless sand, lean concrete or sand cement grout.

3.4 ORITECT EXISTING UTILITIES

A. Contractor shall shore and protect existing utilities when working on or adjacent to such utilities.

3.5 INSTALLATION

A. Excavation support shall be installed as indicated in the approved submittals.

B. Excavations, including trenching, shall not begin until the excavation support submittals have been accepted and until the materials necessary for the installation are on site.

END OF SECTION 311500

SECTION 31 20 00 - EARTH MOVING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This Section covers all earthwork required for construction of the new Flood Wall. Such earthwork shall include, but not be limited to the loosening, removing, loading, transporting, depositing, and compacting in its final location of all materials wet and dry, as required for the purposes of completing the new Flood Wall specified in the Contract Documents and/or Contract Drawings (including Contract Drawings). The new Flood Wall shall also include the supporting of structures (such as fencing) and utilities (such as drainage and corrosion protection utilities, where warranted) above and below the ground, all backfilling around structures and utilities and all backfilling of trenches and pits, the disposal of excess excavated materials, borrow of materials to make up deficiencies of fill/s, and all other incidental earth works, all in accordance with the requirements of the Contract Documents and/or Contract Drawings.

1.2 RELATED SECTIONS

A. The following is a list of Specifications which may be related to this Section:

1. Section 31 10 00 - Site Clearing
2. Section 31 50 00 - Excavation Support and Protection
3. Section 31 23 19 - Dewatering
4. Section 03 30 00 - Cast-in-Place Concrete

1.3 REFERENCE

A. Geotechnical Engineering Report and Supplemental Memorandum Reports

B. The following is a list of standards which may be referenced in this Section:

1. New York City Building Code (NYCBC), Latest Edition
2. New York City Department of Transportation (NYCDOT)
3. New York State Department of Transportation (NYSDOT)
4. OSHA Safety and Health Standards for Construction 29 CFR 1926
5. Manual of Uniform Traffic Control Devices (MUTCD), recent edition
6. United States Army Corps of Engineers (USACE) Specifications and Design Manuals:

a. EM 1110-2-2104, Strength Design for Reinforced Concrete Hydraulic Structures
b. EM 1110-2-2105, Design of Hydraulic Steel Structures
c. EM 1110-2-2502, Retaining and Flood Walls
d. EM 1110-2-2705, Structural Design of Closure Structures for Local Flood
e. EM 1110-2-1901, Seepage Analysis and Control for Dams
f. EM 1110-2-2100, Stability Analysis of Concrete Hydraulic Structures

7. American Society for Testing and Materials International (ASTM):

a. C330, Standard Specification for Lightweight Aggregates for Structural Concrete
b. D1556, Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
c. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 or 2,700 kN-m/m^3).
d. D2419, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
e. D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
f. D2844, Standard Test Method for Resistance R-Value and Expansion Pressure of Compacted Soils.
g. D3744, Standard Test Method for Aggregate Durability Index.
h. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
i. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
j. D4355, Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon-Arc Type Apparatus.
k. D4491, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
l. D4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
m. D4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
n. D4833, Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.

o. D5261, Standard Test Method for Measuring Mass Per Unit Area of Geotextiles.
p. D4533, Standard Test Method for Trapezoid Tearing Strength of Geotextiles.

q. D6938, Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.4 QUALITY ASSURANCE

A. The Contractor shall accomplish the specified compaction for backfill or other earthwork. Compaction testing will be provided by the BPCA or General Contractor at a testing laboratory of the BPCA or General Contractor's choice.

B. Where soil material is required to be compacted to a percentage of maximum density, the maximum density at optimum moisture content shall be determined in accordance with ASTM D1557.

C. Where cohesionless, free draining soil material is required to be compacted to a percentage of relative density, the calculation of relative density shall be determined in accordance with ASTM D4253 and ASTM D4254.

D. Particle size analysis of soils and aggregates shall be performed using ASTM D422.

E. Determination of sand equivalent value shall be performed using ASTM D2419.

F. The determination of aggregate durability index shall be made using ASTM D3744.

G. Existing asphalt or concrete cannot be buried.

H. No recycled materials shall be used.

I. Asphalt cannot be reused as fill.

J. Materials used within the NYS and NYC DOT right of way as base and subbase materials for pavement shall follow the latest specifications and standards of the governing agency.

1.5 QUALITY CONTROL

A. Field density in-place tests (special inspections) shall be performed in accordance with ASTM D1556, ASTM D6938, or by such other means acceptable to the Engineer. It is the responsibility of the Contractor to accomplish the specified compaction for earthwork.

B. The Contractor shall give the Engineer a minimum 24 hours' notice before requiring compaction testing services in the field. The Contractor will be charged for the cost of all re-tests where the tests do not meet the requirements of the Specifications.

C. In case the tests of the fill or backfill show non-compliance with the required density in the field, the Contractor shall accomplish such remedy as may be required to insure compliance. Subsequent testing to show compliance shall be by a testing laboratory selected by the BPCA or General Contractor and shall be at the Contractor's expense.

1.6 SUBMITTALS

A. Submittals for all material, and equipment items specified herein shall be submitted by the Contractor and shall be in accordance with the Contract Documents and/or Contract Drawings: The following is a list of material and work and shall by no means be exhaustive:

1. Geotechnical laboratory results of onsite subsurface soils, such as gradation analysis, compaction (modified proctor) at maximum dry density and optimum moisture, etc.
2. Mill certificate and geotechnical laboratory results of all imported fill/structural fill.
3. Specifications for soil excavating and compaction equipment (including gross vehicle weight).
4. Signed and sealed flowable fill mix design.

B. A copy of this Specification Section, with any addendum updates included, and all referenced and applicable Sections, with any addendum updates included, shall be submitted with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole.

C. If deviations from the Specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the Specifications.

D. The submittal shall be accompanied by a detailed, written justification for each deviation. Failure to include a copy of the marked-up Specification Sections, along with justification(s) for any requested deviations to the Specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

E. Submittals shall be provided to confirm that materials to be used are in full compliance with information specified herein.

F. The Contractor shall submit to the Engineer a schedule of proposed disposal locations and written authorization from disposal site owner, where soils and fill material are planned to be disposed of.

G. The Contractor shall submit their work safety plans (including means and methods), work safety measures drawings and other diagrammatic safety protocols pertaining to this work.

H. The Contractor shall submit equipment and material (such as fill) staging plans, including notes on work sequencing.

PART 2 PRODUCTS

2.1 SUITABLE MATERIALS GENERAL

A. Aggregate Base

1. Where applicable, Aggregate Base may be used to form a stable base ofr roadways and structures where needed.
2. Aggregate Base shall conform to the following gradation requirements:

Aggregate Base	
Sieve Size	Percent Passing
1-inch	100
¾-inch	90-100
No. 4	35 - 60
No. 30	10 - 30
No. 200	2- 9

3. Aggregate Base shall be hard, sound and durable gravel or crushed rock, which shall not slake or disintegrate in water. Recycled materials are not acceptable. It shall be free from vegetative or other organic matter and other deleterious substances and form a firm, stable base when compacted.

B. Coarse Bedding Material

1. Coarsely graded bedding material may be used as bedding material for foundations and other underground structures where drainage is considered.
2. Coarse bedding material should be clean, durable, crushed (i.e., angular) aggregate rock conforming to the following gradation requirements:

Coarse Bedding Material	
Sieve Size	Percent Passing
2-inch	100
1 ½-inch	95-100
¾-inch	5-30
⅜-inch	5-20
No. 200	0-4

C. Drain Rock

1. Drain Rock may be used for temporary path/roadways for heavy equipment.
2. Drain rock shall be ½-inch diameter crushed rock or gravel, durable and free from slaking or decomposition under the action of alternate wetting or drying.

The material shall be uniformly graded and shall meet the following gradation requirements:

3.

Drain Rock	
Sieve Size	Percent Passing
1-inch	100
¾-inch	90-100
⅜-inch	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

D. Gravel

1. Gravel shall refer to ½- or ¾-inch diameter clean crushed rock or gravel, durable and free from slaking or decomposition under the action of alternate wetting or drying.
2. The material shall be uniform in size and angular in shape.
3. Gravel may be used in conjunction with geotextiles to allow a less-thick placement for over excavations.

E. Flowable Fill

1. Flowable Fill (controlled low strength material) may be used to fill in voids encountered during excavation.

2. Flowable Fill mix shall be composed of a cementitious material, water, fine aggregate and an admixture. The cementitious material shall be Portland cement in combination with fly ash (if authorized by NYCDEP). The admixture shall be an air-entraining agent.
3. The proportions of all material used in the flowable fill shall conform to the specific mix design as intended by the Engineer.
4. Flowable Fill shall have an unconfined compressive 28-day strength from 50 psi (hand excavatability) to a maximum of 100 psi (backhoe excavatability).
5. The wet unit weight of the flowable fill shall be no greater than 100 pounds per cubic foot (pcf); the cured unit weight shall be no greater than 120 pcf
6. Consistency of the flowable fill shall be flowable and self-leveling, with slump from 6 to 10 inches.
7. Any aggregates which produce performance characteristics of the flowable fill may be submitted for approval. Flowable Fill mixture shall contain no aggregate that is larger than ⅜-inch.

8. The amount of material passing the No. 200 sieve shall not exceed 12 percent; no plastic fines shall be present.
9. The air content by volume based on measurement made immediately after discharge from the mixer shall be determined by ASTM C231 as is based on the specified cured unit weight.
10. Provide the Engineer with delivery tickets for each truck load that shows the flowable fill mix, the batch size and the time batched.

a. Cement shall conform to ASTM C150, Type II.
b. At NYCDEP's direction, concrete that is in contact with potable water shall not contain recycled content (fly ash) due to potential leaching issues shall conform to ASTM C618, Class F.
c. If authorized by NYCDEP, fly ash and other pozzolanic material admixtures may be added at a rate not to exceed 30 lb per 94 lb of cement. The admixture shall conform to ASTM C618:

i. Fly ash shall not inhibit the entrainment of air during application.
ii. Fly ash shall not leach into the groundwater.

d. Air entraining admixture shall conform to ASTM C260.

11. Flowable Fill shall be batched by a ready mixed concrete plant and mixed and delivered to the jobsite by means of transit mixing trucks.
12. Field testing of flowable fill shall be as specified for concrete based on ACI standards and the Contract Drawings.
13. No equipment or traffic shall be allowed on the flowable fill until the surface of the flowable fill will withstand the weight of equipment or traffic without displacement or damage. If necessary to prevent displacement or damage, provide steel trench plates that span the trench or other means that prevent equipment or traffic contact with flowable fill.

F. Lightweight Fill

1. Lightweight fill shall conform to ASTM Designation C330 Standard Specification for Lightweight Aggregates for Structural Concrete.
2. Lightweight aggregate shall have a proven record of durability and non-corrosive with the following properties:

a. The gradation should conform to the ASTM C330 Size Designation Coarse Aggregate, which is as follows:

Sieve Size	Percent Passing
1-inch	100
3/4-inch	80-100
3/8-inch	10-50
No. 4	0-15

No. 100	0-5

b. The dry, loose unit weight shall be less than 55 pcf. The Contractor shall verify a compacted density of less than 60 pcf, as measured in accordance with ASTM D-698 (the standard test methods of moisture-density relations of solid and aggregate mixtures using a 5.5 lb. hammer and 12-inch drop).

3. Lightweight fill shall be placed in layers not exceeding twelve (12) inches, measured prior to compaction. Lightweight fill behind the Flood Wall, where warranted, shall be compacted according to the manufacturer's Specification and shall not induce excessive stresses to the new Flood Wall.
4. Construction equipment, other than for compaction, shall not operate on the exposed lightweight fill.
5. The areas to be backfilled shall not have any standing water in it prior to placement of the lightweight fill.
6. Lightweight fill shall not be placed when frozen or on frozen material.
7. Lightweight fill shall have a pH between 6.5 and shall conform to ASTM C88 for soundness and durability.

G. Sand

1. Sand shall be free of organics and other deleterious materials.
2. Sand should be chemically inert and non-corrosive.
3. Sand may be backfilled as utility bedding or for purposes of leveling or setting.
4. Sand shall meet the following gradation requirements:

Sieve Size	Percent Passing
No. 4	95-100
No. 200	0-5

F. Native Material

1. Native Material may be reused if it meets the requirements below and only where native material is indicated for use on the Contract Documents and/or Contract Drawings:

a. Native soil below the stripped layer (topsoil or fill) and having an organic content of less than 3 percent by volume.

b. Native soil that does not contain rocks or lumps larger than 6 inches in greatest dimension with not more than 15 percent larger than 2.5 inches.

c. Native soil shall be considered unsuitable material as outlined below.

1) Unsuitable soils for fill material shall include, but not be limited to, all soils which when classified under ASTM D2487 fall in the classification of PT, OH, CH, MH, or OL.
2) In addition, any soil which cannot be compacted sufficiently to achieve the percentage of maximum density specified for the intended use shall be classified as unsuitable material.
3) Detrimental amounts of organic matter shall be no more than 5 percent. Amount of organic matter shall be determined based on ASTM Test Method D2974.
4) Materials containing rock or similar irreducible material with a maximum dimension greater than 6 inches.
5) Materials containing foreign manmade objects, such as construction debris.
6) Materials of such unstable nature as to be incapable of being compacted to specified density using ordinary methods at optimum moisture content.
7) Materials that are too wet to be properly compacted and circumstances that prevent suitable in-place drying prior to incorporation into the new Flood Wall. However, the presence of excessive moisture in a material is not, by itself, sufficient cause for determining that the material is unsuitable – this shall be assessed by the Geotechnical Engineer during earthmoving activities.
8) Materials that are unsuitable for the planned use as described in the Contract Documents and/or Contract Drawings.

2.2 USE OF FILL, BACKFILL, AND EMBANKMENT MATERIAL TYPES

A. The Contractor shall use the types of materials as designated herein and as shown on the Contract Documents and/or Contract Drawings for all required construction.

B. Fill, backfill, and embankment types shall be used in accordance with the following provisions:

1. Earthwork not included below or specified elsewhere shall be constructed of Fill Material as defined herein and within the Contract Documents and/or Contract Drawings.
2. Aggregate Base materials under pavements, sidewalk slabs, curb and gutters shall be constructed to the thicknesses shown or specified in the Contract Documents and/or Contract Drawings. Materials shall meet the requirements of NYC or NYS DOT.
3. Backfill materials beneath the Flood Wall foundations shall be as shown in the Contract Documents and/or Contract Drawings.
4. Trench backfill and final backfill for utilities under slabs shall be the same material as used within the pipe zone, except where concrete encasement is required by the Contract Documents and/or Contract Drawings.

PART 3 – EXECUTION

3.1 GENERAL

A. Excavations shall be shored and braced as set forth in the rules, orders, and regulations of the City of New York and OSHA. The Contractor's shoring and bracing and general trenching operation shall consider vehicular and other loads that may be applied near the edge of an open trench and shall be in accordance with Section 31 50 00 - Excavation Support and Protection.

B. Excavation shall include removal of all waters that interfere with the construction work. Dewatering shall be in accordance with Section 31 23 19 - Dewatering.

C. Excavated spoils not used for backfill in approved areas shall be dumped directly into trucks for hauling off the site.

D. Excavated spoils may be staged correctly with the appropriate slopes and at a height no higher than 6 feet at an authorized area within the site and covered/protected from the elements.

E. Staged and protected excavated spoils shall not obstruct pedestrian and worker passage within Right-of-Ways (ROW).

F. Dumping of excavated materials onto adjacent pavements will not be permitted.

G. Excavation widths for the installation of the new Flood Wall foundations and associated appurtenances is shown on the Contract Drawings.

H. Safe and convenient passage for pedestrians shall be provided during trench excavations. The Engineer may designate a passage to be provided at any point deemed necessary. Access to fire stations, fire hydrant, and hospitals shall be maintained at all times.

3.2 STRUCTURE, PAVEMENT AND UTILITY EXCAVATIONS

A. The Contractor shall submit an excavation plan for review before any excavation commences.

B. All excavations shall be protected and secured from pedestrian and vehicular traffic. This will entail the Contractor to provide appropriate fencing, concrete barricades, signage and other Maintenance and Protection of Traffic (MPT) controls.

C. Excavations near areas of pedestrian or vehicular traffic shall be open the minimum time necessary to complete the work but shall not exceed 4 days maximum before backfilling the trench or excavation.

D. Except when specifically provided to the contrary, excavation shall include the removal of all materials of whatever nature encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the new Flood Wall.

E. The removal of said materials shall conform to the lines and grades shown or ordered. Unless otherwise provided, the entire construction site shall be stripped of all vegetation and debris, and such material shall be removed from the site prior to performing any excavation or placing any fill.

F. All excavations shall be supported in a safe manner in accordance with applicable State safety requirements and the requirements of OSHA as specified herein.

G. All excavations shall be dewatered in accordance with Section 31 23 19 - Dewatering and shored in accordance with Section 31 50 00 - Excavation Support and Protection, if necessary.

H. Excavations shall be carried to a grade of 12 inches below the bottom of the foundation footing or key.

I. At all slabs on grade, the excavation shall be carried to a grade of 6 inches below the bottom of the slab.

J. Ample workspace within the protected excavation shall be provided.

K. Excavation under areas to be paved shall extend to the bottom of the Aggregate Base unless additional removal is required for removal of existing fill materials and unsatisfactory soils as outlined herein. After the required excavation has been completed, the exposed surface shall be scarified, brought to optimum moisture content and compacted.

L. Unless otherwise shown, ordered, or accepted by the Engineer, excavation for utilities shall be vertical trenches, shored if required, and shall be uniform width from top to bottom.

M. Existing utilities, manholes, drainage structures, and other facilities shall be protected, supported, and kept in service.

N. The bottom of the trench shall be excavated uniformly. The trench bottom shall be given a final trim, using a laser to set the string line for establishing grade, such that

each pipe section when first laid will be continually in contact with the ground along the extreme bottom of the pipe.

O. Rounding out the trench to form a cradle for the pipe will not be required. Bell holes shall be excavated in the pipe bedding material as required to ensure uniform bearing of the pipe barrel on the bottom of the trench.

P. If the maximum trench width is exceeded, the Contractor shall consult the Engineer immediately, and the Contractor shall provide additional bedding, another more stringent type of bedding, or higher strength pipe as directed by the Engineer at no additional cost to the BPCA or General Contractor.

Q. The maximum lengths of open trench permitted in any one location shall be the length necessary to accommodate the amount of pipe installed in a single day or 100 ft, whichever is lesser. The distance is the collective length at any location, including open excavation, pipe laying and appurtenance construction, and backfill that has not been temporarily resurfaced.

R. All trench excavations shall be fully backfilled at the end of each day, unless use of steel plates is permitted.

S. Use of steel plates as open trench covers are permitted with approval by the Engineer and the BPCA or General Contractor and as described below:

1. Trench plates will be allowed to cover a minimum area over the end of the last section of pipe installed each day, provided the trench is properly shored.
2. Temporary backfill of the trench in the plated area is not required.
3. When pedestrian or vehicular traffic plates are authorized, they shall be provided with non-skid coating and cold mix asphalt around the plate perimeter.

T. Where steel plates cannot be used, trenches shall be backfilled with an approved fill material (such as Gravel or Aggregate Base) and topped with temporary paving.

3.3 OVEREXCAVATION AND REPLACEMENT

A. Where actual conditions during Construction-Phase indicate that trenches shall be over-excavated and when directed by the Engineer, they shall be excavated to the depth as directed by the Engineer, and then backfilled/compacted to the grade of the bottom of the bedding.

B. If the bottom of the excavation is found to consist of soft or unstable material which is incapable of properly supporting the pipe or structure, the Engineer shall be advised immediately. At the Engineer's direction, such material shall be removed to the depth and for the lengths specified and the trench installed with the appropriate geotextile to

prevent migration of fines and backfilled to grade with Gravel or compacted Drain Rock.

C. When over-excavation is ordered by the Engineer, compensation will be provided to the Contractor.

1. The Contractor shall obtain the Engineer's written approval prior to over-excavating.
2. Any over-excavating and resultant backfill and compaction without such approval shall be at the Contractor's expense. The quantity of approved unsuitable material excavated and its replacement shall be paid for as extra work, as directed by the Engineer.

3.4 DISPOSAL OF EXCESS EXCAVATED MATERIAL

A. The Contractor shall remove and dispose of all excess excavated material in a legal manner at a site located off-site as selected by the Contractor and reviewed by the Engineer.

3.5 FOUNDATION SUBGRADE

A. All native soils and existing fills at the subgrade level shall be cleaned of deleterious materials, visually inspected and probed by the Engineer to determine if satisfactory for foundation support.

B. Where unsatisfactory soils and other deleterious material are encountered by the Contractor during excavation to the foundation subgrade elevations, removal and replacement shall be performed per the Overexcavation and Replacement Sections.

C. The subgrade soils beneath rigid concrete pavements and foundations shall be proof-rolled using the appropriate compaction equipment with the effective number of overlapping passes as noted in the Contract Drawings and/or as directed by the Engineer.

D. Prior to placing any concrete, subgrade soils shall be moisture conditioned between 2 and 5 percent above laboratory optimum moisture per ASTM D1557.

3.6 GENERAL BACKFILL OF MATERIALS

A. Backfill shall not be dropped at a significant height directly upon any structure or pipe.

B. Backfill shall not be placed around or upon any structure until the concrete has attained sufficient strength to withstand the loads imposed and has been in place for seven (7) days.

C. Backfill around water retaining structures shall not be placed until structure has been tested, and structures shall be full of water when backfill is being placed.

D. Except for materials being placed in over-excavated areas, backfill shall be placed after all water is removed from the excavation.

E. Backfill materials shall be placed and spread evenly in layers, loose depth 8 inches or less as specified herein.

F. During spreading of the backfill, each layer shall be thoroughly mixed as necessary to promote uniformity of material in each layer.

G. Where the backfill material moisture content is too low to permit the specified degree of compaction, water shall be added before or during spreading until the proper moisture content is achieved. Jetting will not be permitted for compaction.

H. Where the backfill material moisture content is too high to permit the specified degree of compaction, the material shall be dried until the moisture content is satisfactory.

I. Storage of backfill materials overnight at the job site is prohibited, unless stored in a designated stockpile area.

3.7 FLOOD WALL BACKFILL MATERIALS

A. Where at-grade foundation footprints transition from excavation backfill to the existing soil outside the excavation, existing soil shall be over-excavated to a minimum depth of three feet below the bottom of the foundation and backfilled with Aggregate Base and shall be in accordance with the requirements defined herein for removal of existing fill materials and weak soils and site preparation beneath all slab-on-grade and concrete foundations.

B. In localized areas, where there is not adequate space to properly compact backfill, Sand shall be used as backfill. Flowable Fill may be used to mitigate voids and other inaccessible areas where backfill and compaction cannot be performed effectively.

C. Fill material shall be spread and compacted in uniform horizontal lifts not exceeding 8 inches in loose thickness and to a minimum relative compaction as noted herein.

D. Original pavements (asphalt or concrete), tree stumps, roots, topsoil, organic soils, construction debris, garbage and other deleterious material cannot be left in place and backfilled over – these materials shall be removed completely before backfilling.

E. Flowable Fill shall be designed and placed using approved and accepted methods, at location where warranted by the Engineer (such as voids or around areas where backfill and compaction equipment is not possible).

3.8 UTILITY TRENCH BEDDING AND BACKFILL

A. Pipe zone backfill materials shall be manually spread around the pipe so that when compacted, the pipe zone backfill will provide uniform bearing and side support.

B. Sand or Coarse Bedding shall first be placed to a depth so that the pipe has support over its full length. Additional bedding material will be placed to a point no greater than ¼ of the pipe diameter. The bedding shall then be uniformly placed in maximum 6-inch thick loose lifts on each side of the pipe, thoroughly shovel-sliced into the haunch area of the pipe before the backfill is brought up to the spring line of the pipe. Above the spring line of the pipe, pipe zone backfill shall be brought up in 8-inch lifts to a point that is 12 inches over the top of the pipe; placed and compacted.

C. The pipe zone shall be backfilled with the specified backfill material as specified in the Contract Documents and/or Contract Drawings. The Contractor shall exercise care to prevent damage to the pipeline coating, cathodic bonds if present and the pipe itself during the installation and backfill operations.

D. Bell or coupling holes shall be provided. Do not shovel-slice bedding material into the bell or coupling hole.

E. After the pipe zone backfill has been placed as specified above, and after all excess water has completely drained from the trench, backfilling of the trench zone may proceed.

F. Trench zone backfill shall be placed in maximum 8-inch-thick loose lifts.

G. Where pipe embedment is disturbed after compaction, such as by the removal of sheeting and shoring, the BPCA or General Contractor may require recompaction to the specified minimum limit.

H. If the allowable deflection specified for the pipe is exceeded, the Contractor shall expose and re-round or replace the pipe, repair all damaged lining and coating, and reinstall the pipe zone material and trench backfill as specified at no additional expense to the BPCA or General Contractor.

3.9 COMPACTION OF ALL BACKFILL MATERIALS

I. If Aggregate Base is used as backfill around the wall foundations, it shall be compacted in lifts no greater than 8 inches in thickness to at least 95 percent of maximum dry density (i.e., relative compaction) and at a soil moisture content at or near optimum soil moisture. The maximum dry density and optimum moisture content shall be determined by ASTM D1557 test methods.

J. If Gravel is to be used as backfill around the wall foundations, minimal compaction by the appropriate equipment shall be used.

K. Compaction equipment chosen by the Contractor shall not exert damaging forces on the adjacent structures/walls.

L. Each layer of backfill materials as defined herein shall be mechanically compacted to the specified percentage of maximum density. Equipment that is consistently capable of achieving the required degree of compaction shall be used and each layer shall be compacted over its entire area while the material is at the required moisture content. Lightweight tampers or vibrating plate compactors shall be used in utility trenches to prevent damage to existing or new utilities.

M. All backfill shall be uniformly moisture-conditioned to between 2 and 6 percent above the optimum moisture content and placed in horizontal lifts less than 8 inches in loose thickness.

N. Compaction of backfill adjacent to all subgrade structure walls shall follow a pattern of compaction that begins at the wall face and progresses outward to the outside edge of the excavation before beginning a new lift.

O. Flooding, ponding, or jetting shall not be used as a means for compaction.

P. All backfill materials placed below 3 feet above the top of the pipe should be compacted with hand-compaction equipment. Materials placed above 3 feet above the top of the pipe shall be compacted using heavier, self-propelled compaction equipment.

Q. After hand-compacting the bedding, the Contractor shall perform a final trim using a string line for establishing grade, such that each pipe Section when first laid will be continually in contact with the bedding along the extreme bottom of the pipe.

R. Additional QC tests may be made at the request of the Engineer to verify that compaction is meeting the specified requirements.

S. If compaction fails to meet the specified requirements, the Contractor shall remove and replace the backfill at proper compaction or shall increase the compaction to specified level by other means acceptable to the Engineer. Subsequent tests required to verify that the reconstructed backfill meets the specified compaction shall be paid by the Contractor.

T. Track rig, loader or dump truck walking of fill to achieve compaction shall not be allowed.

U. The following compaction test requirements shall be in accordance with ASTM D1557, or in accordance with ASTM D4253 and D4254, as applicable:

Location of backfill	Required % Compaction
Asphaltic and concrete pavements	95
Beneath footings, foundation walls, slabs and pads	95
Around footings and slabs	95
Beneath anchor blocks and around threaded anchor bar trenches	95
Behind existing and new Flood Wall	92
Behind foundation walls	90
Beneath landscaped areas and walkways	90
Behind new Flood Wall between STA 3+11.10 and STA 4+05.15	90
Above and around utility pipe zone	90

3.10 DISPOSAL OF SURPLUS MATERIAL

A. Remove excess earth materials, unsuitable materials, and debris from the site and dispose of it in a legal manner. Location of disposal site and length of the haul shall be the Contractor's responsibility. Site shall be located off BPCA or General Contractor property.

3.11 EXISTING UTILITIES

A. Locate and indicate on the Contract Drawings utilities and/or other facilities, which may conflict with, cross, or lie close to the new Flood Wall.

B. While the existing utility locations shown in the Contract Drawings are believed to be reasonably correct, neither the Engineer nor the BPCA can guarantee the accuracy or adequacy of this information.

C. The Contractor shall verify the location and depth (elevation) of all existing utilities and services prior to performing excavation work in an area. Contractor shall record on the record drawings the location and depth (elevation) of all existing utilities and services and any that are discovered during excavation.

D. The Contractor shall call One Call or Call Before You Dig (811) at least 5 working days prior to start of any excavations and confer with all agencies and utilities that have or may have aboveground and/or underground facilities in the vicinity of the new Flood Wall and other associated utilities.

E. The purpose of One Call is to notify said agencies and utilities of the proposed construction schedule and locate and/or verify the locations of all facilities, including connections, in the area of the new Flood Wall within the ROW.

F. The Contractor shall arrange for all necessary suspension of service and make arrangements to physically locate and avoid interference with all existing utilities and facilities.

G. The Contractor may make arrangements for alterations or relocations for his sole convenience (not actually required to complete foundation or utility installations); such alterations or relocations shall be completely at the expense of the Contractor.

H. Where existing utilities and/or other facilities, aboveground and/or underground, are encountered during construction, they shall not be displaced or molested unless necessary.

I. If it is necessary to relocate a utility or if a utility is disturbed or accidentally damaged in the construction of the new Flood Wall, the Contractor shall notify the BPCA, the General Contractor or the proper Authority.

J. The Contractor shall abide with the requirements of and cooperate with BPCA or Authority (who may enter upon the new Flood Wall construction zone at any time) while protecting, repairing, replacing or relocating such utilities.

K. All abandoned pipelines that are severed during the new Flood Wall construction shall be immediately plugged by the Contractor with approved material, unless otherwise directed by the Authority.

L. A 12-inch minimum clearance shall be maintained at all utility crossings. Adjustments to the pipe alignment and elevation will be made by the Contractor where exploratory work indicates the need.

M. Excavation around utilities shall follow the general protocol below:

1. Excavation and other work under or adjacent to utilities shall not interfere with their safe operation and use.
2. Contractor shall carefully probe to determine the exact location of utility, and hand excavate where necessary to avoid damages.
3. In the event of damage incurred during construction, the Contractor shall immediately notify BPCA or the Authority and shall arrange for immediate repairs at his expense.

3.12 GEOTEXTILE FABRIC

A. The fabric shall be provided in rolls wrapped with protective covering to protect the fabric from mud, dirt, dust, debris, ultraviolet radiation, and abrasion due to shipping and handling.

B. The fabric shall be free of defects or flaws that significantly affect its physical properties as it is intended for this Contract.

C. Each roll of fabric in the shipment shall be labeled with a number or symbol to identify that production run.

D. Geotextile fabric shall be handled and installed in accordance with the manufacturer's recommendations and as noted in the Contract Drawings. The fabric shall be stretched, aligned, and placed in a wrinkle-free manner.

E. Punctures in the geotextile shall be covered with a minimum 12-inch square patch.

3.13 SHORING REMOVAL

A. Shoring shall be removed as soon as the trench backfill has been placed and compacted to a level adequate to support the trench walls, unless otherwise indicated.

B. Compaction of the backfill shall be continuous throughout the shoring removal process in order to minimize the potential creation of voids between trench walls and compacted trench backfill.

C. Observable voids created by removal of shoring shall be backfilled with the appropriate and approved fill material discussed herein and compacted as discussed herein.

D. Shoring shall be completely removed prior to compaction of the top 4 feet of trench depth.

END OF SECTION 312000

SECTION 312319 - DEWATERING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This section covers controlling groundwater, site drainage, and storm flows during construction. The Contractor is cautioned that the Work involves construction in and around drainage channels, local rivers, and areas of local drainage. These areas are subject to frequent periodic inundation.

1.2 RELATED SECTIONS

A. The following is a list of Specifications which may be related to this section:

1. Section 312000 - Earth Moving
2. Section 311000 - Site Clearing
3. Section 315000 - Excavation Support and Protection

1.3 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. New York City Department of Transportation (NYCDOT)
2. New York City Department of Environmental Protection (NYCDEP)
3. American Society for Testing and Materials International (ASTM):

    a. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft^3 or 600 kN-m/m^3).

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Support of excavation and dewatering Contractor shall have, as a minimum, three (3) successful past installations and operations similar to those found on the Work.

1.5 SUBMITTALS

A. Contractor shall submit a Water Control Plan to the Engineer two (2) weeks prior to execution of this Work. At a minimum, the Water Control Plan shall include:

1. Descriptions of proposed groundwater and surface water control facilities including, but not limited to, equipment, methods, standby equipment and power supply, means of measuring inflow to excavations, pollution control facilities, regulatory permitting (NYCDEP), effluent testing, discharge locations to be utilized, and provisions for immediate temporary water supply as required by this Section.

2. Drawings showing locations, dimensions, and relationships of elements of each system.
3. Design calculations demonstrating adequacy of proposed dewatering systems and components.
4. If system is modified during installation or operation, revise or amend and resubmit Water Control Plan.

PART 2 PRODUCTS

2.1 MATERIALS

A. Onsite materials may be used within the limits of construction to construct temporary dams and berms. Materials such as plastic sheeting, sand bags, and storm sewer pipe may also be used if desired by Contractor.

PART 3 EXECUTION

3.1 GENERAL

A. For all excavation, Contractor shall provide suitable equipment and labor to remove water, and keep the excavation dewatered so that construction can be carried on under dewatered conditions.

1. Water control shall be accomplished such that no damage is done to adjacent channel banks or structures.
2. Continuously control water during course of construction, including weekends and holidays and during periods of work stoppages, and provide adequate backup systems to maintain control of water.

B. Contractor is responsible for investigating and becoming familiar with all site conditions that may affect the Work including surface water, potential flooding conditions, level of groundwater and the time of year the work is to be done.

C. Contractor shall conduct operations in such a manner that storm or other waters may proceed uninterrupted along their existing drainage courses.

1. By submitting a bid, Contractor acknowledges that Contractor has investigated the risk arising from such waters and has prepared bid accordingly and assumes all of said risk.

D. For all excavation, Contractor shall provide suitable equipment and labor to remove water, and keep the excavation dewatered so that construction can be carried on under dewatered conditions.

1. Any damage to adjacent property resulting from Contractor’s alteration of surface or subsurface drainage patterns shall be repaired by Contractor at no additional cost to Owner.

E. Pumps and generators used for dewatering and water control shall be quiet equipment enclosed in sound deadening devices.

F. Contractor shall remove all temporary water control facilities when they are no longer needed or at the completion of this Work.

G. All excavations made as part of dewatering operations shall be backfilled with the same type material as was removed and compacted to ninety-five percent (95%) of Maximum Standard Proctor Density (ASTM D698) except where replacement by other materials and/or methods are required.

3.2 CONSTRUCTION

A. Surface Water Control:

1. Surface water control generally falls into the following categories:

   a. Normal low flows along the channel.
   b. Storm/flood flows along the channel.
   c. Flows from existing storm drain pipelines.
   d. Local surface inflows not conveyed by pipelines.

2. Contractor shall coordinate, evaluate, design, construct, and maintain temporary water conveyance systems:

   a. These systems shall not worsen flooding, alter major flow paths, or worsen flow characteristics during construction. Contractor is responsible to ensure that any such worsening of flooding does not occur.
   b. Contractor is solely responsible for determining the methods and adequacy of water control measures.

3. At a minimum, Contractor shall be responsible for diverting the quantity of surface flow around the construction area so that the excavations will remain free of surface water for the time it takes to install these materials, and the time required for curing of any concrete or grout.
4. Contractor is cautioned that the minimum quantity of water to be diverted is for erosion control and construction purposes and not for general protection of the construction site.

   a. It shall be Contractor's responsibility to determine the quantity (volume and flow) of water which shall be diverted to protect from damage caused by stormwater, perched water and /or groundwater.

5. Contractor shall, at all times, maintain a flow path for all channels:

   a. Temporary structures such as berms, sandbags, pipeline diversions, etc., may be permitted for the control of channel flow, as long as such measures are not a major obstruction to flood flows, do not worsen flooding, or alter historic flow routes.

B. Groundwater Control:

1. Contractor shall install adequate measures to maintain the level of groundwater below the foundation subgrade elevation and maintain sufficient bearing capacity for all structures, pipelines and earthwork.

    a. Such measures may include, but are not limited to, installation of perimeter subdrains and swales, or by pumping from sumps installed below the subgrade elevation.

2. The structure bearing surfaces are to be kept dewatered and stable until the structures or other types of work are complete and backfilled.

    a. Disturbance of foundation subgrade by Contractor operations shall not be considered as originally unsuitable foundation subgrade and shall be repaired at Contractor's expense.

3. Contractor shall dispose of groundwater as follows:

    a. Containment: upon extraction, store groundwater extracted in the process of construction dewatering in containers prior to discharge or disposal of water, as applicable. Keep containers locked to prevent accidental or purposeful discharge of the water. Contain and store the water on-site and in such a manner that it will not interfere with the Contractor's existing or continued construction operations.
    b. Obtain discharge permit for water disposal from authorities having jurisdiction.
    c. Treat water collected by dewatering operations, as required by regulatory agencies, prior to discharge.
    d. Discharge water as required by discharge permit and in manner that will not cause erosion or flooding, or otherwise damage existing facilities, completed Work, or adjacent property.
    e. Remove solids from treatment facilities and perform other maintenance of treatment facilities as necessary to maintain their efficiency.

4. Any temporary dewatering trenches or well points shall be restored following dewatering operations to reduce permeability in those areas as approved by Engineer.
5. Extracted groundwater of sufficient quality as shown by test data may be used on site with Engineer's written approval for those purposes approved by the Engineer.

END OF SECTION 312319

SECTION 323116 - WELDED WIRE FENCE PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Custom made metallic-coated-steel, welded-wire fences panels to match existing as directed by Owner.

B. Related Requirements:

1. Section 051200 – “Structural Steel” for steel fence posts.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For fencing panels

1. Include plans, elevations, sections, post spacing, and mounting attachment details.

C. Samples: for Verification: Submit samples for welded wire mesh to match existing as selected by Owner

1. Provide Samples 12-inches in length for linear materials.
2. Provide Samples 16-inches square for wire mesh.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Include three panels length of fence complying with requirements.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of custom welded wire fences panels and other construction contiguous with fence by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Wind Loading:

1. Fence Height: As indicated on drawings.
2. Design Criteria: Refer to drawings.

2.2 METALLIC-COATED-STEEL, WELDED-WIRE FENCES

A. Fence Fabric: Metallic-coated-steel wire. For wire pattern coordinate with Owner selection to match selected existing fence.

B. Fasteners: Manufacturer's standard tamperproof, corrosion-resistant, color-coated fasteners matching fence components with resilient polymer washers or clips.

2.3 PANEL IN-FILL FENCE MATERIALS

A. Metallic-Coated-Steel Wire: Welded-wire fence fabric, hot-dip galvanized after fabrication. Weight of zinc coating shall be not less than 1.0 oz./sq. ft..

B. Plates, Shapes, and Bars: ASTM A36/A36M.

C. Tubing: ASTM A500/A500M, cold-formed steel tubing.

D. Galvanizing: For components indicated to be galvanized and for which galvanized coating is unspecified, hot-dip galvanize to comply with ASTM A123/A123M. For hardware items, hot-dip galvanize to comply with ASTM A153/A153M.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.5 METALLIC-COATED-STEEL FINISHES

A. Galvanized Finish: Clean welds, mechanical connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.

B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FENCE INSTALLATION

A. Install fences according to manufacturer's written instructions.

B. Install infill fences panels by setting between posts as indicated and fastening to posts. Peen threads of bolts after assembly to prevent removal.

END OF SECTION 323116

SECTION 323120 - ARCHITECTURAL METAL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Architectural aluminum panels.

B. Related Requirements:

1. Section 051200 "Structural Steel" for Structural Steel Floodwall.
2. Section 099113 “Exterior Painting” for structural steel priming and painting.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For architectural panels.

1. Include plans, elevations, sections, gate locations, post spacing, mounting and attachment details.

C. Samples: For each fence material and for each color specified.

1. Provide Samples 12 inches in length for linear materials.
2. Provide Samples 36 inches square for architectural panel including architectural pattern for verification of pattern, finish and workmanship.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Include three full-size single panels, including attachment hardware mounted to structural steel wall and complying with requirements. Mock up to reflect conditions along West Street.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Wind Loading:

1. Comply with applicable Building Code and Regulations.

2.2 ARCHITECTURAL ALUMINUM PANELS

A. Architectural Aluminum Panels: Panels made from aluminum plate.

B. Architectural Panels: Aluminum plate, type 6061, 1/4 inch thick.

C. Architectural pattern: 'Stix' by ANOVA Furnishings. Panels to have 1.5" solid continuous border with pattern inset.
1. Pattern to be designed for largest panel and centered, then trimmed from the sides or bottom as necessary to accommodate smaller panels. No stretching of the pattern.
2. No openings that pass a 4" sphere authorized.

D. Fasteners: Stainless steel, tamperproof, with neoprene washers and sleeves to prevent galvanic action.

E. Fabrication: Custom panel patterns may be produced by laser-cutting, water jet or CNC.

1. Edges shall be smooth without sharp edges, burs or creases.

F. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.

2.3 ALUMINUM

A. Aluminum, General: Provide alloys and tempers with not less than the strength and durability properties of alloy and temper designated in paragraphs below for each aluminum form required.

B. Plate and Sheet: ASTM B 209, Alloy 6061-T6.'

2.4 STEEL AND IRON

A. Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.5 COATING MATERIALS

A. Epoxy Zinc-Rich Primer for Uncoated Steel: See Section 099113 “Exterior Painting”.

B. Anti-Graffiti Coating for Architectural Panels: Clear protective coating that provides a barrier between the applied to surface and graffiti.

1. Product: Anti-Graffiti Coat as manufactured by Coval Molecular Coatings, Burleson, TX (817) 233-6926.

2.6 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for strength and compatibility in fabricated items.

B. Neoprene-backed washers and sleeves.

1. For separating dissimilar metals to prevent galvanic actions. See Drawings.

a. Stainless steel neoprene-backed washers.
b. Neoprene sleeves.
c. Nylon sleeves and washers.

C. Surface Cleaner for Anti-Graffiti Coating system: Surface cleaner applied prior to application of anti-graffiti coating.

1. Product: Step #1 Cleaner for Painted Surfaces as manufactured by Coval Molecular Coatings, Burleson, TX (817) 233-6926.

D. Sealant

1. Silicone, single component, nonsag, 50% expansion capable, in contact with anodized aluminum and painted metal.
2. Type S, Grade NS, Class 50, Use: A, O.
3. Color- clear.

2.7 ALUMINUM FINISHES

A. Class 1 clear architectural anodization- A41 per AAMA 611-98.

2.8 STEEL FINISHES

A. Shop-Painted Finish: Comply with Section 099113 "Exterior Painting."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.

B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Mark locations of panel lines and corresponding bracket mounting hardware locations.

3.3 ARCHITECTURAL PANEL INSTALLATION

A. Install panels by mounting as indicated and fastening infill panels to floodwall panels as shown on the Drawings.

END OF SECTION 323119

SECTION 329113 - SOIL PREPARATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes planting soils including layered soil assemblies specified by composition of the mixes based on existing soils AND the reinstallation of the existing soils to be salvaged and amended prior to reinstallation. The intent of this work is to use all soils on site with required amendments based on existing soil samples to be provided by the contractor. Should additional quantities of soil be required testing requirement are herein. Prior to beginning any work existing soils shall be tested and tests submitted to the landscape architect

B. Related Requirements:
   1. Section 311000 "Site Clearing"
   2. Section 329300 "Plants"

1.3 UNIT PRICES

A. Work of this Section is affected by unit prices specified in Section 012300 "Alternates & Unit Prices".

1.4 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Compaction: Compaction of the soil fabric is any force applied to the soil that reduces porosity and where 90 percent of all compaction can be accomplished with only three application of force under optimum soil moisture conditions.

C. Dry Soil: The condition of the soil at or below the wilting point of plant available water in which the soil is subject to blowing.

D. Finish Grade: Elevation of finished surface of planting soil.

E. Frozen Soil: The point at which the soil water has frozen and the soil has become very hard and cloddy. Ice crystals can be seen in the pore spaces of the soil.

F. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

G. Moist Soil: the condition of the soil in where it can be formed into a ball and maintain its shape. Deformation of the soil is difficult with hand pressure. Free water is not visible and is usually considered the point between the wilting point and filed capacity of the soil.

H. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

I. Planting Area: Areas to be planted.

J. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

K. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

L. Saturated: All the pore space within a soil is filled with water and the remaining water is under gravitational forces to drain through the profile.

M. Scarification: The loosening of the surface of a soil lifts by mechanical or manual means to alleviate compaction of the soil surface. Depth of scarification is dependent on material and extent of compaction.

N. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

O. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

P. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

Q. Wet Soils: Soil that is considered wet will easily be deformed by hand pressure, maintain their shape and free water will be visible within the pore spaces. The water content at this soil condition is considered field capacity or wetter.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: The contractor shall examine previous work, related work and conditions under which this work is to be performed and shall notify the Landscape Architects in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means the contractor accepts substrates, pervious work and conditions. The Contractor shall not place any planting soil until all work in adjacent areas is complete and approved by the Landscape Architect.

1.6 ACTION SUBMITTALS

A. Product Data: Submit technical descriptive data for each manufactured or packaged product of this Section. Include manufacturer's product testing and analysis and installation instructions for manufactured or processed items and materials.

B. Locations: Submit locations of material sources. Submit location of mixing sites.
   1. Soil Mix supplier shall have a minimum of five years experience in supplying custom planting soil mixes.
   2. Submit supplier name, address, telephone and fax numbers and contract name.
   3. Submit certification that accepted supplier is able to provide sufficient quantities of materials and mixes for the entire project.
   4. Landscape Architect shall have the right to reject any soil supplier.

C. Test Reports – Soil Analysis: The Contractor shall submit representative samples of all soil materials and organic material components which are intended to be used for planting soil mixes and final mixes, to a Soil and Plant Testing Laboratory listed here. All reports shall be sent to the Landscape Architect for approval. Samples of all soil materials to be brought to the site must be approved before delivery. Deficiencies in the soils shall be corrected organically (peatmoss is not acceptable) by the Contractor, as directed by the Landscape Architect after review of the testing agency report. Testing reports shall include the following:

   1. Date issued.
   2. Project Title and names of Contractor and material supplier.
   3. Testing laboratory name, address and telephone number, and name(s), as applicable, of each field and laboratory inspector.
   4. Date, place, and time of sampling or test, with record of temperature and weather conditions.
   5. Location of material source both on and off site.
   6. Type(s) of test.
   7. Results of tests including identification of deviations from acceptable ranges.
   8. Particle size analysis to include sand sieve analysis shall be performed and compared to the USDA Soil Classification System per ASTM D422 (hydrometer test) or ASTM F1632 (pipette test). The silt and clay content shall be determined on soil passing the #270 sieve and shall be reported separately.
   9. Percent of organic shall be determined by an Ash Burn Test or Walkley/Black Test, ASTM F1647.
   10. Saturated hydraulic conductivity per any of the test methods stated in ASTM F1815.
   11. Chemical analysis shall be undertaken for Nitrate, Ammonium, Nitrite, Phosphorous, Potassium, Calcium, Magnesium, Iron, Manganese, Zinc, Copper, Soluble Salts, Cation Exchange Capacity, and acidity (pH).
   12. Soil analysis tests shall show recommendations for soil additives, including organic and inorganic soil amendments, necessary to accomplish particular planting objectives noted.

13. All tests shall be performed in accordance with the current standards of the Association of Official Agriculture Chemists.

14. Certified reports on analysis from producers of composted organic materials are required, particularly when sources are changed. The analysis performed shall include pH, density, salinity, total organic nitrogen, C:N Ratio, Solvita Maturity Index, moisture, sodium, potassium, calcium, magnesium, and phosphorous.

15. Soil Components and Soil Mix Sampling requirements: At middle height of wind row/pile, remove sample two feet into the pile. Place sample in clean container. Repeat gathering methods for five to ten times at equidistant spacing on both sides of the pile. Mix gathered samples with clean utensils. Remove approximately 500g of composite samples and place that final sample by overnight courier to the testing laboratory. Submit sample with completed testing laboratory submission form.

16. Biological Tests for organisms in compost and mixes:
    a. Contact the testing laboratory to review testing and sampling requirements before sending samples.
    b. Sampling requirements: At middle height of wind row, remove sample two feet into the pile. Place sample in clean container. Repeat gathering methods for five to ten times at equidistant spacing on both sides of the compost pile. Mix gathered samples with clean utensils. Remove approximately 500g of composite samples and place that final sample by overnight courier to the testing laboratory. Submit sample with completed testing laboratory submission form.
    c. Maintain clear and concise records for testing and sampling procedures.

17. Testing Agencies: The following firms are acceptable testing agencies for the various components.
    a. Compost testing:
        a. Woods End Research Laboratory, PO Box 297, Mt. Vernon, ME 04352, phone 800-451-0337, fax 207-293-2488.
    b. Physical soil analysis including particle size analysis and hydraulic conductivity
        a. A. McNitt & SerenSoil Testing, 1338 Deerfield Drive, State College, PA 16803 phone 610-360-5985
    c. Nutrient analysis:
        a. Penn State Extension, Agricultural Analytical services Laboratory, 111 Ag Analytical Svcs Lab, University Park, PA 16802 phone 814-863-0841
    d. Compost/Biological Testing:
        a. Soil Foodweb New York, 17 Clinton Street, Center Moriches, NY 11934, tel. 631-750-1553, fax 631-750-1554.

D. All approved samples to be submitted to Landscape Architect:

1. Leaf mold, each source, 5 lb. packaged.
2. Sand, each source, 5 lb. packaged.
3. Loam, each source, 5 lb. packaged.
4. Base component material, each source, 5 lb. packaged.
5. Yard Waste Compost, each source, 5 lb. packaged.
6. Each mix type specified 5 lb. packaged.

E. Statement(s) of Qualifications: Submit within 45 days of notice to proceed to confirm qualifications as specified herein.

F. Equipment Data: Submit descriptive information with wheel load data for each proposed item of equipment to be used for execution of earthwork of this Contract. Equipment Data will be evaluated for conformance to site restriction of use.

G. Schedule and Protection Plan: Submit a detailed plan for scheduling and sequencing of all contract work and for protection of soil mixes and other completed work including coordination with contractors requiring access through the site. Indicate with schedules and plans the utilization of finished work protection measures (wooden protection boards or other approved methods) over the work area of construction operations concurrent with all construction operations until substantial completion.

H. Schedule for performing percolation tests.

1.7 QUALITY ASSURANCE

A. Agricultural Chemist/Soil Scientist: Experienced person or persons employed by public or private soils testing laboratory, qualified and capable of performing tests, making soil recommendations, and issuing reports as specified. The Testing Laboratory shall be as approved by the Battery Park City Parks Conservancy.
   1. Preapproved supplier:
      a. The Dirt Company, Alan Marolf 917-524-5054

B. References:
   1. Association of Official Agricultural Chemists.
   2. American Society for Testing and Materials (ASTM) using test criteria as specified or required by other references.
   3. Soil Science Society of America, Methods of Soil Analysis.

1.8 TESTING REQUIREMENTS

A. General: Perform all tests on components and soil blends according to requirements in this article.

   1. Soil, leaf mold, mulch and other material testing and soil mix testing required in this Section or additionally required by the landscape architect or Battery Park City Parks Conservancy, shall be furnished and paid for by Contractor.

   2. Landscape Architect reserves the right to take and analyze at any time such additional samples of materials as deemed necessary for verification of conformance to specification requirements. Contractor shall furnish samples for this purpose upon request and shall perform testing as requested.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.

B. Soil or amendment materials stored on site temporarily in stockpiles prior to placement shall be protected from intrusion of contaminants and erosion. All temporary storage means and methods shall be approved by Landscape Architect.

C. Store and handle packaged materials in strict compliance with manufacturer's instructions and recommendations. Protect all materials from weather, damage, injury and theft.

D. In addition, the following provision is established: Material should not be handled or hauled, placed or compacted when it is wet as after a heavy rainfall or is frozen. Soil should be handled only when the moisture content is less than the point where maximum compaction will occur (as defined by Landscape Architect).

E. After mixing, soil materials shall be covered with a tarpaulin until time of actual use and protected from contamination or erosion.

F. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Do not amend or blend soil mixes, move or handle materials when they are wet or frozen.
4. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General- Salvaged Planting Soils

1. Existing Planting Soils shall be removed, labeled and maintained off site during construction. Prior to reinstallation, and as early as weather permits, soils shall be tested for organic content and quantitative biological testing for 5-7% organic content. If these soils do not meet that criterion they shall be amended with the specified organic matter resulting in a 5-7% organic content. In addition, they shall be tested for quantitative biological as specified herein.

B. General – Newly Blended Soils-for augmentation of existing soils

1. Newly blended soil quantities to be determined by quantities calculated during removal with appropriate "fluff" factor.
2. All soil mix material shall fulfill the requirements for new soil mixes as specified.
3. Samples of individual components of soil mixes and also blended soil mixes shall be submitted by the Contractor for testing and analysis to the approved testing laboratory. Include verification testing of on-site sub soils. Comply with specific materials requirements specified.

a. No base component or soil components for soil mixes shall be used until certified test reports by an approved agricultural chemist have been received and approved by the Landscape Architect.

b. As necessary, make any and all soil mix amendments and resubmit tests reports indicating amendments until approved.

4. The Landscape Architect, Construction Manager or Owner may request additional testing by Contractor for confirmation of mix quality and/or soil mix amendments at any time until completion.

5. Base Component Material shall be sand that meets the requirements outlined below mixed by volume with loam material that meets the requirements outlined below. Base component materials can be site salvaged and or off-site borrow material.

6. Test Base Component Materials, both individual components and mixed materials, for compliance with material specifications. These test criteria and results, when approved, shall establish the standard to which all subsequent Base Component Material tests must conform.

7. Prior to mixing Base Component Material with organic matter (leaf mold or yard waste compost), have one (1) composite sample tested from each 50 c.y. of material intended for use in soil mixes of planting work.

8. Test sand and loam components individually as components and together to form the Base Component mixed materials, for compliance with material specifications. These test criteria and results, when approved, shall establish the standard to which all subsequent Base Component Material tests must conform.

9. Organic matter (leaf mold or yard waste compost) shall be tested prior to mixing Base Component Material with organic matter. Have one (1) composite organic matter sample tested from each 50 c.y. of material intended for use in soil mixes of planting work.

C. Sand for Base Component Material shall meet the following requirements:

1. Texture:

Sand Fraction	Size (mm)	Sieve Size	% Passing
Gravel	> 2.0	#10	95 – 100%
Very coarse sand	1.0 – 2.0	#18	90 – 100%
Coarse sand	0.5 – 1.0	#35	65 – 75%
Medium sand	0.25 – 0.5	#60	15 – 20%
Fine sand	0.1 – 0.25	#140	0 – 4%
Very fine sand	0.05 – 0.1	#270	0 – 2%

2. Chemical Analysis:
   1) Soil reaction (pH) - 5.0 – 6.5 ± 0.5
   2) Soluble salt content (Conductivity) - < 1.5 dSm^{-1}

3. Material shall have a saturated hydraulic conductivity rate of no less than 30 inches per hour, per ASTM 1815.

D. Loam for Base Component Material shall meet the following requirements:

1. Soil Texture per ASTM D422 or ASTM F1632, as determined on material passing a 2 mm screen:

Main Fractions	Size (mm)	Percent
Sand	0.05-2.0	83 - 87
Silt	0.002-0.05	7 - 10
Clay	<0.002	4 – 8

In addition, maximum size shall be ½", the total gravel (> 2 mm) shall be less than 10% of the total material, and the sand passing the 2 mm screen shall have the following particle size distribution:

Sand Fraction	Size (mm)	Sieve Size	% Passing
Very coarse	1.0 – 2.0	#18	87-90
Coarse	0.5 – 1.0	#35	65-71
Medium	0.25 – 0.5	#60	34-42
Fine	0.10 – 0.25	#140	17-23
Very fine	0.05 – 0.10	#270	14-18

2. Chemical Analysis:
   1) Organic matter content (%) oven dry weight of soil shall be within the range of 4 to 10%.
   2) Soil reaction (pH) - 6.0 ± 0.5
   3) Soluble salt content (Conductivity) - < 1.5 dSm^{-1}

E. Before base sand-loam mix (base component) is used for mixing with organic amendments, handle and pile the mix in the following manner:
   a. Mix the base sand with base loam in a ratio of 3 parts sand to 1 part loam. Adjustments to the ratio may have to be made to meet the specifications for the base component. Homogenize to make a uniform mix, free of subsoil lenses and other irregularities.
   b. Aerate the base component to make a friable planting medium.
   c. Screen out all clay lumps, stones, roots, and other debris.

These proportions are approximate and may need to be adjusted to meet specifications.

1. Base Component Mix: The final mix of sand and loam materials shall substantially conform to the following:

   a. Soil Texture per ASTM D422 or ASTM F1632, as determined on material passing a 2 mm screen:

Main Fractions	Size (mm)	Percent
Sand	0.05-2.0	95.0
Silt	0.002-0.05	3.0
Clay	<0.002	2.0

In addition, maximum size shall be ½", the total gravel (> 2 mm) shall be less than 5% of the total material, and the sand passing the 2 mm screen shall have the following particle size distribution:

Sand Fraction	Size (mm)	Sieve Size	% Passing
Very coarse sand	1.00	#18	92-95
Coarse sand	0.50	#35	67-73
Medium sand	0.25	#60	20-26
Fine sand	0.10	#140	5-9
Very fine sand	0.05	#270	5

B. Organic Matter: Organic matter for amending planting media shall be a stable, material produced from the aerobic decomposition and curing of yard wastes. The compost shall meet the following criteria:
   1) Organic matter content of no less than 40% as determined by ASTM 2974
   2) Moisture content of 35 to 70% as determined by ASTM D2974.
   3) Carbon to nitrogen ratio of 15:1 to 30:1
   4) Soluble salts not exceeding 4 dSm-1
   5) Solvita Maturity Index 6 to 8
   6) 95 – 100% passing a 3/8" screen
   7) pH 6 to 7.5
   8) Biological Organisms: The compost shall have the following levels of organisms (direct microscopy).
      · 15 to 25 or more µg active bacteria /g dry weight (dw) compost
      · 100 µg (fungal compost) to 300 or more µg (bacterial compost) total bacteria /g dw compost
      · 15 to 25 µg or more active fungi /g dw compost
      · 100 to 300 µg total fungal biomass /g dw compost
      · 10,000 or more flagellates
      · 10,000 or more amoebae
      · 50 - 100 ciliates.
      · 20 – 30 Total nematodes (No root feeding nematodes)

C. Nutrient cycling capacity will be a minimum of 200 lbs/available nitrogen per acre due to microbial presence and activity.
   Nutrient Analysis:
      1. Ammonium (NH4) and Nitrate (NO3): below 100 ppm
      2. Phosphorous
      3. Potassium
      4. Calcium (CA), Magnesium (Mg): ratio of 7 part Ca to 1 part Mg
      5. Iron (Fe) 1 to 4 ppm
      6. Manganese (Mn) 3 to 20 ppm
      7. Zinc (Zn) 0.1 to 70 ppm
      8. Copper (Cu) 0.3 to 8 ppm

D. Chemical Analysis:
   1. Organic matter content (%) oven dry weight of soil: 1- 4%
   2. Soil reaction (pH): 6 - 7
   3. Soluble salt content (Conductivity) - < 1.5 dSm^{-1}

E. Saturated hydraulic conductivity of no less than 15 inches per hour per ASTM 1815.

2.2 PLANTING SOILS MIXES

A. Adequate quantities of mixed planting soil materials shall be provided to attain, after compaction and natural settlement, all design finish grades.

B. Uniformly mix ingredients using a mechanical soil blender designed for such purpose as specified for each Mix Type (Base Component Material, compost, and other ingredients deemed to be necessary as a result of testing). Wind rowing/tilling on an approved hard surface area may also be used as an alternative. Organic matter shall be maintained moist, not wet during mixing.

1. Mixing of Amendments: Add organic amendment in proportions as specified and as confirmed by testing. Other amendments shall not be added unless approved to extent and quantity by Battery Park City Parks Conservancy and additional tests have been conducted to verify type and quantity of amendment is acceptable.

C. Testing of Mixes:

1. Perform initial tests to confirm compliance with base material and mix specifications. These test results, when approved, will establish the standard to which all other test results must conform.

2. Follow-up Testing: Have one (1) composite sample delivery and upon arrival to the site from each 10 c.y. or as required by the Landscape Architect for use in each type plant mix to include the following:

a. Particle size analysis: Use sieve sizes as specified for Base Component Material.

b. Organic matter content as per mix specified.

c. Nutrient Analysis:

1) Have nutrient levels (pH, ammonium nitrogen, nitrate nitrogen, nitrite nitrogen, phosphorus, potassium, magnesium, calcium, magnesium, zinc, iron, copper, and manganese) tested, and request testing laboratory recommendations for additional fertilizer requirements at all plant areas if nutrient levels are below average. Soluble salts shall also be tested.

2) Contractor shall not use amendments to correct nutrient deficiencies.

d. Biological Organisms: The mixes shall have a minimum of the following levels of organisms (direct microscopy). Natural nutrient cycling will be a minimum of 150 lbs per acre, available Nitrogen from microbial activity. Mix shall have microbiological populations as listed below. Acceptance or rejection of mixes based on these test values will be determined by the Landscape Architect.

Plant Material	Active Bacterial Biomass (ug/g)	Total Bacterial Biomass (ug/g)	Active Fungal Biomass (ug/g)	Total Fungal Biomass (ug/g)	Hyphal Diameter (ug/g)	Protozoa Numbers/g Flagellates	Ciliates	Amoebae	Total Beneficial Nematode Numbers (#/g)
Deciduous Trees and Shrubs	40-60	400-800	30-45	400-900	3.0	10,000	10,000	50-100	20-30

PART 3 - EXECUTION

3.1 GENERAL

A. Place planting soil according to requirements in other Specification Sections.

B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil. If contamination by foreign or deleterious material or liquid is present in soil, remove the soil and contamination as directed by Landscape Architect and replace with new planting soil to the extend directed by the Landscape Architect or BPCPC.

C. Proceed with placement only after unsatisfactory conditions have been corrected.

3.2 PLACING MANUFACTURED PLANTING SOIL OVER EXPOSED SUBGRADE

A. General: When placing either the Salvaged Planting Soils or the Newly Blended Supplemental Soils DO NOT apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet

B. Salvaged Planting Soils: Prior to placing Salvaged Planting Soils test for organic matter and quantitative biological as stated here in. The top 8" of Salvaged Planting Soils shall be amended as per these test results and placed after scarifying the installed Salvaged Planting Soils

C. Newly Blended Soils: Apply manufactured soil on-site in its final, blended condition.

D. New Blended Soils Application: Place planting soil layers in the depths needed to total depth not less than required to meet finish grades after natural settlement. Do not handle, spread soil or subgrade if frozen, muddy, or excessively wet.

1. Lifts: Apply planting soil in lifts not exceeding 6 inches.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Perform the following tests and inspections:

1. Compaction: Test planting-soil compaction after placing each soil profile using a densitometer or soil-compaction meter calibrated to a reference test value based on laboratory testing according to ASTM D 698. Space tests at no less than one for each planter and three total at the street tree pits of in-place soil or part thereof.
2. Insitu Verification Testing: Contractor shall provide biological, pH, organic and soil texture test reports from labs used for approval of mixes for every 500 square feet of planter and 1 test for the tree pits.

1. Soil will be considered defective if it does not pass tests.

E. Label each sample and test report with the date, location keyed to a site plan or other location system, visible conditions when and where sample was taken, and sampling depth.

3.4 PROTECTION

A. Protection Zone: Protection Zones for the installation of salvaged soils and the specified blended soils of this specification are indicated on the drawings.

B. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:

Storage of construction materials, debris, or excavated material.
Parking vehicles or equipment.
Vehicle traffic.
Foot traffic.
Erection of sheds or structures.
Impoundment of water.
Excavation or other digging unless otherwise indicated.

C. If planting soil or subgrade is over compacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by Landscape Architect and replace contaminated planting soil with new planting soil.

3.5 CLEANING

A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.

B. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.

C. Dispose of excess subsoil and unsuitable materials on-site where directed by Owner.

END OF SECTION

SECTION 329300 - PLANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Trees
2. Shrubs
3. Goundcovers, Perennial, Herbaceous Plants and Vines
4. Mulch, fertilizer and other soil amendment applications to suit plant type during and after planting.
5. Protecting completed work.
6. Warranty
7. Coordination with other trades
8. Clean up

B. Related Requirements:
1. Section 311000 Site Clearing – for salvaged planting soil to be reused
2. Section 329113 Soil Preparation

1.3 UNIT PRICES

A. Work of this Section is affected by unit prices specified in Section 012300 “Alternates & Unit Prices."

B. Unit prices apply to authorized work covered by quantity allowances.

C. Unit prices apply to additions to and deletions from the Work as authorized by Change Orders.

1.4 REFERENCES

A. ANLA: American Nursery and Landscape Association (Formerly: AAN-American Association of Nurserymen)

B. ANSI: American National Standards Institute

C. AOAC: Association of Official Agricultural Chemists

D. ASTM: American Society for Testing Materials.

1.5 APPLICABLE STANDARDS

A. The references listed herein shall be in the standards used for performance of the Work: All standards shall include the latest additions and amendments as of the date of advertisement for bids.
   1. American National Standards for Tree Care Operations, ANSI A300. American National Standards Institute, 11 West 42nd Street New York, NY 10036.
   2. American Standard for Nursery Stock, ANSI Z60.1 American Nursery and Landscape Associating, 1250 Eye Street NW Suite 500 Washington DC 20005
   3. Horticultural Standards, American Nursery & Landscape Association.
   4. Hortus Third, The Staff of the L.H.Bailey Hortorium. 1976. MacMillan Publishing Co, New York
   5. Standardized Plant Names, American Joint Committee on Horticultural Nomenclature, 1942 edition
   6. American Society for Testing Material (ASTM)
   7. International Society of Arboriculture.

1.6 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with a ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.

C. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

D. Finish Grade: Elevation of finished surface of planting soil.

E. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.

F. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

G. Planting Area: Areas to be planted.

H. Planting Soil for Soil Profiles: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

I. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

J. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.7 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1.

1.8 ACTION SUBMITTALS

A. Submittals shall conform to Section 013300-Shop Drawings, Product Data and Samples

B. Product Data: For each type of product.

1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
2. Plant Photographs: Include color photographs in **digital** format of each required species and size of plant material as it will be furnished to Project. These photos shall be submitted a minimum of 10 workings days prior to the tagging trip they are to be tagged. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 15 plants are required, include a minimum of three photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.

C. Samples for Verification: For each of the following:

1. Shrubs: Landscape Architect and BPCPC will accompany landscape contractor for tagging all plant material.
2. Milled Leaf Mulch: 1-quart (1-L) volume in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.

1.9 INFORMATIONAL SUBMITTALS

A. Qualification Data: For landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.

B. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following. Submit inspection certificates required by authorities having jurisdiction. Supply Certificates of Compliance for all materials required for fabrication and installation, certifying that each material item complies with, or exceed, specified requirements

1. Manufacturer's certified analysis of standard products including but not limited to:
   a. Soil amendments
   b. Mulch, maturity certification

2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

C. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

D. Sample Warranty: For special warranty.

1.10 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before expiration of required maintenance periods.

1.11 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants. Submit resumes for Landscape Project Manager, Foreman/Site Supervisor showing the following:

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
2. Experience: Five years' experience in landscape installation.
3. Installer's Field Supervision: Require Installer to maintain an experienced English speaking, full-time supervisor on Project site when work is in progress.
4. Pesticide Applicator: State licensed, commercial.

B. Provide quality, size, genus, species, and variety of plants indicated. Provide only healthy, vigorous stock, grown in a recognized nursery acceptable to the Landscape Architect and BPCPC and free from disease, insects, eggs, larvae and other defects. Provide plants in strict compliance with the recommendations of the following:
1. ANSI Z 60.1 American Standard for Nursery Stock, latest edition.
2. American Association of Nurserymen, Horticultural standards.
3. American Joint Committee on Horticultural Nomenclature, Standardized Plant Names, 1942 edition.
4. International Society of Arboriculture.

5. Selection of plants purchased under allowances is made by Landscape Architect, who tags plants at their place of growth before they are prepared for transplanting.
6. Landscape Architect, Battery Park City Parks Conservancy staff member or Resident Engineer retains right to reject any plant at any time due to transportation damage, disease, loose rootball or lack of correct maintenance practices while plants are being maintained on site.

C. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.

1. Shrubs: Measure with branches or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container-grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip..

D. Pruning: Unless otherwise noted, pruning of plants before, during or after installation shall be prohibited except to remove dead or broken branches and limbs. Confer with Landscape Architect before any

pruning. Plants pruned without permission from the Landscape Architect are subject to rejection and replacement.

E. Inspection: The Landscape Architect will inspect plant materials at place of growth before planting for compliance with requirement for genus, species, variety, size and quality. Landscape Architect retains right to inspect plant materials further for size and condition of balls and root systems, insects, injuries, and latent defect and to reject unsatisfactory or defective material at any time during progress of work even if previously inspected and approved. Remove and replace rejected pants immediately from Project site at no change to the Owner.
   1. Selection: All plants shall be tagged in the nursery by the Landscape Architect prior to digging of plants. The Landscape Architect shall place seals on selected plant at the nursery. Seals shall remain on plants until acceptance of work.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if applicable.

B. Bulk Materials:

   1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
   2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
   3. Accompany each delivery of bulk materials with appropriate certificates.

C. Do not prune shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

D. Handle planting stock by supporting the rootball or container

E. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.

F. Apply anti-desiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.

   1. If deciduous shrubs are moved in full leaf, spray with anti-desiccant at nursery before moving and again two weeks after planting.

G. Deliver plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist. Plants shall not be stored on asphalt or any other pavement without a minimum of 3” mulch layer over pavement.
   1. Set balled stock on ground and cover ball with soil, mulch, sawdust, or other acceptable material.
   2. Do not remove container-grown stock from containers before time of planting.

3. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

1.13 FIELD CONDITIONS

A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

B. Digging Season: Plants shall be delivered freshly dug. Plants dug the previous season shall not be accepted. When it is anticipated that planting will occur outside of the digging seasons, storage shall conform to the requirements of this Specification.
1. Spring Dig: Plants shall be dug as early as determined by nursery owner and no later than bud break.

C. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.
Trees and Shrubs

	Spring Season	Fall Season
Perennials and Grasses	April 30 to June 15	Sept. 15 to Nov 1
Deciduous (container)	March 15 to June 15	Sept. 15 to Nov1
Deciduous (Balled and burlapped)	March 15 to June 15	Sept. 15 to Nov1

D. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

1.14 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period. Provide written warranty agreeing to remove and replace work that exhibits defect in materials or workmanship for the specified periods. “Defects” is defined to include, but is not limited to death, unsatisfactory growth, disease, insect infestation, abnormal foliage density, abnormal size abnormal color failure to thrive and other unsatisfactory characteristics.

1. Failures include, but are not limited to, the following:

   a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner.
   b. Structural failures including plantings falling or blowing over.
   c. Faulty performance of tree stabilization and tree grates

2. Warranty Periods: From date of Substantial Completion.

   a. Trees: 12 months.

b. Shrubs: 12 months.
c. Ground Covers, Perennials, Ornamental Grasses and Other Plants: 12 months.

3. Include the following remedial actions as a minimum:

a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
c. A limit of one replacement of each plant is required except for losses or replacements due to failure to comply with requirements.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL-GENERAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Planting Schedule indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
1. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.

B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Landscape Architect, with a proportionate increase in size of roots or balls.

C. Hardiness: Provide plant stock certified to have been grown within hardiness Zones 2 through 6 as established by the Arnold Arboretum, Jamaica Plan Massachusetts. Plants without this certification will be rejected.

D. Root-Ball Depth: Furnish shrubs with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

E. Root-Ball Handling: All plants balled and burlapped shall be moved with the root systems as solid units with balls of earth firmly wrapped with untreated biodegradable eight-ounce burlap. Firmly held in place by stout cord and drum lacing. The diameter and depth of the rootballs of earth must be sufficient to encompass the fibrous ad root feeding system necessary for the healthy development of the plant. NO plant shall be accepted with the ball of earth surrounding its roots has been badly cracked or broken preparatory to or during the process of planting or after the burlap, stave, ropes or platform required connection with its transplanting have been removed. The plants and balls shall remain intact during all operations. Burlap for containing rootballs shall be untreated, made from biodegradable natural fibers. Inspect root crown for girdling roots. Plants with girdling roots will be rejected.
1. Root flare of all plants shall be clearly visible prior to planting. Carefully avoid damage to roots while removing soil overburden from the rootball. Adventitious roots shall be removed with sharp pruners.
a. Root flares more than 2” below grade at source shall be cause for rejection. The Landscape Architect may request a larger diameter rootball to compensate for a buried root

flare, as the soil overburden shall be removed prior to planting which effectively reduces the size of the root ball. This will be at no additional cost to the Owner.

F. Container Stock: Container stock shall have a full container of well-developed root system. Plants loose in the container are not acceptable. The surface of the root zone shall be free of circling or kinked roots. When removed from the container, the rootball shall be free from numerous circling roots. Large matted roots at the side or bottom of the container will not be accepted. Container grown plants may be accepted for balled and burlapped material if approved by Landscape Architect.

G. Labeling: Label each plant of each variety, and size, with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant.

H. Select stock for uniform height and spread, and number the labels to assure symmetry in planting.

I. Handling of Plants: Plants delivered by truck and plants requiring overnight storage on site shall be properly wrapped and covered to prevent wind-drying and desiccation of branches, leaves and buds; plant balls shall be firmly bound, unbroken, reasonably moist to indicate watering prior to delivery and during storage, and tree trunks shall be free from fresh scare and damage in handling.

2.2 MULCH

A. Milled Leaf Mulch: Provide partially decomposed, minimum six-month-aged, finely shredded leaf mulch that is free of weeds, excessive fine particles and stringy material. Provide leaf mulch approved by Landscape Architect.

2.3 MISCELLANEOUS PRODUCTS

A. Anti-desiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

B. Burlap: Untreated biodegradable eight-ounce burlap.

C. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance and covered completely to be protected from the wind.
3. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
4. Uniformly moisten excessively dry soil that is not workable or which is dusty.

B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Landscape Architect and replace with new planting soil to the extend directed by the Landscape Architect or BPCPC.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Preinstallation Examination Required: The contractor shall examine previous work, related work and conditions under which this work is to be performed and notify Landscape Architect in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means contractor accepts substrates, previous work and conditions. The contractor shall not place any plants or planting soil mixtures until all work in adjacent areas is complete and accepted by the Landscape Architect.

D. Planting Soil Mixture Preparation: Refer to Section 311000 Site Clearing for salvaged and maintaining Planting Soil Section 329113 and Soil Preparation-for Planting Soil to makeup volumes lost during storage

E. General: Prepare planting area for soil placement and mix planting soil according to Section 329113 Soil Preparation.

F. Placing Planting Soil: according to Section 329113 Soil Preparation.

G. Lay out individual shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Landscape Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.

H. Mark herbaceous groupings as shown on Planting Plans for approval of Landscape Architect and BPCPC. Final layout of all herbaceous plants will be as per the design Landscape Architect and BPCPC. Contractor shall understand groupings on the Planting Plans may change as per field conditions. No additional cost to the Owner will be allowed for these adjustments.

I. Application of Mycorrhizal Fungi: At time directed by Landscape Architect, broadcast dry product uniformly over prepared soil at application rate as indicated by biological test results performed as per Section 329113 Soil Preparation.

3.3 PLANTING

A. Roots: Do not plant if roots are girdling. Landscape Architect, BPCPC or Resident Engineer retains the right to reject all plants with this condition.

B. Balled and Burlapped Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.
   1. Remove all burlap prior to backfilling pits.
   2. Backfill: Planting soil as per drawings.
   3. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap and rope from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
   4. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
   5. Continue backfilling process. Water again after placing and tamping final layer of soil.

C. Container-Grown Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.

   1. Backfill: Planting soil
   2. Carefully remove root ball from container without damaging root ball or plant.
   3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.

D. Planting Bulbs: Plant bulbs concurrently with ground cover if season of planting permits. The design Landscape Architect and BPCPC shall approve layout of bulbs. Plant bulbs to proper depth for species, place shoots upright. Provide 1 teaspoon of Bonemeal per bulb mixed in the planting hole.

3.4 PLANTING TREES AND SHRUBS

A. Planting Bed Preparation for Shrubs: Create continuous plant bed in planters; do not place plants in pits. Plant soil mixture will be used to back fill the planters
   1. Plant Installation: All Planting Soil salvaged and marked for relocation to original location shall be placed in depths needed to meet proposed grades. Prior to planting, salvaged soils shall be tested for organic content and quantitative biology as per Section 329113 Soil Preparation.
   2. Any newly blended soils required in addition to the salvaged soils shall be placed as per Section 329113 Soil Preparation.
   3. Inspection: At time of planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

4. Staking and Layout: Stake trees and obtain Landscape Architect's acceptance of location and finish grade elevation before planting.
5. Ball Pedestals: Provide a rootball pedestal immediately beneath the ball or root mass so that tree or plant will not settle and will have the relationship to finish grade described below.
6. Obstructions: If obstruction or other conditions detrimental to healthy plant growth are encountered, notify Landscape Architect immediately and request additional instruction. At the Landscape Architect's direction and at no additional cost to Owner, plants shall be relocated to avoid the obstruction.
7. Keep excavations covered or otherwise protected when unattended by Installer's personnel.

B. Backfill Soil: Subsoil and topsoil removed from excavations may not be used as backfill soil unless otherwise indicated.

C. Obstructions: Notify Landscape Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

1. Hardpan Layer: Drill 6-inch diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.

D. Drainage: Notify Landscape Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.

E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.5 SHRUB AND VINE PRUNING

A. Remove only dead, dying, or broken branches according to standard professional horticultural and arboricultural practices Do not prune for shape.

B. Do not apply pruning paint to wounds.

3.6 GROUND COVER AND PLANT PLANTING

A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated on Drawings in even rows with triangular spacing.

B. Use planting soil as indicated on drawings for backfill.

C. Dig holes large enough to allow spreading of roots.

D. For rooted cutting plants supplied in flats, plant each in a manner that minimally disturbs the root system but to a depth not less than two nodes.

E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.7 PLANTING AREA MULCHING

A. Mulch backfilled surfaces of planting areas and other areas indicated.
   1. Organic Mulch in Planting Areas: Apply 2-inch average thickness of organic mulch over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 6 inches of trunks or stems.

3.8 PLANT MAINTENANCE

A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Of particular importance is weeding and mulching. Contractor to review project for weeding needs weekly through the maintenance period.

B. Fill in, as necessary, soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.9 PESTICIDE APPLICATION

A. Apply biological control agents according to authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with BPCPC'S operations and others in proximity to the Work. Notify BPCPC before each application is performed.

B. Pre-Emergent Herbicides (Selective and Nonselective): Apply to tree, shrub, and ground-cover areas according to manufacturer's written recommendations. Do not apply to seeded areas. Apply only with the knowledge and direction of BPCPC.

C. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations. Apply only with the knowledge and direction of BPCPC.

3.10 REPAIR AND REPLACEMENT

A. General: Repair or replace plants that are damaged by construction operations, in a manner approved by Landscape Architect and BPCPC.
   1. Protect all soils to remain during all waterproofing and pavement installations.
   2. Submit details and products to be used during all construction operations and those of proposed repairs or remediation.

3. Perform repairs within 24 hours, if approved.
4. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Landscape Architect.

B. Remove and replace plants that are more than **25** percent dead or in an unhealthy condition immediately or are damaged during construction operations that Landscape Architect determines are incapable of restoring to normal growth pattern.

1. Provide any replacements at same size and form.
2. Species of Replacement Trees: Same species being replaced

3.11 CLEANING AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

C. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

D. After installation and at the direction of the Landscape Architect remove nursery tags, nursery stakes, tie tape, and other debris from plant material, planting areas, and Project site.

E. At time of Substantial Completion, verify that watering devices are in good working order and leave them in place. Replace improperly functioning devices.

3.12 MAINTENANCE SERVICE

A. Maintenance: Provide maintenance by skilled employees of landscape installer. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:

1. Maintenance Period: 12 months after Substantial Completion

END OF SECTION 329300-PLANTS