Project Manual

Bid No. 21-16

Town of Arlington

Arlington Reservoir

Phase 2 Site Improvements

Arlington, Massachusetts

AWARDING AUTHORITY
TOWN OF ARLINGTON
acting through and by its

TOWN MANAGER
Town Hall Annex
730 Massachusetts Ave.
Arlington, MA 02476

February 4, 2021

Prepared by:

LANDSCAPE ARCHITECT
Kyle Zick Landscape Architecture, Inc.
36 Bromfield Street, Suite 202
Boston, MA 02108
(617) 451-1018

ENVIRONMENTAL CONSULTANT
SWCA Environmental Consultants
15 Research Drive
Amherst, MA 01002
(413) 575-9883

CIVIL ENGINEER
Woodard & Curran
980 Washington Street, #325
Dedham, MA 02026
(800) 446-5518

ELECTRICAL ENGINEER
Allied Consulting Engineering Services
235 Littleton Road, Suite 5
Westford, MA 01886
(918) 443-7888

STRUCTURAL ENGINEER
Childs Engineering Corporation
34 William Way
Bellingham, MA 02019
(508) 966-9092

ARCHITECT
Bargmann Hendrie + Archetype, Inc.
9 Channel Center Street, #300
Boston, MA 02110
(617) 350-0450

Town of Arlington
Bid No. 21-16

Rule for Award

PROJECT INFORMATION

The contract shall be awarded to the responsible and responsive Bidder submitting the lowest total price. The lowest total price will consist of the Base Bid plus the selected Add Alternates in the order they are provided in the bid package. The contract will be awarded within ninety (90) days after the bid opening. The time for award may be extended for up to 45 additional days by mutual agreement between the Town and the apparent lowest responsive and responsible bidder.

BACKGROUND

PROJECT INFORMATION	
Managing Town Department:	Recreation Department
Project Manager:	Joe Connelly, Director
Project Manager Email:	jconnelly@town.arlington.ma.us
Designer:	Kyle Zick Landscape Architecture, Inc.
Designer Contact:	Danielle Desilets, ddd@kylezick.com
Project Address:	210 Lowell Street, Arlington, MA
Brief Project Description:	The scope of work of the Base Bid includes installation of a porous pavement parking lot, new play area facility, restoration of perimeter trail, invasive species management, bank stabilization and revegetation, reinforced concrete pavement, installation of new ADA-accessible pathways, new recreational facilities, a boat launch, bathing beach improvements, and removal and pruning of select existing trees.
Estimated Project Cost:	$2,700,000.00
PROJECT SCHEDULE	
Bid Opening Date:	3/10/2021
Estimated Award Date:	4/15/2021
Estimated Start Date:	4/15/2021
Date of Substantial Completion:	12/1/2021
Date of Final Completion:	5/31/2022

MINIMUM QUALITY REQUIREMENTS

Quality requirements, or basic business requirements, are the minimum set of standards that an entity must meet and certify to be considered responsible and responsive. **Please complete the Quality Requirements form, below, and submit it with your completed bid.** The Town of Arlington will disqualify any response that does not meet the minimum quality requirements. A "No Response" to items 1 or 2, or a failure to respond to any of the following minimum standards may result in disqualification of your bid.

QUALITY REQUIREMENTS		**Yes**	**NO**
1.	Has the contractor been established in this specified field for at least 5 years?		
2.	Has the contractor successfully completed a minimum of three (3) similar sized Municipal Park projects (over $1,000,000) within the past five (5) years?		

In order to provide verification of affirmative responses to items 1 or 2 under the quality requirements listed in the Quality Requirements Form, Offeror must submit written information that details the general background, experience, and qualifications of the organization. Subcontractors, if applicable, must be also included.

TABLE OF CONTENTS

ARLINGTON RESERVOIR – PHASE 2 SITE IMPROVEMENTS
ARLINGTON, MA
100% Construction Documents – February 4, 2021

TECHNICAL SPECIFICATIONS:

END OF SECTION

INVITATION TO BID

Sealed Bids for construction of:

Arlington Reservoir
Phase 2 Site Improvements
210 Lowell Street
Arlington, MA 02474

in accordance with Contract Documents prepared by:

Kyle Zick Landscape Architecture, Inc. (KZLA)
36 Bromfield Street, Suite 202
Boston, MA 02108

hereinafter called the “Landscape Architect”, will be received by:

Town of Arlington
acting by and thorough its
Town Manager: Mr. Adam Chapdelaine

hereinafter called the "Awarding Authority", or "Owner" at:

Purchasing Department
Town Hall Annex
730 Massachusetts Ave.
Arlington, MA 02476
Attention: Town Manager Mr. Adam Chapdelaine

BID No. 21-16 - ARLINGTON RESERVOIR PHASE 2 SITE IMPROVEMENTS

Sealed bids for Arlington Reservoir Phase 2 Site Improvements for the Town of Arlington, Massachusetts, will be received at the Purchasing Department, 730 Massachusetts Avenue, Arlington, MA 02476 until **10:00 AM prevailing time, on Wednesday, March 10, 2021** at which time and place said bids will be publicly opened and read aloud.

All bids must be in a sealed envelope plainly marked:
BID No. 21-16 - ARLINGTON RESERVOIR PHASE 2 SITE IMPROVEMENTS
The scope of work of the Base Bid includes installation of a porous pavement parking lot, new play area facility, restoration of perimeter trail, invasive species management, bank stabilization and revegetation, reinforced concrete pavement, installation of new ADA-accessible pathways, new recreational facilities, a boat launch, bathing beach improvements, and removal and pruning of select existing trees.

Bid Security in the form of a bid bond, cash, certified check, treasurer’s, or cashier’s check payable to the Owner, is required in the amount of five percent of the bid, in accordance with Division 00 Section, INSTRUCTIONS TO BIDDERS.

The contract duration for the Base Bid is 365 consecutive days.

Contract Documents including Project Manual (Specifications) will be available for download from the Town’s purchasing website at: **www.arlingtonma.gov/purchasing** on **Wednesday, February 10, 2020 at 9:00 AM.**

Contract Documents and plans will not be mailed.

A **mandatory pre-bid conference** will be held on **Tuesday, February 23, 2021 at 11:00 AM.** The pre-bid conference will be held on-site at 210 Lowell Street in Arlington. Due to COVID-19 restrictions currently in place in the Commonwealth of Massachusetts, the pre-bid conference will be limited to 25 people. **Attendees must pre-register** with Joe Connelly, Town of Arlington Director of Recreation on or before **Wednesday, February 17, 2021** by email: jconnelly@town.arlington.ma.us. If an additional pre-bid conference needs to be held to accommodate all interested parties, the registrant will be made aware and the second pre-bid conference will be held on Tuesday, February 23, 2021 at 12:15 PM.

Questions should be directed to Danielle Desilets at Kyle Zick Landscape Architecture, Inc. via email: ddd@kylezick.com and will be accepted until **Friday, February 26, 2021 at 4:00 PM.** Responses will be posted on the Town's purchasing website the following week.

The selected contractor shall furnish a performance bond and a payment bond in amount at least equal to one hundred percent (100%) of the contract price as stipulated in Section 00 72 00 GENERAL CONDITIONS of these specifications.

Minimum Wage Rates as determined by the Commissioner of the Division of Occupational Safety of the Executive Office of Labor and Workforce Development under the provisions of the Massachusetts General Laws Chapter 149, Section 26 to 27D, as amended, apply to this project. It is the responsibility of the Bidder, before bid opening, to request if necessary, any additional information on Minimum Wage Rates for those trades people who may be employed for the proposed work under this contract.

By-law of the Town of Arlington, Title 1, Article 16, Minority/Woman Workforce Participation in Construction Projects which exceed $200,000.00 is part and parcel of the bid.

All bids for this project are subject to applicable bidding laws of Massachusetts, including General Laws Chapter 30, Section 39M as amended.

The Bidder agrees that this bid shall be good and may not be withdrawn for a period of 30 working days, Saturdays, Sundays, and legal holidays excluded after the opening of bids.

The Owner reserves the right to waive any informalities or to reject any or all bids.

TOWN OF ARLINGTON
acting through and by its
TOWN MANAGER
Adam W. Chapdelaine

INSTRUCTIONS TO BIDDER

1.0 COMPLEMENTARY DOCUMENT

A. INVITIATION TO BID, including herewith, is complementary to this document and shall be reviewed by bidder for specific instruction which are not repeated herein.

2.0 STATUTES REGULATING COMPETITIVE BIDDING

A. Bidding procedures and award of general contract and subcontracts shall be in accordance with the provisions of Chapter 30, Section 39M and Chapter 149, Section 44A through 44L inclusive, of the General Laws of the Commonwealth of Massachusetts, including all current amendments.

B. In the event of any discrepancy or inconsistency between the provisions of these Bid and Contract Documents and the above-mentioned statutes, the provisions of the above-mentioned statutes shall govern. In such event, the application of all remaining provisions not in conflict to any circumstance other than that in which the conflict occurs shall not be affected thereby.

3.0 BIDDER'S QUALIFICATIONS

A. DCPO Certification not required.

B. The Contractors' Update Statements are not public records and will not be open to public inspection.

4.0 INTERPRETATION OF DOCUMENTS: NOTIFICATION OF ERRORS

A. Interpretations of the provisions of the Bid and Contract Documents will be made by the designer upon written request of any general bidder or sub-bidder, provided that such request is received by the Designer at least seven (7) days prior to the date of the applicable bid opening, and that the Designer considers such interpretation to be of sufficient importance. Oral or telephone interpretations will not generally be made, and if made shall be strictly informal and not legally valid or binding.

B. Such written interpretations shall be in the form of Addenda to the Bid and Contract Documents.

C. Bidders are urged to communicate all errors and discrepancies found in the Bid and Contract Documents to the Designer. Telephone calls pointing out any such errors or discrepancies will be taken by the Designer, but only for the purpose of receiving the information in order that it may be properly processed, and not for interpretation or clarification.

5.0 EXAMINATION OF BIDDING AND CONTRACT DOCUMENTS

A. Each Bidder shall carefully examine the Bid and Contract Documents to obtain a thorough understanding of the work of his bid in addition to the work of related trades. In addition, each General Bidder shall personally visit the site to thoroughly acquaint himself/herself with the conditions as they exist hereon.

B. Failure of any Bidder to thoroughly examine the Bid and Contract Documents or to visit and examine the site shall in no way relieve him/her of any obligation with respect to his/her bid or of any responsibility assigned to him under the Contract.

6.0 PRE-BID CONFERENCE

A. A **mandatory pre-bid conference** will be held on **Tuesday, February 23, 2021 at 11:00 AM.**

B. The pre-bid conference will be held on-site at 210 Lowell Street in Arlington.

C. Due to COVID-19 restrictions currently in place in the Commonwealth of Massachusetts, the pre-bid conference will be limited to 25 people. **Attendees must pre-register** with Joe Connelly, Town of Arlington Director of Recreation on or before **Wednesday, February 17, 2021** by email: jconnelly@town.arlington.ma.us.

D. If an additional pre-bid conference needs to be held to accommodate all interest parties, the registrant will be made aware and the second pre-bid conference will be held on Tuesday, February 23, 2021 at 12:15 PM.

7.0 MODIFICATION AND WITHDRAWAL OF BIDS

A. Modification of withdrawal of Bids will be permitted after the submission of such bids provided clearly written, readily understandable instructions for same are received by the Owner in writing prior to the time established for opening of such bids. No Bid may be withdrawn after that time, except as otherwise provided herein or by law.

8.0 ADDENDA

A. Addenda may be required during the bidding period to modify, clarify, or interpret the Bid and Contract Documents. The Contractor is responsible for downloading Addendum from the Town's purchasing website at: **www.arlingtonma.gov/purchasing**.

B. Failure to receive such Addend shall in no way relieve any bidder from the execution of its provisions. All bidders are cautioned to verify the number of Addenda which have been issued and to secure any needed copies from the Designer before submitting their Bid.

9.0 FORM FOR BIDS

A. The Owner will make available, to every person applying therefor, a Bid Form. Each bona fide Bidder will be furnished forms for his proposal upon request. Such forms will be made available at the Owner's office during the regular office hours throughout the bidding period. Bids must be submitted on the forms provided by Owner or of forms included in the bid documents of the Project Manual.

B. All blank spaces provided on the bid forms shall be filled in with ink or typewriter. Where space if provided, sums shall be expressed in both words and figures. In case of a discrepancy between the two, the written words shall govern.

C. No interlineations, additional, alterations or erasures shall be made on the forms.

10.0 SUBMISSION OF BIDS

A. The Bid Form shall be properly executed and enclosed with the required bid deposit in a sealed envelope plainly marked on the outside with the following information.

Bid For:

_____

SUBMITTED BY:

_____

(Name of Bidder) (Address of Bidder)

B. If Bids are mailed; the above required envelope shall be enclosed in a second envelope identified with the above markings and mailed to the place of bid opening, as described in the Invitation to Bid. Mailed Bids must be received before the time scheduled for opening of Bids.

11.0 PERFORMANCE AND PAYMENT BONDS

A. The Performance and Labor and Materials Payment Bonds required of the General Contractor shall each be in the amount of 100% of the contract sum from a surety company qualified to do business under the laws of the Commonwealth of Massachusetts and approved by the Owner.

12.0 FOREIGN CORPORATIONS

A. The attention of bidders is called to General Laws, Chapter 30, Section 39L, as amended by Acts of 1967, Chapter 3, under which the Owner may not enter into a contract with a foreign corporation as a subcontractor unless the foreign corporation has filed with the Owner a certificate by the State Secretary stating that the foreign corporation has complied with General Laws Chapter 181, Sections 3 and 5 and stating the date of such compliance.

13.0 AWARD OF CONTRACT

A. The Contract will be awarded to the lowest responsible and eligible bidder except in the event of a substitution as provided by under Chapter 149, Sections 44E and 44F of the above-reference General Laws.

14.0 COMMENCEMENT AND COMPLETION OF WORK

A. The successful bidder, upon completion of the Contract Agreement, shall commence the work of the Contract within seven (7) calendar days from receipt of written Notice to Proceed issued by the Owner within fourteen (14) calendar days after said execution of the Contract Agreement and shall therefore diligently and continuously carry on the work in such manner as to substantially complete the work on or before May 31, 2019 except as noted herein.

15.0 LIQUIDATED DAMAGES

A. The attention of bidders is particularly called to the requirements as to the conditions of employment to be observed, the minimum wage rates to be paid under the Contract and affirmative action to ensure equal employment opportunity.

B. Contractor shall make full good faith efforts to secure at least ten percent (10%) of the Labor and Materials incorporated in the Work from Minority

Business Enterprises and five percent (5%) of the Labor and Materials incorporated in the Work from Women Business Enterprises certified by the Commonwealth of Massachusetts and consistent with the Federal Equal Employment Opportunity requirements attached hereto as Attachment A. Satisfactory documentation of such effort shall be furnished promptly upon request by Owner.

C. The Owner is an equal employment opportunity employer and has an active Affirmative Action Plan (AAP). For more information, direct correspondence to Patricia M. Libby, Affirmative Action Officer for the Town of Arlington.

BID FORM

For: **Arlington Reservoir Phase 2 Site Improvements**

Proposal (BID) of_____
(hereinafter called "Bidder") a corporation, organized and existing under the laws of the Commonwealth of Massachusetts.

_____

doing business as:_____
(corporation, proprietorship, partnership)

to the TOWN OF ARLINGTON hereinafter called "Owner". Gentlemen:

A. The Bidder, in compliance with your invitation for bids for the Arlington Reservoir Phase 2 Site Improvements, Arlington Massachusetts, having examined the plan and specifications with related documents and the site of the proposed project including the availability of materials and labor, hereby proposes to furnish all labor, materials and supplies, and to construct the project in accordance with the Contract Documents, within the time set forth therein, and at the prices stated below. These prices are to cover all expenses incurred in performing the work required under the Contract Documents, of which this proposal is a part.

Bidder hereby agrees to commence work under this Contract on or before a date to be specified in the written "Notice to Proceed" from the Owner, and to complete the work by May 31, 2019. The Bidder further agrees to pay as liquidated damages, the sum of $100.00 for each consecutive calendar day thereafter that the works remains incomplete, as provided in the Instruction to Bidders, Modifications to General Conditions. Required completion dates are as follows:

B. Bidder agrees to perform all work described in the specifications and shown on the drawings, for the following lump sum price of:

1. Total Proposed Base Bid Contract Price:

_____Dollars ($_____)

the form of_____is submitted herewith in accordance with the INSTRUCTION FOR BIDDERS and is to become property of the Owner in

the event the Contract and bonds are not executed within the time above set forth, as liquidated damages for the delay and additional expense to the Owner caused thereby.

2. The Bid does not include premiums on Performance/Labor and Materials Bond. Cost of required Bond Premiums:

Bid Premiums Add $_____

3. The Supplemental Unit Prices set forth herein shall be used to determine any equitable adjustment of the Contract in connection with the changes or extra work performed under this Contract as directed by the **Town of Arlington**.

It is mutually understood and agreed that such Supplemental Unit Prices include all items of costs, equipment, taxes, and insurance of every kind, overhead, and profit for the **Contractor** and they shall be used uniformly, without modification for addition and deductions. Prices listed under ADDITIONS and DEDUCTIONS are to be the complete total price billed to and paid by the **Town of Arlington**

therefor. There can be no more than fifteen (15) percent difference in price between the additions and deductions.

SUPPLEMENTAL UNIT PRICES FORM

	ITEM DESCRIPTION (All references to items shall correspond to work as described in the relevant portions of the Construction Documents.)	**UNIT**	**COST**	**APPROVED**
1	Construction fencing	LF	$	
2	12” straw wattle, secured in place, per Detail 2 on Sheet LD1	LF	$	
3	Silt sack inlet protection, per Detail 3 on Sheet LD1	EA	$	
4	Tree protection fencing – fence, per Detail 1 on Sheet LD1	LF	$	
5	Tree protection fencing – wood board, per Detail 2 on Sheet LD1	EA	$	
6	Remove tree & dispose of stump, 4” caliper DBH or less	EA	$	
7	Remove tree & dispose of stump, 4” caliper to 8” caliper	EA	$	
8	Remove tree & dispose of stump, 8” caliper DBH or greater	EA	$	
9	Remove shrub planting	EA	$	
10	Crown cleaning of existing tree	EA	$	
11	Crown raising of existing tree	EA	$	
12	Root pruning of existing tree	EA	$	
13	Rock excavation of 3 CY or greater, per specifications	CY	$	
14	Ordinary borrow/clean fill, complete in place	CY	$	
15	Dense graded gravel, complete in place	CY	$	
16	3/4” Crushed stone/drainage stone, complete in place	CY	$	
17	Placed boulders, 18”-24” in size, complete in place	EA	$	
18	Clean screened loam, complete in place	CY	$	
19	Planting soil, complete in place	CY	$	
20	Bituminous concrete paving, per detail and specification	SF	$	
21	5” reinforced concrete paving, complete in place including base and subbase preparation & broom finish	SF	$	
22	Turf seed & loam, per detail and specifications	SF	$	
23	Conservation seeding, per detail and specifications	SF	$	

C. If the Bid is accepted by the Owner, the undersigned agrees to complete the entire work provided to be done under the contract within the time stipulated by the Owner.

D. The undersigned agrees that for extra work, if any, performed in accordance with the AGREEMENT, he will accept compensation as stipulated therein in full payment for such extra work.

E. Bidder understands that the Owner reserves the right to reject any and all bids.

F. The undersigned hereby agrees that he will not withdraw the Bid within sixty (60) consecutive calendar days after the actual date of the opening of Bids and that, if the Owner accepts this Bid, the undersigned will duly execute and acknowledge the required Contract Bonds within 10 days after notification that the AGREEMENT is ready for signature.

G. Should the undersigned fail to fulfill any of his agreements as here in before set forth, the Owner shall have the right to retain as liquidated damages the amount of the Bid security, which shall become the Owner/s property. If a bid was furnished as bid security, it is agreed that the amount thereof shall be paid as liquidated damages to the Owner by the Surety.

H. The Undersigned certifies under penalty of perjury that this Bid is in all respect bona fide, fair and made without collusion or fraud with any other person. As used in this subsection the "person" shall men natural person, joint venture, partnership, corporation or other business or legal entity.

I. The undersigned certifies that he is able to furnish labor that can work in harmony with all with all laws and regulations applicable to awards made subject forty-four A.

a. Have been in business under the present name for_____years.
b. Ever failed to complete any work awarded?_____(Yes),_____(No)
If yes, explain: _____
_____
c. Bank Reference: _____

J. The Bidder is required to state below all work he/she and his/her subcontractors (if subcontractors are to perform substantial portions of the work) has compete within the past 5 years of a similar character and value to that of the work included in the proposed Contract and to give references that will enable the Owners to judge the Bidder's experience, skill and business standing. The Bidder is required to list a minimum of 3 completed projects that are comparable in scope, complexity, and value. For each project, include the name, location, type, date complete, construction value and owner contact.

_____
_____
_____
_____
_____

(add supplementary page if necessary)

K. The Bidder is required to state below all construction projects he/she currently has under contract. For each project, include the name, location, type, scheduled completion date, construction value and owner contact.

_____
_____
_____
_____
_____

L. The undersigned further certifies under the penalty of perjury that the said undersigned is not presently debarred from doing public construction work in the Commonwealth of Massachusetts under the provisions of section 29F, or any other applicable debarment provisions of any other chapter of the General Laws or any rule or regulation declared there under.

M. The undersigned bidder hereby certifies he/she will comply with the minority workforce percentage ratio and specific affirmative action steps contained in the EEO/AA provisions of the Contract, including compliance with Minority/Women Business Enterprise as required under these contract provisions. The contractor receiving the award of the Contract shall be required to obtain from each of its subcontractors a copy of its bidder's certification and submit it to the contracting agency prior to the award of such subcontract, regardless of tier, that it will comply with the minority workforce ratio and specific affirmative action steps contained in these EEO/AA contract provisions.

Date: _____

_____
Name of General Bidder

By:

_____
Name and Title of Person

_____
Signing Bond Business Address

FORM A: CERTIFICATE OF NON-COLLUSION

The undersigned certifies under penalties of perjury that this bid is in all respects bona fide, firm and made without collusion or fraud with any other person. As used in this section the word 'person' shall mean any natural person, joint venture, partnership, corporation or other business or legal entity.

Authorized Name

Authorized Signature Date

Social Security Number or Federal

Identification Number Legal Name of Business Entity (Print or Type)

Address

City, State, Zip Code

Corporate Seal (If applicable)

FORM B: CERTIFICATE OF FOREIGN CORPORATION

The undersigned certifies that it has been duly established, organized, or chartered as a corporation under the laws of:

_____

Jurisdiction

The undersigned further certifies that it complies with the requirements of M.G.L, c. 30, sec. 39L and with the requirements of M.G.L, c. 181 relative to the registration and operation of foreign corporations within the Commonwealth of Massachusetts.

_____

Name of Person Signing the Bid or Proposal Date

_____

Signature of Person Signing the Bid or Proposal Date

_____

Name of Business (Print or Type)

Corporate Seal (If applicable)

FORM C: COMMONWEALTH OF MASSACHUSETTS SCHEDULE FOR PARTICIPATION BY WOMEN/MINORITY BUSINESS ENTERPRISE BIDDER CERTIFICATION

A bidder agrees to expend at least the amount of the contract set forth below if awarded, for W/MBE. For the purposes of this commitment, the designation means a business that has been certified by SOMWBA as such. The Bidder must indicate the W/MBE it intends to utilize in this document as follows: (Attach another sheet of necessary.)

Company Name and Address	Nature of Participant	Dollar Value of Participation
1.		$
2.		$
3.		$

The undersigned hereby certifies that he or she read the terms of this condition and is authorized to bind the Bidder to the commitment herein set forth.

Name of Person Signing the Bid or Proposal Date

Signature of Person Signing the Bid or Proposal Date

Title Name of Business (Print or Type)

Corporate Seal (If applicable)

FORM D: BIDDER CERTIFICATION REGARDING PAYMENT OF PREVAILING WAGES

The undersigned hereby certifies, under pains and penalties of perjury, that the foregoing bid is based upon the payment to laborers to be employed on the project of wages in an amount no less that the applicable wage rates established for the project by the Massachusetts Department of Labor and Industries. The undersigned bidder agrees to identify the awarding authority for, from, and against any loss, expense, damages, action, or claims, including any expense incurred in connection with any delay or stoppage of the project work, arising out of or as a result of (1) the failure of the said bid to be based upon the payment of the said applicable prevailing wage rates or (2) the failure of the bidder, of selected as the contractor, to pay laborers employed on the project the said applying prevailing wage rates.

_____
Date

_____
Name of Person Signing the Bid or Proposal

_____
Signature of Person Signing the Bid or

_____
Proposal Title Name of Business (Print or Type)

Corporate Seal (If applicable)

FORM E: CERTIFICATION OF PAYMENT OF STATE TAXES

Legislation enacted by the Commonwealth of Massachusetts, effective, 1983, requires that attestation below be signed:

Pursuant to M.G.L c. 62C, sec. 49A, I certify under the penalties of perjury, that I, to my best knowledge and belief, have filed all state tax returns and paid all state taxes required by law.

APPROVAL OF A CONTRACT OR ANY OTHER AGREEMENT WILL NOT BE GRANTED UNLESS THIS CERITIFCATION CLAUSE IS SIGNED BY AN AUTHORIZED CORPORATE OFFICER.

THE TAXPAYER IDENTIFICATION NUMBER WILL BE FURNISHED TO THE MASSACHUSETIS DPEARTMENT OF REVENUE TO DETERMINE IF TAX FILINGS AND/OR TAX PAYMENT OBLIGATIONS HAVE BEEN MET. PROVIDERS WHO FAIL TO CORRECT THIER NON-FILING AND/OR DELIQUENCY STATUS SHALL NOT HAVE A CONTRACT OR ANY OTHER AGREEMENT ISSUED, RENEWED OR EXTENDED

(Signature of Individual) Title

Social Security Number or Federal Identification Number Corporate Name

Name of Person Signing the Proposal (Print or Type) Date

Legal Name of Business Entity (Printor Type) Business Address

Corporate Seal (If applicable):

FORM F: CERTIFICATION OF AUTHORITY MEETING OF BOARD OF DIRECTORS

(Note: If business entity is a partnership or individual, all owners shall sign this form.)

At a meeting of the Directors of the_____(Corporation) duly called and held at _____(Location) on the_____day of_____, 20___, at which a quorum was present and acting, it was voted that _____, (Name) the _____(Title/Position) of this Corporation, is hereby authorized and empowered to make, into, sign, seal and deliver on behalf of the Corporation a Contract for_____ with the _____, and the performance and payment bonds each in the amount as specified by the Owner.

I hereby certify that the above is a true and correct copy of the record, that said vote has not been amended or repealed and is in full force, and effect as of this date and that _____ _____, (Name) is duly elected _____(Title/Position) of the corporation.

_____

Clerk or secretary of the Corporation Date

(Note: If the Bidder is a corporation, affix corporate seal and give below the names of its president, treasurer, and general manager, if any: if a partnership, give full names and residential addresses of all partners; and if an individual, give residential dress if different form business address.)

The required names and addresses of all person interested in this proposal, as Principals, are as follows: _____

_____

FORM G: REFERENCE FORM

Bidder must provide references for three other Municipalities provided the same, or similar, services of a same size.

Bidder: _____

Address: _____

Reference: _____ Contact: _____

Address: _____ Phone: _____

_____ Email: _____

Description and date(s) of supplies or services provided: _____

_____

_____

Reference: _____ Contact: _____

Address: _____ Phone: _____

_____ Email: _____

Description and date(s) of supplies or services provided: _____

_____

_____

Reference: _____ Contact: _____

Address: _____ Phone: _____

_____ Email: _____

Description and date(s) of supplies or services provided: _____

_____

_____

CONTRACT FORM
for
ARLINGTON RESERVOIR PHASE 2 SITE IMPROVEMENTS

THIS AGREEMENT, made as of this_____day of__, 20____, by and between the TOWN OF ARLINGTON, MASSACHUSETTS, acting through its TOWN MANAGER, hereinafter called the 'Owner' and_____(Name of Contractor) of ,county of _____ and State of_____, hereinafter called the 'Contractor'.

WITNESSETH; That the Contractor and the Owner for the consideration hereinafter named agrees as follow:

1. SCOPE: The Contractor will furnish at his own proper cost and expense all materials, supplies, machinery, equipment, appliances, tools, superintendence, labor, insurance and other items and services necessary to complete the work as shown and described on the Contract Documents entitled "**Arlington Reservoir Phase 2 Site Improvements**", Arlington, Massachusetts, hereinafter called the 'Project', prepared by Kyle Zick Landscape Architecture, Inc. hereinafter called the 'Designer', or 'Landscape Architect'.

2. CONTRACT SUM: The owner agrees to pay the contractor, and the contractor agrees to accept in full consideration for the performance of the contract, subject to additions and deductions provided for in the contract documents, in current funds, the sum of dollars ($), hereinafter called the 'Contract Sum' and to make payments on account thereof, as described below and elsewhere in the Contract Documents.

3. COMMENCEMENT OF WORK AND TIME OF COMPLETION: The contractor agrees to commence work on the contract within seven (7) calendar days from the receipt of written Notice to Proceed issued by the Owner and/or within fourteen (14) calendar days after execution of the contract Agreement and to thereafter diligently and continuously carry on the work. He agrees to complete the work on or before **May 31, 2022**, except as herein noted.

4. LIQUIDATED DAMAGES: The Contractor agrees to pay the Owner liquidated damages for failure to complete the Project in conformance with the time allowances as set forth above at the rate of $100.00 per calendar day.

5. PAYMENTS TO CONTRACTOR: Payments shall be made in accordance with Chapter 30, Section 39K of the General Laws of the Commonwealth of Massachusetts, including all current amendments, generally as follows:

A. Within fifteen days after receipt from the Contractor, at the place designated by the Owner if such a place is so designated, of a period estimate requesting payment of the amount due for the preceding month, the Owner will make a periodic payment to the Contractor for the work performed during the preceding month and for the - materials not incorporated in the work but delivered and suitably stored at the site (or at some location agreed upon in writing) to which the Contractor has title or to which pa subcontractor has title and has authorized to Contractor to transfer title to the Owner, less (1) a retention based on its estimate of the fair value of its claims against the Contractor and less (2) a retention for direct payments to subcontractors based on demands for same in accordance with the provisions of Section 39F, and less (3) a retention not exceeding five percent of the approved amount of the periodic payment. After the receipt of a periodic estimate requesting final payment and within sixty-five days after (a) the Contractor fully completes the work or

substantially completes the work so that the value of the work remaining to be done is, in the estimate of the Owner, less than one percent of the original contract price, or (b) the Contractor substantially completes the work and the Owner takes possession for occupancy, whichever occurs first, the Owner shall pay the Contractor the entire balance due on the Contract less (1) a retention based on its estimate of the fair value of its claim against the Contractor and of the cost of completing the incomplete and unsatisfactory items of work and less (2) a retention for direct payments to subcontractors based on the demands for same in accordance with the provisions of Section 39F, or based on the record of payments by the Contractor to the subcontractors under this contract if such record of payment indicates that the Contractor has not paid subcontractors as provided in Section 39F. If the Owner fails to make payment as herein provided, there shall be added to each such payment daily interest at the rate of five percent per annum commencing on the first day after said payment is due and continuing until the payment is delivered or mailed to the Contractor, provided, that no interest shall be due, in any event, on the amount due on a periodic estimate for Final Payment until fifteen days after receipt of such a periodic estimate from the Contractor, at the place designated by the Owner if such a place is so designated. The Contractor agrees to pay to each subcontractor a portion of any such interest paid in accordance with the amount due each subcontractor.

B. The Owner may make changes in any periodic estimate submitted by the Contractor and the payment due on said periodic estimate shall be computed in accordance with the changes so made, but such changes or any requirement for a corrected periodic estimate shall not affect the due date for the periodic payment or the date for the commencement of interest charges on the amount of the periodic payment computed in accordance with the changes made, as provided herein; provided that the Owner may, within seven days after receipt, return to the Contractor for correction any periodic estimate which is not in the required form or which contains computations not arithmetically correct and, in that event, the date of receipt for such periodic estimate in proper form and with arithmetically correct computations. The date of receipt of a periodic estimate received on a Saturday shall be the first working day thereafter. The provisions of Section 39G shall not apply to any contract for the construction, reconstruction, remodeling, repair, or demolition of any public building to which this section applies.

6. PAYMENTS TO SUBCONTRACTORS: Payments shall be made in accordance with Chapter 30, Section 39F of the General Laws of the Commonwealth of Massachusetts, including all current amendments, generally as follows:

A. Forthwith after the General Contractor receives payment on account of a period estimate, the General Contractor shall pay to each Subcontractor the amount paid for the labor performed and the materials furnished in any court proceedings barring such payment and also less any amount claimed due from the Subcontractor by the General Contractor.

B. Not later than the sixty-fifth day after each Subcontractor substantially completes his work in accordance with the plans and specifications, the entire balance due under the Subcontract less amounts retained by the Owner as the estimated cost of completing the incomplete and unsatisfactory items of work, shall be due the Subcontractor, and the Owner shall pay that amount to the General Contractor. The General Contractor shall forthwith pay to the Subcontractor the full amount received from the Owner less any amount specified in any court proceedings barring such payment and also less any amount claimed due from the Subcontractor by the General Contractor.

C. Each payment made by the Owner to the General Contract pursuant to subparagraphs (A) and (B) of this paragraph for the labor performed and the

materials furnished by a Subcontractor shall be made to the General Contractor for the account of that Subcontractor: and the Owner shall take reasonable steps to compel the General Contractor to make each payment to each such Subcontractor. If the Owner has received a demand for direct payment from a Subcontractor for any amount which has already been included in a payment to the General Contractor for payment to the Subcontractor as provided in subparagraphs (A) and (B), the Owner shall act upon demand as provided in this Section.

D. If, within seventy days after the Subcontractor has substantially completed the Subcontract work, the Subcontractor has not received from the General Contractor the balance due under the Subcontract including any amount due for extra labor and materials furnished to the General Contractor, less any amount retained by the Owner as the estimated cost of completing the incomplete and unsatisfactory items of work, the Subcontractor may demand direct payment of that balance from the Owner. The demand shall be by a sworn statement delivered to or sent by certified mail to the Owner, and a copy shall be delivered to or sent by certified mail to the General Contractor at the same time. The demand shall contain a detailed breakdown or the balance due under the Subcontract and also a statement of the status of completion of the Subcontract work. Any demand made after Substantial Completion of the Subcontract work shall be- valid even if delivered or mailed prior to the seventieth day after the Subcontractor has substantially completed the Subcontract work Within ten days after the Subcontractor has delivered or so mailed the demand to the Owner and delivered or so mailed a copy to the General Contractor, the General Contractor may reply to the demand. The reply shall be a sworn statement delivered to or sent by certified mail to the Owner and a copy shall be delivered to or sent by certified mail to the Subcontractor at the same time. The reply shall contain a detailed breakdown of the balance due under the Subcontract including any amount due for extra labor and materials furnished to the General Contractor and of the amount due for each claim made by the General Contractor against the Subcontractor.

E. Within fifteen days after receipt of the demand by the Owner, but in no event prior to the seventieth day after Substantial Completion of the Subcontract work, the Awarding Authority shall make direct payment to the Subcontractor of the balance due under the Subcontract, less any amount (i) retained by the Owner as the estimated cost of completing the incomplete or unsatisfactory items of work, (ii) specified in any court proceedings barring such payment, or (iii) disputed by the General Contractor in the sworn reply: provided, that the Owner shall not deduct from a direct payment any amount as provided in part (iii) if the reply is not sworn to, or for which the sworn reply does not contain the detailed breakdown required in subparagraph (D); The Owner shall make further direct payments to the Subcontractor forthwith after the removal of the basis for deductions from direct payments made as provided in pans (i) and (ii) of this subparagraph.

F. The Owner shall forthwith deposit the amount deducted from a direct payment as provided in part (iii) of subparagraph (E) in an interest-bearing joint account in the names of the General Contractor and the Subcontractor in a bank in Massachusetts; selected by the Owner and agreed upon by the General Contractor and the Subcontractor and shall notify the General Contractor and the Subcontractor of the date of deposit and the bank receiving the deposit. The bank shall pay the amount on the account, including accrued interest, as provided in an agreement between the General Contractor and the Subcontractor or as determined by decree of a court of competent jurisdiction.

G. All direct payments and all deductions from demands for direct payments deposited in an interest-bearing account or accounts in a bank pursuant to subparagraph (F) shall be made out of amounts payable to the General Contractor at the time of receipt of a demand for direct payment from a Subcontractor and out of amounts

later become payable to the General Contractor and in order of receipt of such demands from Subcontractors. All direct payments shall discharge the obligation of the Owner to the General Contractor to the extent of such payment.

H. The Owner shall deduct from payments to a General Contractor amounts which, together with the deposits in interest-bearing accounts pursuant to subparagraph (F), are sufficient to satisfy all unpaid balances of demands for direct payment received from Subcontractors. All such amounts shall be earmarked for such direct payments, and the Subcontractors shall have a right in such deductions prior to any claims against such amounts by creditors of the General Contractor.

I. On all contracts for building construction subject to the provisions of Sections 44A to 44L, inclusive, of Chapter 149, periodic payments for work performed by a Subcontractor shall be made to the General Contractor for payment to the Subcontractor and shall be paid to the Subcontractor forthwith after receipt thereof by the General Contractor and without any ten day waiting period as provided above, less any amount claimed by the General Contractor it a letter containing a breakdown of the claim and sent to the Subcontractor with such payment, provided that a General Contractor, who has received a periodic estimate for a periodic payment in proper form from a Subcontractor three days, Saturdays, Sundays and holidays excluded, before the due date of the General Contractor's periodic estimate for the same periodic payment period less any amount claimed by the General Contractor in a letter containing a breakdown of the claim and sent to the Subcontractor with such payment, even though the General Contractor does not submit a periodic estimate to the Owner for that payment period; and provided, further, that the Owner shall take all reasonable steps to compel the General Contractor to make payment to the Subcontractors as provided in this paragraph, and upon the written request of a Subcontractor setting forth the amount payable but not paid, a copy of which shall be sent to the General Contractor, shall make direct payment to a Subcontractor, as provided for above, which shall discharge the obligation of the Owner to the General Contractor to extent of any such payment.

J. The Owner shall not include in any direct payment to a Subcontractor pursuant to this section any amount claimed from that Subcontractor by the General Contractor in a letter containing a breakdown of the claim and sent to the Owner within ten days after the receipt by the General Contractor of the copy of the request of the Subcontractor to the Owner for direct payment.

7. CONDITIONS OF EMPLOYMENT

A. The schedule of Minimum Wage Rates and Health and Pension Fund Contributions as determined by the Commissioner under the provisions of the Massachusetts General Laws, Chapter 149, Sections 26 m 27D, inclusive, AS amended, is hereby made a part of this Agreement.

B. The Contractor shall pay to any reserve police officer employed by him in any city or town the prevailing rate of wages paid to regular police officers in such city or town.

C. No laborer, workman, mechanic, foreman o inspector working within the Commonwealth, in the employ of the Contractor, Subcontractor or any other person doing or contracting to do the whole or a part of the work contemplated by the Contract, shall be required or permitted to work more than eight hours in any one day or forty-eight hours in any one week, or more than six days in any one week, except in cases of emergency.

D. Every employee of the Contractor or any Subcontractor shall lodge, board and trade where and with whom he elects; and no person or his agents or employees shall be directly or indirectly required, as a condition of employment that the

employee to lodge, board, or trade at a particular place or with a particular person.

8. SUBCONTRACTORS

A. The Contractor will employ the following Subcontractors on the work and will pay for the execution of his as defined in the Contract Documents; and subject to the additions and deductions provided in the subject to the additions and deductions provided in the Contract Documents, the sum shown opposite his name.

Class of Work	Subcontractor	Sub-Contractor Sum

The names of any additional Subcontractors whom the Contractor proposed to employ shall be submitted to the Designer for approval. No such Subcontractor shall be employed to who's standing or ability the Owner or the Designer has any reasonable objection.

9. THE CONTRACT DOCUMENTS: The General Conditions of the Contract, the Specifications, and the Drawings, together with this Agreement, for the Contract, and they are as fully a part of the Contract as if hereto attached or herein repeated Drawings and Specifications titled: Hill's Hill Playground ADA Walkway

10. INCORPORATION OF STATUTES BY REFERENCE: If statutes of the Commonwealth of Massachusetts in any way relating to the construction, alterations, repair, and installation of public works, particularly with reference to labor and labor rates, they shall be strictly complied with by the Contractor and it is understood that all such statutes are incorporated by reference in this Contract.

11. It is expressly agreed that this Agreement is to be executed for and in behalf of the Owner by the members of its Board of Selectmen and any of its appoints and that such persons are acting in a representative capacity for and in behalf of Owner, and that such persons shall not incur any personal liability hereunder.

IN WITNESS whereof, inhabitants of the Town of Arlington and

_____

have caused these presents to be executed by their

_____

hereunto duly authorized the day and year first written.

TOWN OF ARLINGTON

_____
Adam W. Chapdelaine, Town Manager

_____

_____

Certification:
I hereby Certify that an
appropriation in the amount
of the Contract is available.

_____
Town Accountant

_____
Contractor

By: (Title)

Approved as to Matter of Form:

_____
Town Counsel

THIS PAGE INTENTIONALLY LEFT BLANK

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: That we

_____
(Name of Contractor)

A_____
(Corporation, Partnership or Individual)

hereinafter called “Principal” and

_____
(Surety)
of_____, State of_____, hereinafter called the
"Surety", are held and firmly bound into

THE TOWN OF ARLINGTON, MASSACHUSETTS
(Owner)

acting through its TOWN MANAGER

ARLINGTON, MASSACHUSETTS
(City and State)

hereinafter called "Owner", in the penal sum of_____
__Dollars ($_____) in lawful money of the United states, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that Whereas, the Principal entered into a certain contract with the Owner, dated_

_____
day of a copy of which is hereto attached and made a part hereof for the construction of

_____

Arlington, Massachusetts

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions, and agreements of said contract during the original term thereof, and any extensions thereof which may be granted by, the Owner, with or without notice to the Surety, and if he shall satisfy all claims and demands incurred under such contract, and shall fully indemnify and save harmless the Owner from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the Owner all outlay and expense which the Owner may incur in making good any default, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said Surety, for value received hereby stipulates and agrees that no change, extension of time, alteration, or addition to the terms of the Contract or to the work to be performed thereunder or the specifications
accompanying the same

shall in any way affect its obligation of this, Bond, and it does hereby waive notice of any such change, extension of time, alteration, or addition to the terms of the contract or to the work or to the specifications.

PROVIDED, FURTHER, that no final settlement between the Owner and the Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

INWITNESS WHEREOF, the parties to these present have duly executed in this Bond on the day of_____

ATTEST:

_____
Principal

By:

_____
Secretary

_____

_____

_____
(Address - zip code)

_____ (Seal)
Witness as to Principal

_____

_____

_____
(Address - zip code)

ATTEST:

_____
Surety

By:

_____
(Surety)

_____
Secretary

_____

_____

_____
(Address-Zip Code)

_____ (Seal)
Witness as to Surety

_____

_____

_____
(Address-Zip Code)

NOTE: Date of Bond must not be prior to date of Contract. If Contractor is a Partnership, all partners should execute Bond.

END OF DOCUMENT

THIS PAGE INTENTIONALLY LEFT BLANK

LABOR AND MATERIALS PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS: That we

_____
(Name of Contractor) a
(Corporation, Partnership of Individual) hereinafter called
"Principal" and

_____
(Surety)

of_____, State of_____, hereinafter called the "Surety", are held and firmly bound into

TOWN OF ARLINGTON, MASSACHUSETTS
(Owner)
acting through its TOWN MANAGER

ARLINGTON, MASSACHUSETTS
(City and State)

herein called "Owner", in the penal sum of

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

THE CONDITION OF THIS OBLIGATION is such that 'Whereas, the Principal entered into a certain contract with the Owner, dated the day of_____, a copy of which is hereto attached and made a part hereof for the construction of:

ARLINGTON RESERVOIR PHASE 2 SITE IMPROVEMENTS

NOW, THEREFORE, if the Principal shall promptly make payment to all persons, firms, subcontractors, and corporations furnishing materials for or performing labor in the prosecution of the work provided for in such contract, and any authorized extension or modification thereof, including all amounts due for materials, lubricants, oil, gasoline, coal and coke, repairs on machinery, equipment and tools, consumed or used in connection with the construction of such work, and all insurance premiums on said work, and for all labor, performed in such work whether by subcontractor or otherwise, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said surety, for value received hereby stipulates and agrees that no change, extension of time, alteration, or addition to the terms of the contract or to the work to be performed thereunder or the specifications accompanying the Same shall in any wise affect its obligation on this Bond, and it does hereby waive notice of any such change, extension of time, alteration, or addition to the terms of the contract or to the work or to the specifications.

PROVIDED, FURTHER, that no final settlement between the Owner and the Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, the parties to these present have duly executed in this Bond on the day of_____,

ATTEST:

_____
Principal

By:
Secretary

_____

_____

_____
(Address-Zip Code)

_____ (Seal)
Witness as to Principal

_____

_____

_____
(Address-Zip Code)

NOTE: Date of Bond must not be prior to date of Contract. If Contractor is a Partnership, all partners should execute Bond.

END OF DOCUMENT

THIS PAGE INTENTIONALLY LEFT BLANK

MINIMUM WAGE RATES

SCHEDULE OF PREVAILING WAGE RATES

Per Chapter M.G.L. Chapter 149, §§26-27

Insert the schedule of minimum wage rates obtained from the Commonwealth of Massachusetts, Department of Labor and Workforce Development, Division of Occupational Safety

CAUTION: This email
originated from outside of the Town of Arlington's email system. Do not click links or open attachments unless you recognize the REAL sender (whose email address in the From: line in "< >" brackets) and you know the content is safe.

To view and print Weekly Payroll & Statement of Compliance Forms, click on www.mass.gov/dols/pw.

PLEASE NOTE: The attached Prevailing Wage Schedule is valid for 90 days. An Awarding Authority should re-request an up to date Prevailing Wage Schedule if it has NOT opened bids or selected a contractor within 90 days of the issuance date of the attached prevailing wage schedule.

*For MULTI-YEAR projects bid on or after 8/8/08, Awarding Authorities must request an Annual Update to this Prevailing Wage Schedule each year for the duration of the project, no later than two weeks before the anniversary date of the execution of the general contract. Annual updates are not required for projects that last LESS THAN ONE YEAR.

*For CM AT RISK projects (bid pursuant to GL c.149A), Awarding Authorities must request a Prevailing Wage Schedule NOT sooner than 90-days before the earlier of: (a) the execution date of the GMP Amendment, or (b) the bid for the first construction scope of work.

*For MULTI-YEAR CM AT RISK projects, Awarding Authorities must request an Annual Update to this Prevailing Wage Schedule each year for the duration of the project, no later than two weeks before the anniversary date, which is the earlier of: (a)the execution date of the GMP Amendment, or (b) the execution date of the first amendment to procure construction scopes of work.

Apprentice wages (expressed as dollar figures) and the required benefits are listed on the Prevailing Wage Schedule. For further details, please see opinion letter PW-2010-03-03.16.10 (dated March 18, 2010) at www.mass.gov/dols/pw.

Request Prevailing Wage Rates online at: www.mass.gov/dols/pw.

THIS IS A SYSTEM-GENERATED EMAIL. PLEASE DO NOT REPLY TO THIS EMAIL. TO CONTACT DLS REGARDING PREVAILING WAGE MATTERS, CALL 617-626-6953.
==========

APPROVAL/DENIAL COMMENTS

CHARLES D. BAKER
Governor

KARYN E. POLITO
Lt. Governor

THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF LABOR AND WORKFORCE DEVELOPMENT
DEPARTMENT OF LABOR STANDARDS

Prevailing Wage Rates

As determined by the Director under the provisions of the Massachusetts General Laws, Chapter 149, Sections 26 to 27H

ROSALIN ACOSTA
Secretary
MICHAEL FLANAGAN
Director

Awarding Authority: Town of Arlington

Contract Number: 21-16 **City/Town:** ARLINGTON

Description of Work: Phase 2 Site improvements to include but not limited to pavement parking lot, play area, trails, ADA accessible pathways, bank stabilization, revegetation, new recreational facilities, boat launch.

Job Location: Lowell St., Arlington Reservoir Site

Information about Prevailing Wage Schedules for Awarding Authorities and Contractors

- This wage schedule applies only to the specific project referenced at the top of this page and uniquely identified by the "Wage Request Number" on all pages of this schedule.
- An Awarding Authority must request an updated wage schedule from the Department of Labor Standards ("DLS") if it has not opened bids or selected a contractor within 90 days of the date of issuance of the wage schedule. For CM AT RISK projects (bid pursuant to G.L. c.149A), the earlier of: (a) the execution date of the GMP Amendment, or (b) the bid for the first construction scope of work must be within 90-days of the wage schedule issuance date.
- The wage schedule shall be incorporated in any advertisement or call for bids for the project as required by M.G.L. c. 149, § 27. The wage schedule shall be made a part of the contract awarded for the project. The wage schedule must be posted in a conspicuous place at the work site for the life of the project in accordance with M.G.L. c. 149 § 27. The wages listed on the wage schedule must be paid to employees performing construction work on the project whether they are employed by the prime contractor, a filed sub-bidder, or any sub-contractor.
- All apprentices working on the project are required to be registered with the Massachusetts Department of Labor Standards, Division of Apprentice Standards (DLS/DAS). Apprentice must keep his/her apprentice identification card on his/her person during all work hours on the project. An apprentice registered with DAS may be paid the lower apprentice wage rate at the applicable step as provided on the prevailing wage schedule. **Any apprentice not registered with DLS/DAS regardless of whether or not they are registered with any other federal, state, local, or private agency must be paid the journeyworker's rate for the trade.**
- The wage rates will remain in effect for the duration of the project, except in the case of multi-year public construction projects. For construction projects lasting longer than one year, awarding authorities must request an updated wage schedule. Awarding authorities are required to request these updates no later than two weeks before the anniversary of the date the contract was executed by the awarding authority and the general contractor. For multi-year CM AT RISK projects, awarding authority must request an annual update no later than two weeks before the anniversary date, determined as the earlier of: (a) the execution date of the GMP Amendment, or (b) the execution date of the first amendment to permit procurement of construction services. Contractors are required to obtain the wage schedules from awarding authorities, and to pay no less than these rates to covered workers. The annual update requirement is not applicable to 27F "rental of equipment" contracts.
- Every contractor or subcontractor which performs construction work on the project is required to submit weekly payroll reports and a Statement of Compliance directly to the awarding authority by mail or email and keep them on file for three years. Each weekly payroll report must contain: the employee's name, address, occupational classification, hours worked, and wages paid. Do not submit weekly payroll reports to DLS. A sample of a payroll reporting form may be obtained at http://www.mass.gov/dols/pw.
- Contractors with questions about the wage rates or classifications included on the wage schedule have an affirmative obligation to inquire with DLS at (617) 626-6953.
- Employees not receiving the prevailing wage rate set forth on the wage schedule may report the violation to the Fair Labor Division of the office of the Attorney General at (617) 727-3465.
- Failure of a contractor or subcontractor to pay the prevailing wage rates listed on the wage schedule to all employees who perform construction work on the project is a violation of the law and subjects the contractor or subcontractor to civil and criminal penalties.

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Construction						
(2 AXLE) DRIVER - EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE A*	12/01/2020	$36.25	$12.91	$14.82	$0.00	$63.98
	06/01/2021	$37.05	$12.91	$14.82	$0.00	$64.78
	08/01/2021	$37.05	$13.41	$14.82	$0.00	$65.28
	12/01/2021	$37.05	$13.41	$16.01	$0.00	$66.47
(3 AXLE) DRIVER - EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE A*	12/01/2020	$36.32	$12.91	$14.82	$0.00	$64.05
	06/01/2021	$37.12	$12.91	$14.82	$0.00	$64.85
	08/01/2021	$37.12	$13.41	$14.82	$0.00	$65.35
	12/01/2021	$37.12	$13.41	$16.01	$0.00	$66.54
(4 & 5 AXLE) DRIVER - EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE A*	12/01/2020	$36.44	$12.91	$14.82	$0.00	$64.17
	06/01/2021	$37.24	$12.91	$14.82	$0.00	$64.97
	08/01/2021	$37.24	$13.41	$14.82	$0.00	$65.47
	12/01/2021	$37.24	$13.41	$16.01	$0.00	$66.66
ADS/SUBMERSIBLE PILOT *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2020	$103.05	$9.40	$23.12	$0.00	$135.57
For apprentice rates see "Apprentice- PILE DRIVER"						
AIR TRACK OPERATOR *LABORERS - ZONE 1*	12/01/2020	$40.65	$8.60	$17.32	$0.00	$66.57
	06/01/2021	$41.67	$8.60	$17.32	$0.00	$67.59
	12/01/2021	$42.68	$8.60	$17.32	$0.00	$68.60
	06/01/2022	$43.68	$8.60	$17.32	$0.00	$69.60
	12/01/2022	$44.68	$8.60	$17.32	$0.00	$70.60
	06/01/2023	$45.68	$8.60	$17.32	$0.00	$71.60
	12/01/2023	$46.93	$8.60	$17.32	$0.00	$72.85
For apprentice rates see "Apprentice- LABORER"						
AIR TRACK OPERATOR (HEAVY & HIGHWAY) *LABORERS - ZONE 1 (HEAVY & HIGHWAY)*	12/01/2020	$40.65	$8.60	$17.32	$0.00	$66.57
	06/01/2021	$41.67	$8.60	$17.32	$0.00	$67.59
	12/01/2021	$42.68	$8.60	$17.32	$0.00	$68.60
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
ASBESTOS REMOVER - PIPE / MECH. EQUIPT. *HEAT & FROST INSULATORS LOCAL 6 (BOSTON)*	12/01/2020	$38.10	$12.80	$9.45	$0.00	$60.35
ASPHALT RAKER *LABORERS - ZONE 1*	12/01/2020	$40.15	$8.60	$17.32	$0.00	$66.07
	06/01/2021	$41.17	$8.60	$17.32	$0.00	$67.09
	12/01/2021	$42.18	$8.60	$17.32	$0.00	$68.10
	06/01/2022	$43.18	$8.60	$17.32	$0.00	$69.10
	12/01/2022	$44.18	$8.60	$17.32	$0.00	$70.10
	06/01/2023	$45.18	$8.60	$17.32	$0.00	$71.10
	12/01/2023	$46.43	$8.60	$17.32	$0.00	$72.35
For apprentice rates see "Apprentice- LABORER"						
ASPHALT RAKER (HEAVY & HIGHWAY) *LABORERS - ZONE 1 (HEAVY & HIGHWAY)*	12/01/2020	$40.15	$8.60	$17.32	$0.00	$66.07
	06/01/2021	$41.17	$8.60	$17.32	$0.00	$67.09
	12/01/2021	$42.18	$8.60	$17.32	$0.00	$68.10
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
ASPHALT/CONCRETE/CRUSHER PLANT-ON SITE *OPERATING ENGINEERS LOCAL 4*	12/01/2020	$49.98	$13.50	$15.70	$0.00	$79.18
	06/01/2021	$51.08	$13.50	$15.70	$0.00	$80.28
	12/01/2021	$52.23	$13.50	$15.70	$0.00	$81.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
BACKHOE/FRONT-END LOADER *OPERATING ENGINEERS LOCAL 4*	12/01/2020	$49.98	$13.50	$15.70	$0.00	$79.18
	06/01/2021	$51.08	$13.50	$15.70	$0.00	$80.28
	12/01/2021	$52.23	$13.50	$15.70	$0.00	$81.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
BARCO-TYPE JUMPING TAMPER *LABORERS - ZONE 1*	12/01/2020	$40.15	$8.60	$17.32	$0.00	$66.07
	06/01/2021	$41.17	$8.60	$17.32	$0.00	$67.09
	12/01/2021	$42.18	$8.60	$17.32	$0.00	$68.10
	06/01/2022	$43.18	$8.60	$17.32	$0.00	$69.10
	12/01/2022	$44.18	$8.60	$17.32	$0.00	$70.10
	06/01/2023	$45.18	$8.60	$17.32	$0.00	$71.10
	12/01/2023	$46.43	$8.60	$17.32	$0.00	$72.35
For apprentice rates see "Apprentice- LABORER"						
BLOCK PAVER, RAMMER / CURB SETTER *LABORERS - ZONE 1*	12/01/2020	$40.65	$8.60	$17.32	$0.00	$66.57
	06/01/2021	$41.67	$8.60	$17.32	$0.00	$67.59
	12/01/2021	$42.68	$8.60	$17.32	$0.00	$68.60
	06/01/2022	$43.68	$8.60	$17.32	$0.00	$69.60
	12/01/2022	$44.68	$8.60	$17.32	$0.00	$70.60
	06/01/2023	$45.68	$8.60	$17.32	$0.00	$71.60
	12/01/2023	$46.93	$8.60	$17.32	$0.00	$72.85
For apprentice rates see "Apprentice- LABORER"						
BLOCK PAVER, RAMMER / CURB SETTER (HEAVY & HIGHWAY) *LABORERS - ZONE 1 (HEAVY & HIGHWAY)*	12/01/2020	$40.65	$8.60	$17.32	$0.00	$66.57
	06/01/2021	$41.67	$8.60	$17.32	$0.00	$67.59
	12/01/2021	$42.68	$8.60	$17.32	$0.00	$68.60
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
BOILER MAKER *BOILERMAKERS LOCAL 29*	01/01/2020	$46.10	$7.07	$17.98	$0.00	$71.15

Apprentice - *BOILERMAKER - Local 29*

Effective Date - 01/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	65	$29.97	$7.07	$11.69	$0.00	$48.73
2	65	$29.97	$7.07	$11.69	$0.00	$48.73
3	70	$32.27	$7.07	$12.59	$0.00	$51.93
4	75	$34.58	$7.07	$13.49	$0.00	$55.14
5	80	$36.88	$7.07	$14.38	$0.00	$58.33
6	85	$39.19	$7.07	$15.29	$0.00	$61.55
7	90	$41.49	$7.07	$16.18	$0.00	$64.74
8	95	$43.80	$7.07	$17.09	$0.00	$67.96

Notes:

Apprentice to Journeyworker Ratio:1:4

BRICK/STONE/ARTIFICIAL MASONRY (INCL. MASONRY WATERPROOFING) *BRICKLAYERS LOCAL 3 (BOSTON)*	02/01/2021	$55.75	$11.39	$22.09	$0.00	$89.23
	08/01/2021	$57.15	$11.39	$22.25	$0.00	$90.79
	02/01/2022	$57.74	$11.39	$22.25	$0.00	$91.38

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *BRICK/PLASTER/CEMENT MASON - Local 3 Boston*

Effective Date - 02/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$27.88	$11.39	$22.09	$0.00	$61.36
2	60	$33.45	$11.39	$22.09	$0.00	$66.93
3	70	$39.03	$11.39	$22.09	$0.00	$72.51
4	80	$44.60	$10.75	$22.09	$0.00	$77.44
5	90	$50.18	$10.75	$22.09	$0.00	$83.02

Effective Date - 08/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$28.58	$11.39	$22.25	$0.00	$62.22
2	60	$34.29	$11.39	$22.25	$0.00	$67.93
3	70	$40.01	$11.39	$22.25	$0.00	$73.65
4	80	$45.72	$10.75	$22.25	$0.00	$78.72
5	90	$51.44	$10.75	$22.25	$0.00	$84.44

Notes:

Apprentice to Journeyworker Ratio:1:5

BULLDOZER/GRADER/SCRAPER *OPERATING ENGINEERS LOCAL 4*	12/01/2020	$49.45	$13.50	$15.70	$0.00	$78.65
	06/01/2021	$50.54	$13.50	$15.70	$0.00	$79.74
	12/01/2021	$51.68	$13.50	$15.70	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
CAISSON & UNDERPINNING BOTTOM MAN *LABORERS - FOUNDATION AND MARINE*	12/01/2020	$41.05	$8.60	$17.47	$0.00	$67.12
	06/01/2021	$42.07	$8.60	$17.47	$0.00	$68.14
	12/01/2021	$43.08	$8.60	$17.47	$0.00	$69.15
For apprentice rates see "Apprentice- LABORER"						
CAISSON & UNDERPINNING LABORER *LABORERS - FOUNDATION AND MARINE*	12/01/2020	$39.90	$8.60	$17.47	$0.00	$65.97
	06/01/2021	$40.92	$8.60	$17.47	$0.00	$66.99
	12/01/2021	$41.93	$8.60	$17.47	$0.00	$68.00
For apprentice rates see "Apprentice- LABORER"						
CAISSON & UNDERPINNING TOP MAN *LABORERS - FOUNDATION AND MARINE*	12/01/2020	$39.90	$8.60	$17.47	$0.00	$65.97
	06/01/2021	$40.92	$8.60	$17.47	$0.00	$66.99
	12/01/2021	$41.93	$8.60	$17.47	$0.00	$68.00
For apprentice rates see "Apprentice- LABORER"						
CARBIDE CORE DRILL OPERATOR *LABORERS - ZONE 1*	12/01/2020	$40.15	$8.60	$17.32	$0.00	$66.07
	06/01/2021	$41.17	$8.60	$17.32	$0.00	$67.09
	12/01/2021	$42.18	$8.60	$17.32	$0.00	$68.10
	06/01/2022	$43.18	$8.60	$17.32	$0.00	$69.10
	12/01/2022	$44.18	$8.60	$17.32	$0.00	$70.10
	06/01/2023	$45.18	$8.60	$17.32	$0.00	$71.10
	12/01/2023	$46.43	$8.60	$17.32	$0.00	$72.35
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
CARPENTER *CARPENTERS -ZONE 2 (Eastern Massachusetts)*	09/01/2020	$42.94	$9.40	$18.95	$0.00	$71.29
	03/01/2021	$43.54	$9.40	$18.95	$0.00	$71.89
	09/01/2021	$44.19	$9.40	$18.95	$0.00	$72.54
	03/01/2022	$44.79	$9.40	$18.95	$0.00	$73.14
	09/01/2022	$45.44	$9.40	$18.95	$0.00	$73.79
	03/01/2023	$46.04	$9.40	$18.95	$0.00	$74.39

Apprentice - *CARPENTER - Zone 2 Eastern MA*

Effective Date - 09/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$21.47	$9.40	$1.73	$0.00	$32.60
2	60	$25.76	$9.40	$1.73	$0.00	$36.89
3	70	$30.06	$9.40	$13.76	$0.00	$53.22
4	75	$32.21	$9.40	$13.76	$0.00	$55.37
5	80	$34.35	$9.40	$15.49	$0.00	$59.24
6	80	$34.35	$9.40	$15.49	$0.00	$59.24
7	90	$38.65	$9.40	$17.22	$0.00	$65.27
8	90	$38.65	$9.40	$17.22	$0.00	$65.27

Effective Date - 03/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$21.77	$9.40	$1.73	$0.00	$32.90
2	60	$26.12	$9.40	$1.73	$0.00	$37.25
3	70	$30.48	$9.40	$13.76	$0.00	$53.64
4	75	$32.66	$9.40	$13.76	$0.00	$55.82
5	80	$34.83	$9.40	$15.49	$0.00	$59.72
6	80	$34.83	$9.40	$15.49	$0.00	$59.72
7	90	$39.19	$9.40	$17.22	$0.00	$65.81
8	90	$39.19	$9.40	$17.22	$0.00	$65.81

Notes:

% Indentured After 10/1/17; 45/45/55/55/70/70/80/80
Step 1&2 $30.45/ 3&4 $36.42/ 5&6 $54.95/ 7&8 $60.97

Apprentice to Journeyworker Ratio:1:5

CARPENTER WOOD FRAME *CARPENTERS-ZONE 3 (Wood Frame)*	04/01/2020	$22.66	$7.21	$4.80	$0.00	$34.67
	04/01/2021	$23.16	$7.21	$4.80	$0.00	$35.17
	04/01/2022	$23.66	$7.21	$4.80	$0.00	$35.67
	04/01/2023	$24.16	$7.21	$4.80	$0.00	$36.17

All Aspects of New Wood Frame Work

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *CARPENTER (Wood Frame) - Zone 3*

Effective Date - 04/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$13.60	$7.21	$0.00	$0.00	$20.81
2	60	$13.60	$7.21	$0.00	$0.00	$20.81
3	65	$14.73	$7.21	$0.00	$0.00	$21.94
4	70	$15.86	$7.21	$0.00	$0.00	$23.07
5	75	$17.00	$7.21	$3.80	$0.00	$28.01
6	80	$18.13	$7.21	$3.80	$0.00	$29.14
7	85	$19.26	$7.21	$3.80	$0.00	$30.27
8	90	$20.39	$7.21	$3.80	$0.00	$31.40

Effective Date - 04/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$13.90	$7.21	$0.00	$0.00	$21.11
2	60	$13.90	$7.21	$0.00	$0.00	$21.11
3	65	$15.05	$7.21	$0.00	$0.00	$22.26
4	70	$16.21	$7.21	$0.00	$0.00	$23.42
5	75	$17.37	$7.21	$3.80	$0.00	$28.38
6	80	$18.53	$7.21	$3.80	$0.00	$29.54
7	85	$19.69	$7.21	$3.80	$0.00	$30.70
8	90	$20.84	$7.21	$3.80	$0.00	$31.85

Notes:

% Indentured After 10/1/17; 45/45/55/55/70/70/80/80
Step 1&2 $17.41/ 3&4 $19.67/ 5&6 $26.87/ 7&8 $29.14

Apprentice to Journeyworker Ratio:1:5

CEMENT MASONRY/PLASTERING *BRICKLAYERS LOCAL 3 (BOSTON)*	01/01/2020	$49.07	$12.75	$22.41	$0.62	$84.85

Apprentice - *CEMENT MASONRY/PLASTERING - Eastern Mass (Boston)*

Effective Date - 01/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.54	$12.75	$15.41	$0.00	$52.70
2	60	$29.44	$12.75	$17.41	$0.62	$60.22
3	65	$31.90	$12.75	$18.41	$0.62	$63.68
4	70	$34.35	$12.75	$19.41	$0.62	$67.13
5	75	$36.80	$12.75	$20.41	$0.62	$70.58
6	80	$39.26	$12.75	$21.41	$0.62	$74.04
7	90	$44.16	$12.75	$22.41	$0.62	$79.94

Notes:

Steps 3,4 are 500 hrs. All other steps are 1,000 hrs.

Apprentice to Journeyworker Ratio:1:3

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
CHAIN SAW OPERATOR *LABORERS - ZONE 1*	12/01/2020	$40.15	$8.60	$17.32	$0.00	$66.07
	06/01/2021	$41.17	$8.60	$17.32	$0.00	$67.09
	12/01/2021	$42.18	$8.60	$17.32	$0.00	$68.10
	06/01/2022	$43.18	$8.60	$17.32	$0.00	$69.10
	12/01/2022	$44.18	$8.60	$17.32	$0.00	$70.10
	06/01/2023	$45.18	$8.60	$17.32	$0.00	$71.10
	12/01/2023	$46.43	$8.60	$17.32	$0.00	$72.35
For apprentice rates see "Apprentice- LABORER"						
CLAM SHELLS/SLURRY BUCKETS/HEADING MACHINES *OPERATING ENGINEERS LOCAL 4*	12/01/2020	$50.98	$13.50	$15.70	$0.00	$80.18
	06/01/2021	$52.08	$13.50	$15.70	$0.00	$81.28
	12/01/2021	$53.23	$13.50	$15.70	$0.00	$82.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
COMPRESSOR OPERATOR *OPERATING ENGINEERS LOCAL 4*	12/01/2020	$33.00	$13.50	$15.70	$0.00	$62.20
	06/01/2021	$33.75	$13.50	$15.70	$0.00	$62.95
	12/01/2021	$34.54	$13.50	$15.70	$0.00	$63.74
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
DELEADER (BRIDGE) *PAINTERS LOCAL 35 - ZONE 2*	01/01/2021	$52.06	$8.25	$22.75	$0.00	$83.06

Apprentice - *PAINTER Local 35 - BRIDGES/TANKS*

Effective Date - 01/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$26.03	$8.25	$0.00	$0.00	$34.28
2	55	$28.63	$8.25	$6.16	$0.00	$43.04
3	60	$31.24	$8.25	$6.72	$0.00	$46.21
4	65	$33.84	$8.25	$7.28	$0.00	$49.37
5	70	$36.44	$8.25	$19.39	$0.00	$64.08
6	75	$39.05	$8.25	$19.95	$0.00	$67.25
7	80	$41.65	$8.25	$20.51	$0.00	$70.41
8	90	$46.85	$8.25	$21.63	$0.00	$76.73

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

DEMO: ADZEMAN *LABORERS - ZONE 1*	12/01/2020	$40.05	$8.60	$17.32	$0.00	$65.97
	06/01/2021	$41.07	$8.60	$17.32	$0.00	$66.99
	12/01/2021	$42.08	$8.60	$17.32	$0.00	$68.00
	06/01/2022	$43.08	$8.60	$17.32	$0.00	$69.00
	12/01/2022	$44.08	$8.60	$17.32	$0.00	$70.00
	06/01/2023	$45.08	$8.60	$17.32	$0.00	$71.00
	12/01/2023	$46.33	$8.60	$17.32	$0.00	$72.25
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
DEMO: BACKHOE/LOADER/HAMMER OPERATOR *LABORERS - ZONE 1*	12/01/2020	$41.05	$8.60	$17.32	$0.00	$66.97
	06/01/2021	$42.07	$8.60	$17.32	$0.00	$67.99
	12/01/2021	$43.08	$8.60	$17.32	$0.00	$69.00
	06/01/2022	$44.08	$8.60	$17.32	$0.00	$70.00
	12/01/2022	$45.08	$8.60	$17.32	$0.00	$71.00
	06/01/2023	$46.08	$8.60	$17.32	$0.00	$72.00
	12/01/2023	$47.33	$8.60	$17.32	$0.00	$73.25
For apprentice rates see "Apprentice- LABORER"						
DEMO: BURNERS *LABORERS - ZONE 1*	12/01/2020	$40.80	$8.60	$17.32	$0.00	$66.72
	06/01/2021	$41.82	$8.60	$17.32	$0.00	$67.74
	12/01/2021	$42.83	$8.60	$17.32	$0.00	$68.75
	06/01/2022	$43.83	$8.60	$17.32	$0.00	$69.75
	12/01/2022	$44.83	$8.60	$17.32	$0.00	$70.75
	06/01/2023	$45.83	$8.60	$17.32	$0.00	$71.75
	12/01/2023	$47.08	$8.60	$17.32	$0.00	$73.00
For apprentice rates see "Apprentice- LABORER"						
DEMO: CONCRETE CUTTER/SAWYER *LABORERS - ZONE 1*	12/01/2020	$41.05	$8.60	$17.32	$0.00	$66.97
	06/01/2021	$42.07	$8.60	$17.32	$0.00	$67.99
	12/01/2021	$43.08	$8.60	$17.32	$0.00	$69.00
	06/01/2022	$44.08	$8.60	$17.32	$0.00	$70.00
	12/01/2022	$45.08	$8.60	$17.32	$0.00	$71.00
	06/01/2023	$46.08	$8.60	$17.32	$0.00	$72.00
	12/01/2023	$47.33	$8.60	$17.32	$0.00	$73.25
For apprentice rates see "Apprentice- LABORER"						
DEMO: JACKHAMMER OPERATOR *LABORERS - ZONE 1*	12/01/2020	$40.80	$8.60	$17.32	$0.00	$66.72
	06/01/2021	$41.82	$8.60	$17.32	$0.00	$67.74
	12/01/2021	$42.83	$8.60	$17.32	$0.00	$68.75
	06/01/2022	$43.83	$8.60	$17.32	$0.00	$69.75
	12/01/2022	$44.83	$8.60	$17.32	$0.00	$70.75
	06/01/2023	$45.83	$8.60	$17.32	$0.00	$71.75
	12/01/2023	$47.08	$8.60	$17.32	$0.00	$73.00
For apprentice rates see "Apprentice- LABORER"						
DEMO: WRECKING LABORER *LABORERS - ZONE 1*	12/01/2020	$40.05	$8.60	$17.32	$0.00	$65.97
	06/01/2021	$41.07	$8.60	$17.32	$0.00	$66.99
	12/01/2021	$42.08	$8.60	$17.32	$0.00	$68.00
	06/01/2022	$43.08	$8.60	$17.32	$0.00	$69.00
	12/01/2022	$44.08	$8.60	$17.32	$0.00	$70.00
	06/01/2023	$45.08	$8.60	$17.32	$0.00	$71.00
	12/01/2023	$46.33	$8.60	$17.32	$0.00	$72.25
For apprentice rates see "Apprentice- LABORER"						
DIRECTIONAL DRILL MACHINE OPERATOR *OPERATING ENGINEERS LOCAL 4*	12/01/2020	$49.45	$13.50	$15.70	$0.00	$78.65
	06/01/2021	$50.54	$13.50	$15.70	$0.00	$79.74
	12/01/2021	$51.68	$13.50	$15.70	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
DIVER *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2020	$68.70	$9.40	$23.12	$0.00	$101.22
For apprentice rates see "Apprentice- PILE DRIVER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
DIVER TENDER *PILE DRIVER LOCAL 56 (ZONE 1)* For apprentice rates see "Apprentice- PILE DRIVER"	08/01/2020	$49.07	$9.40	$23.12	$0.00	$81.59
DIVER TENDER (EFFLUENT) *PILE DRIVER LOCAL 56 (ZONE 1)* For apprentice rates see "Apprentice- PILE DRIVER"	08/01/2020	$73.60	$9.40	$23.12	$0.00	$106.12
DIVER/SLURRY (EFFLUENT) *PILE DRIVER LOCAL 56 (ZONE 1)* For apprentice rates see "Apprentice- PILE DRIVER"	08/01/2020	$103.05	$9.40	$23.12	$0.00	$135.57
DRAWBRIDGE OPERATOR (Construction) *DRAWBRIDGE - SEIU LOCAL 888*	07/01/2020	$26.77	$6.67	$3.93	$0.16	$37.53
ELECTRICIAN *ELECTRICIANS LOCAL 103*	09/01/2020	$54.45	$13.00	$19.73	$0.00	$87.18
	03/01/2021	$55.41	$13.00	$20.01	$0.00	$88.42
	09/01/2021	$56.84	$13.00	$20.06	$0.00	$89.90
	03/01/2022	$58.04	$13.00	$20.09	$0.00	$91.13
	09/01/2022	$59.48	$13.00	$20.13	$0.00	$92.61
	03/01/2023	$60.67	$13.00	$20.17	$0.00	$93.84

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *ELECTRICIAN - Local 103*

Effective Date - 09/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$21.78	$13.00	$0.65	$0.00	$35.43
2	40	$21.78	$13.00	$0.65	$0.00	$35.43
3	45	$24.50	$13.00	$14.87	$0.00	$52.37
4	45	$24.50	$13.00	$14.87	$0.00	$52.37
5	50	$27.23	$13.00	$15.31	$0.00	$55.54
6	55	$29.95	$13.00	$15.75	$0.00	$58.70
7	60	$32.67	$13.00	$16.19	$0.00	$61.86
8	65	$35.39	$13.00	$16.63	$0.00	$65.02
9	70	$38.12	$13.00	$17.07	$0.00	$68.19
10	75	$40.84	$13.00	$17.53	$0.00	$71.37

Effective Date - 03/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$22.16	$13.00	$0.66	$0.00	$35.82
2	40	$22.16	$13.00	$0.66	$0.00	$35.82
3	45	$24.93	$13.00	$15.13	$0.00	$53.06
4	45	$24.93	$13.00	$15.13	$0.00	$53.06
5	50	$27.71	$13.00	$15.57	$0.00	$56.28
6	55	$30.48	$13.00	$16.01	$0.00	$59.49
7	60	$33.25	$13.00	$16.46	$0.00	$62.71
8	65	$36.02	$13.00	$16.90	$0.00	$65.92
9	70	$38.79	$13.00	$17.34	$0.00	$69.13
10	75	$41.56	$13.00	$17.80	$0.00	$72.36

Notes: :

App Prior 1/1/03; 30/35/40/45/50/55/65/70/75/80

Apprentice to Journeyworker Ratio:2:3***

ELEVATOR CONSTRUCTOR *ELEVATOR CONSTRUCTORS LOCAL 4*	01/01/2021	$63.47	$15.88	$19.31	$0.00	$98.66
	01/01/2022	$65.62	$16.03	$20.21	$0.00	$101.86

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *ELEVATOR CONSTRUCTOR - Local 4*

Effective Date - 01/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$31.74	$15.88	$0.00	$0.00	$47.62
2	55	$34.91	$15.88	$19.31	$0.00	$70.10
3	65	$41.26	$15.88	$19.31	$0.00	$76.45
4	70	$44.43	$15.88	$19.31	$0.00	$79.62
5	80	$50.78	$15.88	$19.31	$0.00	$85.97

Effective Date - 01/01/2022

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$32.81	$16.03	$0.00	$0.00	$48.84
2	55	$36.09	$16.03	$20.21	$0.00	$72.33
3	65	$42.65	$16.03	$20.21	$0.00	$78.89
4	70	$45.93	$16.03	$20.21	$0.00	$82.17
5	80	$52.50	$16.03	$20.21	$0.00	$88.74

Notes:
Steps 1-2 are 6 mos.; Steps 3-5 are 1 year

Apprentice to Journeyworker Ratio:1:1

ELEVATOR CONSTRUCTOR HELPER *ELEVATOR CONSTRUCTORS LOCAL 4*	01/01/2021	$44.43	$15.88	$19.31	$0.00	$79.62
	01/01/2022	$45.93	$16.03	$20.21	$0.00	$82.17
For apprentice rates see "Apprentice - ELEVATOR CONSTRUCTOR"						
FENCE & GUARD RAIL ERECTOR *LABORERS - ZONE 1*	12/01/2020	$40.15	$8.60	$17.32	$0.00	$66.07
	06/01/2021	$41.17	$8.60	$17.32	$0.00	$67.09
	12/01/2021	$42.18	$8.60	$17.32	$0.00	$68.10
	06/01/2022	$43.18	$8.60	$17.32	$0.00	$69.10
	12/01/2022	$44.18	$8.60	$17.32	$0.00	$70.10
	06/01/2023	$45.18	$8.60	$17.32	$0.00	$71.10
	12/01/2023	$46.43	$8.60	$17.32	$0.00	$72.35
For apprentice rates see "Apprentice- LABORER"						
FENCE & GUARD RAIL ERECTOR (HEAVY & HIGHWAY) *LABORERS - ZONE 1 (HEAVY & HIGHWAY)*	12/01/2020	$40.15	$8.60	$17.32	$0.00	$66.07
	06/01/2021	$41.17	$8.60	$17.32	$0.00	$67.09
	12/01/2021	$42.18	$8.60	$17.32	$0.00	$68.10
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
FIELD ENG.INST.PERSON-BLDG,SITE,HVY/HWY *OPERATING ENGINEERS LOCAL 4*	11/01/2020	$45.23	$13.00	$15.70	$0.00	$73.93
	05/01/2021	$46.38	$13.00	$15.70	$0.00	$75.08
	11/01/2021	$47.38	$13.00	$15.70	$0.00	$76.08
	05/01/2022	$48.53	$13.00	$15.70	$0.00	$77.23
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FIELD ENG.PARTY CHIEF-BLDG,SITE,HVY/HWY *OPERATING ENGINEERS LOCAL 4*	11/01/2020	$46.74	$13.00	$15.70	$0.00	$75.44
	05/01/2021	$47.90	$13.00	$15.70	$0.00	$76.60
	11/01/2021	$48.91	$13.00	$15.70	$0.00	$77.61
	05/01/2022	$50.07	$13.00	$15.70	$0.00	$78.77
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
FIELD ENG.ROD PERSON-BLDG,SITE,HVY/HWY *OPERATING ENGINEERS LOCAL 4*	11/01/2020	$22.73	$13.00	$15.70	$0.00	$51.43
	05/01/2021	$23.41	$13.00	$15.70	$0.00	$52.11
	11/01/2021	$24.01	$13.00	$15.70	$0.00	$52.71
	05/01/2022	$24.68	$13.00	$15.70	$0.00	$53.38
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FIRE ALARM INSTALLER *ELECTRICIANS LOCAL 103*	09/01/2020	$54.45	$13.00	$19.73	$0.00	$87.18
	03/01/2021	$55.41	$13.00	$20.01	$0.00	$88.42
	09/01/2021	$56.84	$13.00	$20.06	$0.00	$89.90
	03/01/2022	$58.04	$13.00	$20.09	$0.00	$91.13
	09/01/2022	$59.48	$13.00	$20.13	$0.00	$92.61
	03/01/2023	$60.67	$13.00	$20.17	$0.00	$93.84
For apprentice rates see "Apprentice- ELECTRICIAN"						
FIRE ALARM REPAIR / MAINTENANCE / COMMISSIONING*ELECTRICIANS LOCAL 103*	09/01/2020	$40.84	$13.00	$17.53	$0.00	$71.37
	03/01/2021	$42.11	$13.00	$17.88	$0.00	$72.99
	09/01/2021	$43.77	$13.00	$18.00	$0.00	$74.77
	03/01/2022	$45.27	$13.00	$18.12	$0.00	$76.39
	09/01/2022	$46.99	$13.00	$18.24	$0.00	$78.23
	03/01/2023	$48.54	$13.00	$18.37	$0.00	$79.91
For apprentice rates see "Apprentice- TELECOMMUNICATIONS TECHNICIAN"						
FIREMAN (ASST. ENGINEER) *OPERATING ENGINEERS LOCAL 4*	12/01/2020	$40.75	$13.50	$15.70	$0.00	$69.95
	06/01/2021	$41.66	$13.50	$15.70	$0.00	$70.86
	12/01/2021	$42.61	$13.50	$15.70	$0.00	$71.81
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FLAGGER & SIGNALER (HEAVY & HIGHWAY) *LABORERS - ZONE 1 (HEAVY & HIGHWAY)*	12/01/2020	$24.50	$8.60	$17.32	$0.00	$50.42
	06/01/2021	$24.50	$8.60	$17.32	$0.00	$50.42
	12/01/2021	$24.50	$8.60	$17.32	$0.00	$50.42
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
FLOORCOVERER *FLOORCOVERERS LOCAL 2168 ZONE I*	09/01/2020	$47.79	$9.40	$19.25	$0.00	$76.44
	03/01/2021	$48.59	$9.40	$19.25	$0.00	$77.24
	09/01/2021	$49.39	$9.40	$19.25	$0.00	$78.04
	03/01/2022	$50.19	$9.40	$19.25	$0.00	$78.84

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *FLOORCOVERER - Local 2168 Zone I*

Effective Date - 09/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$23.90	$9.40	$1.79	$0.00	$35.09
2	55	$26.28	$9.40	$1.79	$0.00	$37.47
3	60	$28.67	$9.40	$13.88	$0.00	$51.95
4	65	$31.06	$9.40	$13.88	$0.00	$54.34
5	70	$33.45	$9.40	$15.67	$0.00	$58.52
6	75	$35.84	$9.40	$15.67	$0.00	$60.91
7	80	$38.23	$9.40	$17.46	$0.00	$65.09
8	85	$40.62	$9.40	$17.46	$0.00	$67.48

Effective Date - 03/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.30	$9.40	$1.79	$0.00	$35.49
2	55	$26.72	$9.40	$1.79	$0.00	$37.91
3	60	$29.15	$9.40	$13.88	$0.00	$52.43
4	65	$31.58	$9.40	$13.88	$0.00	$54.86
5	70	$34.01	$9.40	$15.67	$0.00	$59.08
6	75	$36.44	$9.40	$15.67	$0.00	$61.51
7	80	$38.87	$9.40	$17.46	$0.00	$65.73
8	85	$41.30	$9.40	$17.46	$0.00	$68.16

Notes: Steps are 750 hrs.
% After 09/1/17; 45/45/55/55/70/70/80/80 (1500hr Steps)
Step 1&2 $32.70/ 3&4 $39.20/ 5&6 $58.52/ 7&8 $65.09

Apprentice to Journeyworker Ratio:1:1

FORK LIFT/CHERRY PICKER *OPERATING ENGINEERS LOCAL 4*	12/01/2020	$49.98	$13.50	$15.70	$0.00	$79.18
	06/01/2021	$51.08	$13.50	$15.70	$0.00	$80.28
	12/01/2021	$52.23	$13.50	$15.70	$0.00	$81.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
GENERATOR/LIGHTING PLANT/HEATERS *OPERATING ENGINEERS LOCAL 4*	12/01/2020	$33.00	$13.50	$15.70	$0.00	$62.20
	06/01/2021	$33.75	$13.50	$15.70	$0.00	$62.95
	12/01/2021	$34.54	$13.50	$15.70	$0.00	$63.74
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
GLAZIER (GLASS PLANK/AIR BARRIER/INTERIOR SYSTEMS) *GLAZIERS LOCAL 35 (ZONE 2)*	01/01/2021	$41.56	$8.25	$22.75	$0.00	$72.56

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *GLAZIER - Local 35 Zone 2*

Effective Date - 01/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.78	$8.25	$0.00	$0.00	$29.03
2	55	$22.86	$8.25	$6.16	$0.00	$37.27
3	60	$24.94	$8.25	$6.72	$0.00	$39.91
4	65	$27.01	$8.25	$7.28	$0.00	$42.54
5	70	$29.09	$8.25	$19.39	$0.00	$56.73
6	75	$31.17	$8.25	$19.95	$0.00	$59.37
7	80	$33.25	$8.25	$20.51	$0.00	$62.01
8	90	$37.40	$8.25	$21.63	$0.00	$67.28

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

HOISTING ENGINEER/CRANES/GRADALLS *OPERATING ENGINEERS LOCAL 4*	12/01/2020	$49.98	$13.50	$15.70	$0.00	$79.18
	06/01/2021	$51.08	$13.50	$15.70	$0.00	$80.28
	12/01/2021	$52.23	$13.50	$15.70	$0.00	$81.43

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *OPERATING ENGINEERS - Local 4*

Effective Date - 12/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$27.49	$13.50	$0.00	$0.00	$40.99
2	60	$29.99	$13.50	$15.70	$0.00	$59.19
3	65	$32.49	$13.50	$15.70	$0.00	$61.69
4	70	$34.99	$13.50	$15.70	$0.00	$64.19
5	75	$37.49	$13.50	$15.70	$0.00	$66.69
6	80	$39.98	$13.50	$15.70	$0.00	$69.18
7	85	$42.48	$13.50	$15.70	$0.00	$71.68
8	90	$44.98	$13.50	$15.70	$0.00	$74.18

Effective Date - 06/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$28.09	$13.50	$0.00	$0.00	$41.59
2	60	$30.65	$13.50	$15.70	$0.00	$59.85
3	65	$33.20	$13.50	$15.70	$0.00	$62.40
4	70	$35.76	$13.50	$15.70	$0.00	$64.96
5	75	$38.31	$13.50	$15.70	$0.00	$67.51
6	80	$40.86	$13.50	$15.70	$0.00	$70.06
7	85	$43.42	$13.50	$15.70	$0.00	$72.62
8	90	$45.97	$13.50	$15.70	$0.00	$75.17

Notes:

Apprentice to Journeyworker Ratio:1:6

HVAC (DUCTWORK) *SHEETMETAL WORKERS LOCAL 17 - A*	02/01/2021	$51.67	$13.65	$24.57	$2.70	$92.59
	08/01/2021	$53.42	$13.65	$24.57	$2.75	$94.39
	02/01/2022	$55.17	$13.65	$24.57	$2.80	$96.19
For apprentice rates see "Apprentice- SHEET METAL WORKER"						
HVAC (ELECTRICAL CONTROLS) *ELECTRICIANS LOCAL 103*	09/01/2020	$54.45	$13.00	$19.73	$0.00	$87.18
	03/01/2021	$55.41	$13.00	$20.01	$0.00	$88.42
	09/01/2021	$56.84	$13.00	$20.06	$0.00	$89.90
	03/01/2022	$58.04	$13.00	$20.09	$0.00	$91.13
	09/01/2022	$59.48	$13.00	$20.13	$0.00	$92.61
	03/01/2023	$60.67	$13.00	$20.17	$0.00	$93.84
For apprentice rates see "Apprentice- ELECTRICIAN"						
HVAC (TESTING AND BALANCING - AIR) *SHEETMETAL WORKERS LOCAL 17 - A*	02/01/2021	$51.67	$13.65	$24.57	$2.70	$92.59
	08/01/2021	$53.42	$13.65	$24.57	$2.75	$94.39
	02/01/2022	$55.17	$13.65	$24.57	$2.80	$96.19
For apprentice rates see "Apprentice- SHEET METAL WORKER"						
HVAC (TESTING AND BALANCING -WATER) *PIPEFITTERS LOCAL 537*	09/01/2020	$56.44	$11.70	$20.24	$0.00	$88.38
	03/01/2021	$57.94	$11.70	$20.24	$0.00	$89.88
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
HVAC MECHANIC *PIPEFITTERS LOCAL 537*	09/01/2020	$56.44	$11.70	$20.24	$0.00	$88.38
	03/01/2021	$57.94	$11.70	$20.24	$0.00	$89.88
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						
HYDRAULIC DRILLS *LABORERS - ZONE 1*	12/01/2020	$40.65	$8.60	$17.32	$0.00	$66.57
	06/01/2021	$41.67	$8.60	$17.32	$0.00	$67.59
	12/01/2021	$42.68	$8.60	$17.32	$0.00	$68.60
	06/01/2022	$43.68	$8.60	$17.32	$0.00	$69.60
	12/01/2022	$44.68	$8.60	$17.32	$0.00	$70.60
	06/01/2023	$45.68	$8.60	$17.32	$0.00	$71.60
	12/01/2023	$46.93	$8.60	$17.32	$0.00	$72.85
For apprentice rates see "Apprentice- LABORER"						
HYDRAULIC DRILLS (HEAVY & HIGHWAY) *LABORERS - ZONE 1 (HEAVY & HIGHWAY)*	12/01/2020	$40.65	$8.60	$17.32	$0.00	$66.57
	06/01/2021	$41.67	$8.60	$17.32	$0.00	$67.59
	12/01/2021	$42.68	$8.60	$17.32	$0.00	$68.60
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
INSULATOR (PIPES & TANKS) *HEAT & FROST INSULATORS LOCAL 6 (BOSTON)*	09/01/2020	$49.00	$13.80	$17.14	$0.00	$79.94
	09/01/2021	$51.40	$13.80	$17.14	$0.00	$82.34
	09/01/2022	$53.85	$13.80	$17.14	$0.00	$84.79

Apprentice - *ASBESTOS INSULATOR (Pipes & Tanks) - Local 6 Boston*

Effective Date - 09/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.50	$13.80	$12.42	$0.00	$50.72
2	60	$29.40	$13.80	$13.36	$0.00	$56.56
3	70	$34.30	$13.80	$14.31	$0.00	$62.41
4	80	$39.20	$13.80	$15.25	$0.00	$68.25

Effective Date - 09/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$25.70	$13.80	$12.42	$0.00	$51.92
2	60	$30.84	$13.80	$13.36	$0.00	$58.00
3	70	$35.98	$13.80	$14.31	$0.00	$64.09
4	80	$41.12	$13.80	$15.25	$0.00	$70.17

Notes:
Steps are 1 year

Apprentice to Journeyworker Ratio:1:4

IRONWORKER/WELDER *IRONWORKERS LOCAL 7 (BOSTON AREA)*	09/16/2020	$48.66	$8.10	$25.10	$0.00	$81.86

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *IRONWORKER - Local 7 Boston*

Effective Date - 09/16/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$29.20	$8.10	$25.10	$0.00	$62.40
2	70	$34.06	$8.10	$25.10	$0.00	$67.26
3	75	$36.50	$8.10	$25.10	$0.00	$69.70
4	80	$38.93	$8.10	$25.10	$0.00	$72.13
5	85	$41.36	$8.10	$25.10	$0.00	$74.56
6	90	$43.79	$8.10	$25.10	$0.00	$76.99

Notes:

** Structural 1:6; Ornamental 1:4

Apprentice to Journeyworker Ratio:**

JACKHAMMER & PAVING BREAKER OPERATOR *LABORERS - ZONE 1*	12/01/2020	$40.15	$8.60	$17.32	$0.00	$66.07
	06/01/2021	$41.17	$8.60	$17.32	$0.00	$67.09
	12/01/2021	$42.18	$8.60	$17.32	$0.00	$68.10
	06/01/2022	$43.18	$8.60	$17.32	$0.00	$69.10
	12/01/2022	$44.18	$8.60	$17.32	$0.00	$70.10
	06/01/2023	$45.18	$8.60	$17.32	$0.00	$71.10
	12/01/2023	$46.43	$8.60	$17.32	$0.00	$72.35
For apprentice rates see "Apprentice- LABORER"						
LABORER *LABORERS - ZONE 1*	12/01/2020	$39.90	$8.60	$17.32	$0.00	$65.82
	06/01/2021	$40.92	$8.60	$17.32	$0.00	$66.84
	12/01/2021	$41.93	$8.60	$17.32	$0.00	$67.85
	06/01/2022	$42.93	$8.60	$17.32	$0.00	$68.85
	12/01/2022	$43.93	$8.60	$17.32	$0.00	$69.85
	06/01/2023	$44.93	$8.60	$17.32	$0.00	$70.85
	12/01/2023	$46.18	$8.60	$17.32	$0.00	$72.10

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *LABORER - Zone 1*

Effective Date - 12/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$23.94	$8.60	$17.32	$0.00	$49.86
2	70	$27.93	$8.60	$17.32	$0.00	$53.85
3	80	$31.92	$8.60	$17.32	$0.00	$57.84
4	90	$35.91	$8.60	$17.32	$0.00	$61.83

Effective Date - 06/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$24.55	$8.60	$17.32	$0.00	$50.47
2	70	$28.64	$8.60	$17.32	$0.00	$54.56
3	80	$32.74	$8.60	$17.32	$0.00	$58.66
4	90	$36.83	$8.60	$17.32	$0.00	$62.75

Notes:

Apprentice to Journeyworker Ratio:1:5

LABORER (HEAVY & HIGHWAY) *LABORERS - ZONE 1 (HEAVY & HIGHWAY)*	12/01/2020	$39.90	$8.60	$17.32	$0.00	$65.82
	06/01/2021	$40.92	$8.60	$17.32	$0.00	$66.84
	12/01/2021	$41.93	$8.60	$17.32	$0.00	$67.85

Apprentice - *LABORER (Heavy & Highway) - Zone 1*

Effective Date - 12/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$23.94	$8.60	$17.32	$0.00	$49.86
2	70	$27.93	$8.60	$17.32	$0.00	$53.85
3	80	$31.92	$8.60	$17.32	$0.00	$57.84
4	90	$35.91	$8.60	$17.32	$0.00	$61.83

Effective Date - 06/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$24.55	$8.60	$17.32	$0.00	$50.47
2	70	$28.64	$8.60	$17.32	$0.00	$54.56
3	80	$32.74	$8.60	$17.32	$0.00	$58.66
4	90	$36.83	$8.60	$17.32	$0.00	$62.75

Notes:

Apprentice to Journeyworker Ratio:1:5

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
LABORER: CARPENTER TENDER *LABORERS - ZONE 1*	12/01/2020	$39.90	$8.60	$17.32	$0.00	$65.82
	06/01/2021	$40.92	$8.60	$17.32	$0.00	$66.84
	12/01/2021	$41.93	$8.60	$17.32	$0.00	$67.85
	06/01/2022	$42.93	$8.60	$17.32	$0.00	$68.85
	12/01/2022	$43.93	$8.60	$17.32	$0.00	$69.85
	06/01/2023	$44.93	$8.60	$17.32	$0.00	$70.85
	12/01/2023	$46.18	$8.60	$17.32	$0.00	$72.10
For apprentice rates see "Apprentice- LABORER"						
LABORER: CEMENT FINISHER TENDER *LABORERS - ZONE 1*	12/01/2020	$39.90	$8.60	$17.32	$0.00	$65.82
	06/01/2021	$40.92	$8.60	$17.32	$0.00	$66.84
	12/01/2021	$41.93	$8.60	$17.32	$0.00	$67.85
	06/01/2022	$42.93	$8.60	$17.32	$0.00	$68.85
	12/01/2022	$43.93	$8.60	$17.32	$0.00	$69.85
	06/01/2023	$44.93	$8.60	$17.32	$0.00	$70.85
	12/01/2023	$46.18	$8.60	$17.32	$0.00	$72.10
For apprentice rates see "Apprentice- LABORER"						
LABORER: HAZARDOUS WASTE/ASBESTOS REMOVER *LABORERS - ZONE 1*	12/01/2020	$40.05	$8.60	$17.32	$0.00	$65.97
	06/01/2021	$41.07	$8.60	$17.32	$0.00	$66.99
	12/01/2021	$42.08	$8.60	$17.32	$0.00	$68.00
	06/01/2022	$43.08	$8.60	$17.32	$0.00	$69.00
	12/01/2022	$44.08	$8.60	$17.32	$0.00	$70.00
	06/01/2023	$45.08	$8.60	$17.32	$0.00	$71.00
	12/01/2023	$46.33	$8.60	$17.32	$0.00	$72.25
For apprentice rates see "Apprentice- LABORER"						
LABORER: MASON TENDER *LABORERS - ZONE 1*	12/01/2020	$40.15	$8.60	$17.32	$0.00	$66.07
	06/01/2021	$41.17	$8.60	$17.32	$0.00	$67.09
	12/01/2021	$42.18	$8.60	$17.32	$0.00	$68.10
	06/01/2022	$43.18	$8.60	$17.32	$0.00	$69.10
	12/01/2022	$44.18	$8.60	$17.32	$0.00	$70.10
	06/01/2023	$45.18	$8.60	$17.32	$0.00	$71.10
	06/01/2024	$46.43	$8.60	$17.32	$0.00	$72.35
For apprentice rates see "Apprentice- LABORER"						
LABORER: MASON TENDER (HEAVY & HIGHWAY) *LABORERS - ZONE 1 (HEAVY & HIGHWAY)*	12/01/2020	$40.15	$8.60	$17.32	$0.00	$66.07
	06/01/2021	$41.17	$8.60	$17.32	$0.00	$67.09
	12/01/2021	$42.18	$8.60	$17.32	$0.00	$68.10
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
LABORER: MULTI-TRADE TENDER *LABORERS - ZONE 1*	12/01/2020	$39.90	$8.60	$17.32	$0.00	$65.82
	06/01/2021	$40.92	$8.60	$17.32	$0.00	$66.84
	12/01/2021	$41.93	$8.60	$17.32	$0.00	$67.85
	06/01/2022	$42.93	$8.60	$17.32	$0.00	$68.85
	12/01/2022	$43.93	$8.60	$17.32	$0.00	$69.85
	06/01/2023	$44.93	$8.60	$17.32	$0.00	$70.85
	12/01/2023	$46.18	$8.60	$17.32	$0.00	$72.10
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
LABORER: TREE REMOVER *LABORERS - ZONE 1*	12/01/2020	$39.90	$8.60	$17.32	$0.00	$65.82
	06/01/2021	$40.92	$8.60	$17.32	$0.00	$66.84
	12/01/2021	$41.93	$8.60	$17.32	$0.00	$67.85
	06/01/2022	$42.93	$8.60	$17.32	$0.00	$68.85
	12/01/2022	$43.93	$8.60	$17.32	$0.00	$69.85
	06/01/2023	$44.93	$8.60	$17.32	$0.00	$70.85
	12/01/2023	$46.18	$8.60	$17.32	$0.00	$72.10
This classification applies to the removal of standing trees, and the trimming and removal of branches and limbs when related to public works construction or site clearance incidental to construction . For apprentice rates see "Apprentice- LABORER"						
LASER BEAM OPERATOR *LABORERS - ZONE 1*	12/01/2020	$40.15	$8.60	$17.32	$0.00	$66.07
	06/01/2021	$41.17	$8.60	$17.32	$0.00	$67.09
	12/01/2021	$42.18	$8.60	$17.32	$0.00	$68.10
	06/01/2022	$43.18	$8.60	$17.32	$0.00	$69.10
	12/01/2022	$44.18	$8.60	$17.32	$0.00	$70.10
	06/01/2023	$45.18	$8.60	$17.32	$0.00	$71.10
	12/01/2023	$46.43	$8.60	$17.32	$0.00	$72.35
For apprentice rates see "Apprentice- LABORER"						
LASER BEAM OPERATOR (HEAVY & HIGHWAY) *LABORERS - ZONE 1 (HEAVY & HIGHWAY)*	12/01/2020	$40.15	$8.60	$17.32	$0.00	$66.07
	06/01/2021	$41.17	$8.60	$17.32	$0.00	$67.09
	12/01/2021	$42.18	$8.60	$17.32	$0.00	$68.10
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
MARBLE & TILE FINISHERS *BRICKLAYERS LOCAL 3 - MARBLE & TILE*	02/01/2021	$42.57	$11.39	$20.14	$0.00	$74.10
	08/01/2021	$43.69	$11.39	$20.30	$0.00	$75.38
	02/01/2022	$44.16	$11.39	$20.30	$0.00	$75.85

Apprentice - *MARBLE & TILE FINISHER - Local 3 Marble & Tile*

Effective Date - 02/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$21.29	$11.39	$20.14	$0.00	$52.82
2	60	$25.54	$11.39	$20.14	$0.00	$57.07
3	70	$29.80	$11.39	$20.14	$0.00	$61.33
4	80	$34.06	$11.39	$20.14	$0.00	$65.59
5	90	$38.31	$11.39	$20.14	$0.00	$69.84

Effective Date - 08/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$21.85	$11.39	$20.30	$0.00	$53.54
2	60	$26.21	$11.39	$20.30	$0.00	$57.90
3	70	$30.58	$11.39	$20.30	$0.00	$62.27
4	80	$34.95	$11.39	$20.30	$0.00	$66.64
5	90	$39.32	$11.39	$20.30	$0.00	$71.01

Notes:

Apprentice to Journeyworker Ratio:1:3

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
MARBLE MASONS,TILELAYERS & TERRAZZO MECH *BRICKLAYERS LOCAL 3 - MARBLE & TILE*	02/01/2021	$55.77	$11.39	$22.08	$0.00	$89.24
	08/01/2021	$57.17	$11.39	$22.24	$0.00	$90.80
	02/01/2022	$57.74	$11.39	$22.24	$0.00	$91.37

Apprentice - *MARBLE-TILE-TERRAZZO MECHANIC - Local 3 Marble & Tile*

Effective Date - 02/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$27.89	$11.39	$22.08	$0.00	$61.36
2	60	$33.46	$11.39	$22.08	$0.00	$66.93
3	70	$39.04	$11.39	$22.08	$0.00	$72.51
4	80	$44.62	$11.39	$22.08	$0.00	$78.09
5	90	$50.19	$11.39	$22.08	$0.00	$83.66

Effective Date - 08/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$28.59	$11.39	$22.24	$0.00	$62.22
2	60	$34.30	$11.39	$22.24	$0.00	$67.93
3	70	$40.02	$11.39	$22.24	$0.00	$73.65
4	80	$45.74	$11.39	$22.24	$0.00	$79.37
5	90	$51.45	$11.39	$22.24	$0.00	$85.08

Notes:

Apprentice to Journeyworker Ratio:1:5

MECH. SWEEPER OPERATOR (ON CONST. SITES) *OPERATING ENGINEERS LOCAL 4*	12/01/2020	$49.45	$13.50	$15.70	$0.00	$78.65
	06/01/2021	$50.54	$13.50	$15.70	$0.00	$79.74
	12/01/2021	$51.68	$13.50	$15.70	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
MECHANICS MAINTENANCE *OPERATING ENGINEERS LOCAL 4*	12/01/2020	$49.45	$13.50	$15.70	$0.00	$78.65
	06/01/2021	$50.54	$13.50	$15.70	$0.00	$79.74
	12/01/2021	$51.68	$13.50	$15.70	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
MILLWRIGHT (Zone 1) *MILLWRIGHTS LOCAL 1121 - Zone 1*	01/04/2021	$44.07	$9.40	$20.45	$0.00	$73.92
	01/03/2022	$45.82	$9.40	$20.45	$0.00	$75.67
	01/02/2023	$47.57	$9.40	$20.45	$0.00	$77.42

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *MILLWRIGHT - Local 1121 Zone 1*

Effective Date - 01/04/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$24.24	$9.40	$5.58	$0.00	$39.22
2	65	$28.65	$9.40	$16.90	$0.00	$54.95
3	75	$33.05	$9.40	$17.92	$0.00	$60.37
4	85	$37.46	$9.40	$18.93	$0.00	$65.79

Notes: Step 1&2 Appr. indentured after 1/1/2020 receive no pension, but do receive annuity. (Step 1 $5.58, Step 2 $6.50)
Steps are 2,000 hours

Apprentice to Journeyworker Ratio:1:5

MORTAR MIXER *LABORERS - ZONE 1*	12/01/2020	$40.15	$8.60	$17.32	$0.00	$66.07
	06/01/2021	$41.17	$8.60	$17.32	$0.00	$67.09
	12/01/2021	$42.18	$8.60	$17.32	$0.00	$68.10
	06/01/2022	$43.18	$8.60	$17.32	$0.00	$69.10
	12/01/2022	$44.18	$8.60	$17.32	$0.00	$70.10
	06/01/2023	$45.18	$8.60	$17.32	$0.00	$71.10
	12/01/2023	$46.43	$8.60	$17.32	$0.00	$72.35
For apprentice rates see "Apprentice- LABORER"						
OILER (OTHER THAN TRUCK CRANES,GRADALLS) *OPERATING ENGINEERS LOCAL 4*	12/01/2020	$23.20	$13.50	$15.70	$0.00	$52.40
	06/01/2021	$23.75	$13.50	$15.70	$0.00	$52.95
	12/01/2021	$24.33	$13.50	$15.70	$0.00	$53.53
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
OILER (TRUCK CRANES, GRADALLS) *OPERATING ENGINEERS LOCAL 4*	12/01/2020	$27.97	$13.50	$15.70	$0.00	$57.17
	06/01/2021	$28.61	$13.50	$15.70	$0.00	$57.81
	12/01/2021	$29.29	$13.50	$15.70	$0.00	$58.49
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
OTHER POWER DRIVEN EQUIPMENT - CLASS II *OPERATING ENGINEERS LOCAL 4*	12/01/2020	$49.45	$13.50	$15.70	$0.00	$78.65
	06/01/2021	$50.54	$13.50	$15.70	$0.00	$79.74
	12/01/2021	$51.68	$13.50	$15.70	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PAINTER (BRIDGES/TANKS) *PAINTERS LOCAL 35 - ZONE 2*	01/01/2021	$52.06	$8.25	$22.75	$0.00	$83.06

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER Local 35 - BRIDGES/TANKS*

Effective Date - 01/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$26.03	$8.25	$0.00	$0.00	$34.28
2	55	$28.63	$8.25	$6.16	$0.00	$43.04
3	60	$31.24	$8.25	$6.72	$0.00	$46.21
4	65	$33.84	$8.25	$7.28	$0.00	$49.37
5	70	$36.44	$8.25	$19.39	$0.00	$64.08
6	75	$39.05	$8.25	$19.95	$0.00	$67.25
7	80	$41.65	$8.25	$20.51	$0.00	$70.41
8	90	$46.85	$8.25	$21.63	$0.00	$76.73

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (SPRAY OR SANDBLAST, NEW) * * If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used.*PAINTERS LOCAL 35 - ZONE 2*	01/01/2021	$42.96	$8.25	$22.75	$0.00	$73.96

Apprentice - *PAINTER Local 35 Zone 2 - Spray/Sandblast - New*

Effective Date - 01/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$21.48	$8.25	$0.00	$0.00	$29.73
2	55	$23.63	$8.25	$6.16	$0.00	$38.04
3	60	$25.78	$8.25	$6.72	$0.00	$40.75
4	65	$27.92	$8.25	$7.28	$0.00	$43.45
5	70	$30.07	$8.25	$19.39	$0.00	$57.71
6	75	$32.22	$8.25	$19.95	$0.00	$60.42
7	80	$34.37	$8.25	$20.51	$0.00	$63.13
8	90	$38.66	$8.25	$21.63	$0.00	$68.54

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (SPRAY OR SANDBLAST, REPAINT) *PAINTERS LOCAL 35 - ZONE 2*	01/01/2021	$41.02	$8.25	$22.75	$0.00	$72.02

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER Local 35 Zone 2 - Spray/Sandblast - Repaint*

Effective Date - 01/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.51	$8.25	$0.00	$0.00	$28.76
2	55	$22.56	$8.25	$6.16	$0.00	$36.97
3	60	$24.61	$8.25	$6.72	$0.00	$39.58
4	65	$26.66	$8.25	$7.28	$0.00	$42.19
5	70	$28.71	$8.25	$19.39	$0.00	$56.35
6	75	$30.77	$8.25	$19.95	$0.00	$58.97
7	80	$32.82	$8.25	$20.51	$0.00	$61.58
8	90	$36.92	$8.25	$21.63	$0.00	$66.80

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER / TAPER (BRUSH, NEW) *	01/01/2021	$41.56	$8.25	$22.75	$0.00	$72.56

* If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used.*PAINTERS LOCAL 35 - ZONE 2*

Apprentice - *PAINTER - Local 35 Zone 2 - BRUSH NEW*

Effective Date - 01/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.78	$8.25	$0.00	$0.00	$29.03
2	55	$22.86	$8.25	$6.16	$0.00	$37.27
3	60	$24.94	$8.25	$6.72	$0.00	$39.91
4	65	$27.01	$8.25	$7.28	$0.00	$42.54
5	70	$29.09	$8.25	$19.39	$0.00	$56.73
6	75	$31.17	$8.25	$19.95	$0.00	$59.37
7	80	$33.25	$8.25	$20.51	$0.00	$62.01
8	90	$37.40	$8.25	$21.63	$0.00	$67.28

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER / TAPER (BRUSH, REPAINT) *PAINTERS LOCAL 35 - ZONE 2*	01/01/2021	$39.62	$8.25	$22.75	$0.00	$70.62

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER Local 35 Zone 2 - BRUSH REPAINT*

Effective Date - 01/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.81	$8.25	$0.00	$0.00	$28.06
2	55	$21.79	$8.25	$6.16	$0.00	$36.20
3	60	$23.77	$8.25	$6.72	$0.00	$38.74
4	65	$25.75	$8.25	$7.28	$0.00	$41.28
5	70	$27.73	$8.25	$19.39	$0.00	$55.37
6	75	$29.72	$8.25	$19.95	$0.00	$57.92
7	80	$31.70	$8.25	$20.51	$0.00	$60.46
8	90	$35.66	$8.25	$21.63	$0.00	$65.54

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER TRAFFIC MARKINGS (HEAVY/HIGHWAY) *LABORERS - ZONE 1 (HEAVY & HIGHWAY)*	12/01/2020	$39.90	$8.60	$17.32	$0.00	$65.82
	06/01/2021	$40.92	$8.60	$17.32	$0.00	$66.84
	12/01/2021	$41.93	$8.60	$17.32	$0.00	$67.85
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)						
PANEL & PICKUP TRUCKS DRIVER *TEAMSTERS JOINT COUNCIL NO. 10 ZONE A*	12/01/2020	$36.08	$12.91	$14.82	$0.00	$63.81
	06/01/2021	$36.88	$12.91	$14.82	$0.00	$64.61
	08/01/2021	$36.88	$13.41	$14.82	$0.00	$65.11
	12/01/2021	$36.88	$13.41	$16.01	$0.00	$66.30
PIER AND DOCK CONSTRUCTOR (UNDERPINNING AND DECK) *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2020	$49.07	$9.40	$23.12	$0.00	$81.59
For apprentice rates see "Apprentice- PILE DRIVER"						
PILE DRIVER *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2020	$49.07	$9.40	$23.12	$0.00	$81.59

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PILE DRIVER - Local 56 Zone 1*

Effective Date - 08/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.54	$9.40	$23.12	$0.00	$57.06
2	60	$29.44	$9.40	$23.12	$0.00	$61.96
3	70	$34.35	$9.40	$23.12	$0.00	$66.87
4	75	$36.80	$9.40	$23.12	$0.00	$69.32
5	80	$39.26	$9.40	$23.12	$0.00	$71.78
6	80	$39.26	$9.40	$23.12	$0.00	$71.78
7	90	$44.16	$9.40	$23.12	$0.00	$76.68
8	90	$44.16	$9.40	$23.12	$0.00	$76.68

Notes:

% Indentured After 10/1/17; 45/45/55/55/70/70/80/80
Step 1&2 $34.01/ 3&4 $41.46/ 5&6 $62.80/ 7&8 $69.25

Apprentice to Journeyworker Ratio:1:5

PIPEFITTER & STEAMFITTER *PIPEFITTERS LOCAL 537*	09/01/2020	$56.44	$11.70	$20.24	$0.00	$88.38
	03/01/2021	$57.94	$11.70	$20.24	$0.00	$89.88

Apprentice - *PIPEFITTER - Local 537*

Effective Date - 09/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$22.58	$11.70	$8.25	$0.00	$42.53
2	45	$25.40	$11.70	$20.24	$0.00	$57.34
3	60	$33.86	$11.70	$20.24	$0.00	$65.80
4	70	$39.51	$11.70	$20.24	$0.00	$71.45
5	80	$45.15	$11.70	$20.24	$0.00	$77.09

Effective Date - 03/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$23.18	$11.70	$8.25	$0.00	$43.13
2	45	$26.07	$11.70	$20.24	$0.00	$58.01
3	60	$34.76	$11.70	$20.24	$0.00	$66.70
4	70	$40.56	$11.70	$20.24	$0.00	$72.50
5	80	$46.35	$11.70	$20.24	$0.00	$78.29

Notes:

** 1:3; 3:15; 1:10 thereafter / Steps are 1 yr.
Refrig/AC Mechanic **1:1;1:2;2:4;3:6;4:8;5:10;6:12;7:14;8:17;9:20;10:23(Max)

Apprentice to Journeyworker Ratio:**

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
PIPELAYER *LABORERS - ZONE 1*	12/01/2020	$40.15	$8.60	$17.32	$0.00	$66.07
	06/01/2021	$41.17	$8.60	$17.32	$0.00	$67.09
	12/01/2021	$42.18	$8.60	$17.32	$0.00	$68.10
	06/01/2022	$43.18	$8.60	$17.32	$0.00	$69.10
	12/01/2022	$44.18	$8.60	$17.32	$0.00	$70.10
	06/01/2023	$45.18	$8.60	$17.32	$0.00	$71.10
	12/01/2023	$46.43	$8.60	$17.32	$0.00	$72.35
For apprentice rates see "Apprentice- LABORER"						
PIPELAYER (HEAVY & HIGHWAY) *LABORERS - ZONE 1 (HEAVY & HIGHWAY)*	12/01/2020	$40.15	$8.60	$17.32	$0.00	$66.07
	06/01/2021	$41.17	$8.60	$17.32	$0.00	$67.09
	12/01/2021	$42.18	$8.60	$17.32	$0.00	$68.10
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
PLUMBERS & GASFITTERS *PLUMBERS & GASFITTERS LOCAL 12*	09/01/2020	$58.69	$13.57	$17.26	$0.00	$89.52
	03/01/2021	$60.19	$13.57	$17.26	$0.00	$91.02

Apprentice - *PLUMBER/GASFITTER - Local 12*

Effective Date - 09/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	$20.54	$13.57	$6.24	$0.00	$40.35
2	40	$23.48	$13.57	$7.08	$0.00	$44.13
3	55	$32.28	$13.57	$9.63	$0.00	$55.48
4	65	$38.15	$13.57	$11.33	$0.00	$63.05
5	75	$44.02	$13.57	$13.03	$0.00	$70.62

Effective Date - 03/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	$21.07	$13.57	$6.24	$0.00	$40.88
2	40	$24.08	$13.57	$7.08	$0.00	$44.73
3	55	$33.10	$13.57	$9.63	$0.00	$56.30
4	65	$39.12	$13.57	$11.33	$0.00	$64.02
5	75	$45.14	$13.57	$13.03	$0.00	$71.74

Notes:

** 1:2; 2:6; 3:10; 4:14; 5:19/Steps are 1 yr
Step4 with lic$66.82, Step5 with lic$74.39

Apprentice to Journeyworker Ratio:**

PNEUMATIC CONTROLS (TEMP.) *PIPEFITTERS LOCAL 537*	09/01/2020	$56.44	$11.70	$20.24	$0.00	$88.38
	03/01/2021	$57.94	$11.70	$20.24	$0.00	$89.88
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						
PNEUMATIC DRILL/TOOL OPERATOR *LABORERS - ZONE 1*	12/01/2020	$40.15	$8.60	$17.32	$0.00	$66.07
	06/01/2021	$41.17	$8.60	$17.32	$0.00	$67.09
	12/01/2021	$42.18	$8.60	$17.32	$0.00	$68.10
	06/01/2022	$43.18	$8.60	$17.32	$0.00	$69.10
	12/01/2022	$44.18	$8.60	$17.32	$0.00	$70.10
	06/01/2023	$45.18	$8.60	$17.32	$0.00	$71.10
	12/01/2023	$46.43	$8.60	$17.32	$0.00	$72.35

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
For apprentice rates see "Apprentice- LABORER"						
PNEUMATIC DRILL/TOOL OPERATOR (HEAVY & HIGHWAY) *LABORERS - ZONE 1 (HEAVY & HIGHWAY)*	12/01/2020	$40.15	$8.60	$17.32	$0.00	$66.07
	06/01/2021	$41.17	$8.60	$17.32	$0.00	$67.09
	12/01/2021	$42.18	$8.60	$17.32	$0.00	$68.10
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
POWDERMAN & BLASTER *LABORERS - ZONE 1*	12/01/2020	$40.90	$8.60	$17.32	$0.00	$66.82
	06/01/2021	$41.92	$8.60	$17.32	$0.00	$67.84
	12/01/2021	$42.93	$8.60	$17.32	$0.00	$68.85
	06/01/2022	$43.93	$8.60	$17.32	$0.00	$69.85
	12/01/2022	$44.93	$8.60	$17.32	$0.00	$70.85
	06/01/2023	$45.93	$8.60	$17.32	$0.00	$71.85
	12/01/2023	$47.18	$8.60	$17.32	$0.00	$73.10
For apprentice rates see "Apprentice- LABORER"						
POWDERMAN & BLASTER (HEAVY & HIGHWAY) *LABORERS - ZONE 1 (HEAVY & HIGHWAY)*	12/01/2020	$40.90	$8.60	$17.32	$0.00	$66.82
	06/01/2021	$41.92	$8.60	$17.32	$0.00	$67.84
	12/01/2021	$42.93	$8.60	$17.32	$0.00	$68.85
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
POWER SHOVEL/DERRICK/TRENCHING MACHINE *OPERATING ENGINEERS LOCAL 4*	12/01/2020	$49.98	$13.50	$15.70	$0.00	$79.18
	06/01/2021	$51.08	$13.50	$15.70	$0.00	$80.28
	12/01/2021	$52.23	$13.50	$15.70	$0.00	$81.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PUMP OPERATOR (CONCRETE) *OPERATING ENGINEERS LOCAL 4*	12/01/2020	$49.98	$13.50	$15.70	$0.00	$79.18
	06/01/2021	$51.08	$13.50	$15.70	$0.00	$80.28
	12/01/2021	$52.23	$13.50	$15.70	$0.00	$81.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PUMP OPERATOR (DEWATERING, OTHER) *OPERATING ENGINEERS LOCAL 4*	12/01/2020	$33.00	$13.50	$15.70	$0.00	$62.20
	06/01/2021	$33.75	$13.50	$15.70	$0.00	$62.95
	12/01/2021	$34.54	$13.50	$15.70	$0.00	$63.74
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
READY MIX CONCRETE DRIVERS after 4/30/12 (Drivers Hired After 4/30/2012)*TEAMSTERS 25 (Metro) - Aggregate*	08/01/2020	$27.90	$10.91	$14.12	$0.00	$52.93
	05/01/2021	$29.15	$10.91	$15.25	$0.00	$55.31
	08/01/2021	$29.15	$11.41	$15.25	$0.00	$55.81
	05/01/2022	$30.40	$11.41	$15.25	$0.00	$57.06
	08/01/2022	$30.40	$11.91	$15.25	$0.00	$57.56
READY-MIX CONCRETE DRIVER *TEAMSTERS 25 (Metro) - Aggregate*	08/01/2020	$32.91	$10.91	$14.12	$0.00	$57.94
	05/01/2021	$33.66	$10.91	$15.25	$0.00	$59.82
	08/01/2021	$33.66	$11.41	$15.25	$0.00	$60.32
	05/01/2022	$34.41	$11.41	$15.25	$0.00	$61.07
	08/01/2022	$34.41	$11.91	$15.25	$0.00	$61.57
RECLAIMERS *OPERATING ENGINEERS LOCAL 4*	12/01/2020	$49.45	$13.50	$15.70	$0.00	$78.65
	06/01/2021	$50.54	$13.50	$15.70	$0.00	$79.74
	12/01/2021	$51.68	$13.50	$15.70	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
RIDE-ON MOTORIZED BUGGY OPERATOR *LABORERS - ZONE 1*	12/01/2020	$40.15	$8.60	$17.32	$0.00	$66.07
	06/01/2021	$41.17	$8.60	$17.32	$0.00	$67.09
	12/01/2021	$42.18	$8.60	$17.32	$0.00	$68.10
	06/01/2022	$43.18	$8.60	$17.32	$0.00	$69.10
	12/01/2022	$44.18	$8.60	$17.32	$0.00	$70.10
	06/01/2023	$45.18	$8.60	$17.32	$0.00	$71.10
	12/01/2023	$46.43	$8.60	$17.32	$0.00	$72.35
For apprentice rates see "Apprentice- LABORER"						
ROLLER/SPREADER/MULCHING MACHINE *OPERATING ENGINEERS LOCAL 4*	12/01/2020	$49.45	$13.50	$15.70	$0.00	$78.65
	06/01/2021	$50.54	$13.50	$15.70	$0.00	$79.74
	12/01/2021	$51.68	$13.50	$15.70	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
ROOFER (Inc.Roofer Waterproofng &Roofer Damproofg) *ROOFERS LOCAL 33*	02/01/2021	$46.60	$12.18	$17.15	$0.00	$75.93
	08/01/2021	$48.03	$12.18	$17.15	$0.00	$77.36
	02/01/2022	$49.46	$12.18	$17.15	$0.00	$78.79

Apprentice - *ROOFER - Local 33*

Effective Date - 02/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$23.30	$12.18	$4.31	$0.00	$39.79
2	60	$27.96	$12.18	$17.15	$0.00	$57.29
3	65	$30.29	$12.18	$17.15	$0.00	$59.62
4	75	$34.95	$12.18	$17.15	$0.00	$64.28
5	85	$39.61	$12.18	$17.15	$0.00	$68.94

Effective Date - 08/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.02	$12.18	$4.31	$0.00	$40.51
2	60	$28.82	$12.18	$17.15	$0.00	$58.15
3	65	$31.22	$12.18	$17.15	$0.00	$60.55
4	75	$36.02	$12.18	$17.15	$0.00	$65.35
5	85	$40.83	$12.18	$17.15	$0.00	$70.16

Notes: ** 1:5, 2:6-10, the 1:10; Reroofing: 1:4, then 1:1
Step 1 is 2000 hrs.; Steps 2-5 are 1000 hrs.
(Hot Pitch Mechanics' receive $1.00 hr. above ROOFER)

Apprentice to Journeyworker Ratio:**

ROOFER SLATE / TILE / PRECAST CONCRETE *ROOFERS LOCAL 33*	02/01/2021	$46.85	$12.18	$17.15	$0.00	$76.18
	08/01/2021	$48.28	$12.18	$17.15	$0.00	$77.61
	02/01/2022	$49.71	$12.18	$17.15	$0.00	$79.04
For apprentice rates see "Apprentice- ROOFER"						
SHEETMETAL WORKER *SHEETMETAL WORKERS LOCAL 17 - A*	02/01/2021	$51.67	$13.65	$24.57	$2.70	$92.59
	08/01/2021	$53.42	$13.65	$24.57	$2.75	$94.39
	02/01/2022	$55.17	$13.65	$24.57	$2.80	$96.19

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *SHEET METAL WORKER - Local 17-A*

Effective Date - 02/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	42	$21.70	$13.65	$5.89	$0.00	$41.24
2	42	$21.70	$13.65	$5.89	$0.00	$41.24
3	47	$24.28	$13.65	$11.13	$1.48	$50.54
4	47	$24.28	$13.65	$11.13	$1.48	$50.54
5	52	$26.87	$13.65	$12.08	$1.58	$54.18
6	52	$26.87	$13.65	$12.33	$1.59	$54.44
7	60	$31.00	$13.65	$13.70	$1.76	$60.11
8	65	$33.59	$13.65	$14.65	$1.88	$63.77
9	75	$38.75	$13.65	$16.56	$2.08	$71.04
10	85	$43.92	$13.65	$17.96	$2.28	$77.81

Effective Date - 08/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	42	$22.44	$13.65	$5.89	$0.00	$41.98
2	42	$22.44	$13.65	$5.89	$0.00	$41.98
3	47	$25.11	$13.65	$11.13	$1.48	$51.37
4	47	$25.11	$13.65	$11.13	$1.48	$51.37
5	52	$27.78	$13.65	$12.08	$1.58	$55.09
6	52	$27.78	$13.65	$12.33	$1.59	$55.35
7	60	$32.05	$13.65	$13.70	$1.76	$61.16
8	65	$34.72	$13.65	$14.65	$1.88	$64.90
9	75	$40.07	$13.65	$16.56	$2.08	$72.36
10	85	$45.41	$13.65	$17.96	$2.28	$79.30

Notes:
Steps are 6 mos.

Apprentice to Journeyworker Ratio:1:4

SPECIALIZED EARTH MOVING EQUIP < 35 TONS *TEAMSTERS JOINT COUNCIL NO. 10 ZONE A*	12/01/2020	$36.54	$12.91	$14.82	$0.00	$64.27
	06/01/2021	$37.34	$12.91	$14.82	$0.00	$65.07
	08/01/2021	$37.34	$13.41	$14.82	$0.00	$65.57
	12/01/2021	$37.34	$13.41	$16.01	$0.00	$66.76
SPECIALIZED EARTH MOVING EQUIP > 35 TONS *TEAMSTERS JOINT COUNCIL NO. 10 ZONE A*	12/01/2020	$36.83	$12.91	$14.82	$0.00	$64.56
	06/01/2021	$37.63	$12.91	$14.82	$0.00	$65.36
	08/01/2021	$37.63	$13.41	$14.82	$0.00	$65.86
	12/01/2021	$37.63	$13.41	$16.01	$0.00	$67.05
SPRINKLER FITTER *SPRINKLER FITTERS LOCAL 550 - (Section A) Zone 1*	01/01/2021	$61.45	$10.00	$20.75	$0.00	$92.20
	03/01/2021	$63.47	$10.00	$20.75	$0.00	$94.22

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *SPRINKLER FITTER - Local 550 (Section A) Zone 1*

Effective Date - 01/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	$21.51	$10.00	$11.81	$0.00	$43.32
2	40	$24.58	$10.00	$12.50	$0.00	$47.08
3	45	$27.65	$10.00	$13.19	$0.00	$50.84
4	50	$30.73	$10.00	$13.93	$0.00	$54.66
5	55	$33.80	$10.00	$14.56	$0.00	$58.36
6	60	$36.87	$10.00	$15.25	$0.00	$62.12
7	65	$39.94	$10.00	$15.94	$0.00	$65.88
8	70	$43.02	$10.00	$16.63	$0.00	$69.65
9	75	$46.09	$10.00	$17.31	$0.00	$73.40
10	80	$49.16	$10.00	$18.00	$0.00	$77.16

Effective Date - 03/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	$22.21	$10.00	$11.81	$0.00	$44.02
2	40	$25.39	$10.00	$12.50	$0.00	$47.89
3	45	$28.56	$10.00	$13.19	$0.00	$51.75
4	50	$31.74	$10.00	$13.93	$0.00	$55.67
5	55	$34.91	$10.00	$14.56	$0.00	$59.47
6	60	$38.08	$10.00	$15.25	$0.00	$63.33
7	65	$41.26	$10.00	$15.94	$0.00	$67.20
8	70	$44.43	$10.00	$16.63	$0.00	$71.06
9	75	$47.60	$10.00	$17.31	$0.00	$74.91
10	80	$50.78	$10.00	$18.00	$0.00	$78.78

Notes: Apprentice entered prior 9/30/10:
40/45/50/55/60/65/70/75/80/85
Steps are 850 hours

Apprentice to Journeyworker Ratio:1:3

STEAM BOILER OPERATOR *OPERATING ENGINEERS LOCAL 4*	12/01/2020	$49.45	$13.50	$15.70	$0.00	$78.65
	06/01/2021	$50.54	$13.50	$15.70	$0.00	$79.74
	12/01/2021	$51.68	$13.50	$15.70	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TAMPERS, SELF-PROPELLED OR TRACTOR DRAWN *OPERATING ENGINEERS LOCAL 4*	12/01/2020	$49.45	$13.50	$15.70	$0.00	$78.65
	06/01/2021	$50.54	$13.50	$15.70	$0.00	$79.74
	12/01/2021	$51.68	$13.50	$15.70	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TELECOMMUNICATION TECHNICIAN *ELECTRICIANS LOCAL 103*	09/01/2020	$40.84	$13.00	$17.53	$0.00	$71.37
	03/01/2021	$42.11	$13.00	$17.88	$0.00	$72.99
	09/01/2021	$43.77	$13.00	$18.00	$0.00	$74.77
	03/01/2022	$45.27	$13.00	$18.12	$0.00	$76.39
	09/01/2022	$46.99	$13.00	$18.24	$0.00	$78.23
	03/01/2023	$48.54	$13.00	$18.37	$0.00	$79.91

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *TELECOMMUNICATION TECHNICIAN - Local 103*

Effective Date - 09/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	45	$18.38	$13.00	$0.55	$0.00	$31.93
2	45	$18.38	$13.00	$0.55	$0.00	$31.93
3	50	$20.42	$13.00	$14.20	$0.00	$47.62
4	50	$20.42	$13.00	$14.20	$0.00	$47.62
5	55	$22.46	$13.00	$14.53	$0.00	$49.99
6	60	$24.50	$13.00	$14.87	$0.00	$52.37
7	65	$26.55	$13.00	$15.20	$0.00	$54.75
8	70	$28.59	$13.00	$15.53	$0.00	$57.12
9	75	$30.63	$13.00	$15.87	$0.00	$59.50
10	80	$32.67	$13.00	$16.20	$0.00	$61.87

Effective Date - 03/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	45	$18.95	$13.00	$0.57	$0.00	$32.52
2	45	$18.95	$13.00	$0.57	$0.00	$32.52
3	50	$21.06	$13.00	$14.47	$0.00	$48.53
4	50	$21.06	$13.00	$14.47	$0.00	$48.53
5	55	$23.16	$13.00	$14.80	$0.00	$50.96
6	60	$25.27	$13.00	$15.14	$0.00	$53.41
7	65	$27.37	$13.00	$15.47	$0.00	$55.84
8	70	$29.48	$13.00	$15.80	$0.00	$58.28
9	75	$31.58	$13.00	$16.15	$0.00	$60.73
10	80	$33.69	$13.00	$16.48	$0.00	$63.17

Notes:

Apprentice to Journeyworker Ratio:1:1

TERRAZZO FINISHERS *BRICKLAYERS LOCAL 3 - MARBLE & TILE*	02/01/2021	$54.69	$11.39	$22.09	$0.00	$88.17
	08/01/2021	$56.09	$11.39	$22.25	$0.00	$89.73
	02/01/2022	$56.68	$11.39	$22.25	$0.00	$90.32

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *TERRAZZO FINISHER - Local 3 Marble & Tile*

Effective Date - 02/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$27.35	$11.39	$22.09	$0.00	$60.83
2	60	$32.81	$11.39	$22.09	$0.00	$66.29
3	70	$38.28	$11.39	$22.09	$0.00	$71.76
4	80	$43.75	$11.39	$22.09	$0.00	$77.23
5	90	$49.22	$11.39	$22.09	$0.00	$82.70

Effective Date - 08/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$28.05	$11.39	$22.25	$0.00	$61.69
2	60	$33.65	$11.39	$22.25	$0.00	$67.29
3	70	$39.26	$11.39	$22.25	$0.00	$72.90
4	80	$44.87	$11.39	$22.25	$0.00	$78.51
5	90	$50.48	$11.39	$22.25	$0.00	$84.12

Notes:

Apprentice to Journeyworker Ratio:1:3

TEST BORING DRILLER *LABORERS - FOUNDATION AND MARINE*	12/01/2020	$41.30	$8.60	$17.47	$0.00	$67.37
	06/01/2021	$42.32	$8.60	$17.47	$0.00	$68.39
	12/01/2021	$43.33	$8.60	$17.47	$0.00	$69.40
For apprentice rates see "Apprentice- LABORER"						
TEST BORING DRILLER HELPER *LABORERS - FOUNDATION AND MARINE*	12/01/2020	$40.02	$8.60	$17.47	$0.00	$66.09
	06/01/2021	$41.04	$8.60	$17.47	$0.00	$67.11
	12/01/2021	$42.05	$8.60	$17.47	$0.00	$68.12
For apprentice rates see "Apprentice- LABORER"						
TEST BORING LABORER *LABORERS - FOUNDATION AND MARINE*	12/01/2020	$39.90	$8.60	$17.47	$0.00	$65.97
	06/01/2021	$40.92	$8.60	$17.47	$0.00	$66.99
	12/01/2021	$41.93	$8.60	$17.47	$0.00	$68.00
For apprentice rates see "Apprentice- LABORER"						
TRACTORS/PORTABLE STEAM GENERATORS *OPERATING ENGINEERS LOCAL 4*	12/01/2020	$49.45	$13.50	$15.70	$0.00	$78.65
	06/01/2021	$50.54	$13.50	$15.70	$0.00	$79.74
	12/01/2021	$51.68	$13.50	$15.70	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TRAILERS FOR EARTH MOVING EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE A*	12/01/2020	$37.12	$12.91	$14.82	$0.00	$64.85
	06/01/2021	$37.92	$12.91	$14.82	$0.00	$65.65
	08/01/2021	$37.92	$13.41	$14.82	$0.00	$66.15
	12/01/2021	$37.92	$13.41	$16.01	$0.00	$67.34
TUNNEL WORK - COMPRESSED AIR *LABORERS (COMPRESSED AIR)*	12/01/2020	$52.13	$8.60	$17.92	$0.00	$78.65
	06/01/2021	$53.15	$8.60	$17.92	$0.00	$79.67
	12/01/2021	$54.16	$8.60	$17.92	$0.00	$80.68
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
TUNNEL WORK - COMPRESSED AIR (HAZ. WASTE) *LABORERS (COMPRESSED AIR)*	12/01/2020	$54.13	$8.60	$17.92	$0.00	$80.65
	06/01/2021	$55.15	$8.60	$17.92	$0.00	$81.67
	12/01/2021	$56.16	$8.60	$17.92	$0.00	$82.68
For apprentice rates see "Apprentice- LABORER"						
TUNNEL WORK - FREE AIR *LABORERS (FREE AIR TUNNEL)*	12/01/2020	$44.20	$8.60	$17.92	$0.00	$70.72
	06/01/2021	$45.22	$8.60	$17.92	$0.00	$71.74
	12/01/2021	$46.23	$8.60	$17.92	$0.00	$72.75
For apprentice rates see "Apprentice- LABORER"						
TUNNEL WORK - FREE AIR (HAZ. WASTE) *LABORERS (FREE AIR TUNNEL)*	12/01/2020	$46.20	$8.60	$17.92	$0.00	$72.72
	06/01/2021	$47.22	$8.60	$17.92	$0.00	$73.74
	12/01/2021	$48.23	$8.60	$17.92	$0.00	$74.75
For apprentice rates see "Apprentice- LABORER"						
VAC-HAUL *TEAMSTERS JOINT COUNCIL NO. 10 ZONE A*	12/01/2020	$36.54	$12.91	$14.82	$0.00	$64.27
	06/01/2021	$37.34	$12.91	$14.82	$0.00	$65.07
	08/01/2021	$37.34	$13.41	$14.82	$0.00	$65.57
	12/01/2021	$37.34	$13.41	$16.01	$0.00	$66.76
WAGON DRILL OPERATOR *LABORERS - ZONE 1*	12/01/2020	$40.15	$8.60	$17.32	$0.00	$66.07
	06/01/2021	$41.17	$8.60	$17.32	$0.00	$67.09
	12/01/2021	$42.18	$8.60	$17.32	$0.00	$68.10
	06/01/2022	$43.18	$8.60	$17.32	$0.00	$69.10
	12/01/2022	$44.18	$8.60	$17.32	$0.00	$70.10
	06/01/2023	$45.18	$8.60	$17.32	$0.00	$71.10
	12/01/2023	$46.43	$8.60	$17.32	$0.00	$72.35
For apprentice rates see "Apprentice- LABORER"						
WAGON DRILL OPERATOR (HEAVY & HIGHWAY) *LABORERS - ZONE 1 (HEAVY & HIGHWAY)*	12/01/2020	$40.15	$8.60	$17.32	$0.00	$66.07
	06/01/2021	$41.17	$8.60	$17.32	$0.00	$67.09
	12/01/2021	$42.18	$8.60	$17.32	$0.00	$68.10
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
WASTE WATER PUMP OPERATOR *OPERATING ENGINEERS LOCAL 4*	12/01/2020	$49.98	$13.50	$15.70	$0.00	$79.18
	06/01/2021	$51.08	$13.50	$15.70	$0.00	$80.28
	12/01/2021	$52.23	$13.50	$15.70	$0.00	$81.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
WATER METER INSTALLER *PLUMBERS & GASFITTERS LOCAL 12*	09/01/2020	$58.69	$13.57	$17.26	$0.00	$89.52
	03/01/2021	$60.19	$13.57	$17.26	$0.00	$91.02
For apprentice rates see "Apprentice- PLUMBER/PIPEFITTER" or "PLUMBER/GASFITTER"						
Outside Electrical - East						
CABLE TECHNICIAN (Power Zone) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	08/30/2020	$29.67	$9.25	$1.89	$0.00	$40.81
For apprentice rates see "Apprentice- LINEMAN"						
CABLEMAN (Underground Ducts & Cables) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	08/30/2020	$42.03	$9.25	$10.27	$0.00	$61.55
For apprentice rates see "Apprentice- LINEMAN"						
DRIVER / GROUNDMAN CDL *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	08/30/2020	$34.62	$9.25	$10.07	$0.00	$53.94
For apprentice rates see "Apprentice- LINEMAN"						
DRIVER / GROUNDMAN -Inexperienced (<2000 Hrs) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	08/30/2020	$27.20	$9.25	$1.82	$0.00	$38.27
For apprentice rates see "Apprentice- LINEMAN"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
EQUIPMENT OPERATOR (Class A CDL) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104* For apprentice rates see "Apprentice- LINEMAN"	08/30/2020	$42.03	$9.25	$14.35	$0.00	$65.63
EQUIPMENT OPERATOR (Class B CDL) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104* For apprentice rates see "Apprentice- LINEMAN"	08/30/2020	$37.09	$9.25	$10.87	$0.00	$57.21
GROUNDMAN *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104* For apprentice rates see "Apprentice- LINEMAN"	08/30/2020	$27.20	$9.25	$1.82	$0.00	$38.27
GROUNDMAN -Inexperienced (<2000 Hrs.) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104* For apprentice rates see "Apprentice- LINEMAN"	08/30/2020	$22.25	$9.25	$1.82	$0.00	$33.32
JOURNEYMAN LINEMAN *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	08/30/2020	$49.45	$9.25	$17.48	$0.00	$76.18

Apprentice - *LINEMAN (Outside Electrical) - East Local 104*

Effective Date - 08/30/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$29.67	$9.25	$3.39	$0.00	$42.31
2	65	$32.14	$9.25	$3.46	$0.00	$44.85
3	70	$34.62	$9.25	$3.54	$0.00	$47.41
4	75	$37.09	$9.25	$5.11	$0.00	$51.45
5	80	$39.56	$9.25	$5.19	$0.00	$54.00
6	85	$42.03	$9.25	$5.26	$0.00	$56.54
7	90	$44.51	$9.25	$7.34	$0.00	$61.10

Notes:

Apprentice to Journeyworker Ratio:1:2

TELEDATA CABLE SPLICER *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	02/04/2019	$30.73	$4.70	$3.17	$0.00	$38.60
TELEDATA LINEMAN/EQUIPMENT OPERATOR *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	02/04/2019	$28.93	$4.70	$3.14	$0.00	$36.77
TELEDATA WIREMAN/INSTALLER/TECHNICIAN *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	02/04/2019	$28.93	$4.70	$3.14	$0.00	$36.77

Additional Apprentice Information:

Minimum wage rates for apprentices employed on public works projects are listed above as a percentage of the pre-determined hourly wage rate established by the Commissioner under the provisions of the M.G.L. c. 149, ss. 26-27D. Apprentice ratios are established by the Division of Apprenticeship Training pursuant to M.G.L. c. 23, ss. 11E-11L.

All apprentices must be registered with the Division of Apprenticeship Training in accordance with M.G.L. c. 23, ss. 11E-11L.

All steps are six months (1000 hours.)
Ratios are expressed in allowable number of apprentices to journeymen or fraction thereof, unless otherwise specified.

** Multiple ratios are listed in the comment field.
*** APP to JM; 1:1, 2:2, 2:3, 3:4, 4:4, 4:5, 4:6, 5:7, 6:7, 6:8, 6:9, 7:10, 8:10, 8:11, 8:12, 9:13, 10:13, 10:14, etc.
**** APP to JM; 1:1, 1:2, 2:3, 2:4, 3:5, 4:6, 4:7, 5:8, 6:9, 6:10, 7:11, 8:12, 8:13, 9:14, 10:15, 10:16, etc.

CRIMINAL OFFENDER RECORD INFORMATION (CORI) & FORMS

1 CORI SCREENING BY VENDORS OF THE TOWN OF ARLINGTON

1.1 Purpose

These sections are intended to ensure that the persons and businesses supplying goods and/or services to the Town of Arlington deploy fair policies relating to the screening and identification of persons with criminal backgrounds through the CORI System.

1.2 Definitions

Unless specifically indicated otherwise, these definitions shall apply and control in CBC 4-7.

Applicant means any current or prospective employee, licensee, or volunteer and includes all persons included in 803 CMR 2.03.

Awarding Authority means any department, agency, or office of the Town of Arlington that purchases goods and/or services from a vendor.

CHSB means the Criminal History Systems Board defined by MGL c^ and 803 CMR 2.00

Town means the Town of Arlington or department, agency, or office thereof

Otherwise qualified means any applicant that meets all other criteria for a position or consideration for a position.

Vendor means any vendor, contractor, or supplier of goods and/or services to the Town of Arlington.

1.3 CORI-Related Standards of the Town of Arlington

The Town of Arlington will do business only with vendors that have adopted and employ CORI-related policies, practices, and standards that are consistent with Town Standards.

The Town of Arlington employs CORI-related policies and practices that are fair to all persons involved and seeks to do business with vendors that have substantially similar policies and practices. The Awarding Authority shall review all vendors' CORI policies for consistency with Town Standards. The Awarding Authority shall consider all vendors' CORI standards as part of the criteria to be evaluated in the awarding of a contract and will consider a vendor's execution of the CORI standards to be evaluated among the performance criteria of a contract. The Awarding Authority shall consider any vendor's deviation from the CORI standards as grounds for rejection, rescission, revocation, or any other termination of the contract.

The CORI-related policies and practices of the Town include, but are not limited to:

a. The Town does not conduct a CORI check on an applicant unless a CORI check is required by law or the Town has made a good faith determination that the relevant position is of such sensitivity that a CORI report is warranted.

b. The Town reviews the qualifications of an applicant and determines that an applicant is otherwise qualified for the relevant position before the Town conducts a CORI check. The Town does not conduct a CORI check for an applicant that is not otherwise qualified for a relevant position.

c. If the Town has been authorized by the CHSB to receive CORI reports consisting solely of conviction and case-pending information and the CORI report received by the Town contains other information (i.e. cases disposed favorably for the applicant such as not guilty, dismissal) then the Town informs the applicant and provides the applicant with a copy of CHSB's information for the applicant to pursue correction.

d. When the Town receives a proper CORI report of an applicant that contains only the CORI information that the Town is authorized to receive and the Town is inclined to refuse, rescind, or revoke the offer of a position to an applicant then the Town fully complies with 803 CMR 6.11 by, including but not limited to, notifying the applicant of the potential adverse employment action, providing the applicant with a photocopy of the CORI report received by the Town, informing the applicant of the specific parts of the CORI report that concern with the Town including an opportunity for the applicant to present information rebutting the accuracy and/or relevance of the CORI report, reviewing any information and documentation received from the applicant, and documenting all steps taken to comply with 803 CMR 6.11.

e. The Town makes final employment related decisions based on all of the information available to the Town, including the seriousness of the crime(s), the relevance of the crime(s), the number of crime(s), the age of the crime(s), and the occurences in the life of the applicant since the crime(s). If the final decision of the Town is adverse to the applicant and results in the refusal, rescission, or revoation of a position with the Town then the Town promptly notifies the applicant of the decision and the specific reason(s) therefor.

1.4 Waiver

Under exigent circumstances, an Awarding Authority, by its highest ranking member,may grant a waiver of CBC 4-7.3 on a contract-by-contract basis and shall submit a written record of the waiver to the Office of Civil Rights and to the Boston Town Council's Staff Director who shall provide a copy to each and every Town Councilor. The written record shall included, but not limited to, (a) a summary of the terms of the contract, (b) the details of the vendor's failure or refusal to conform with the Town's CORI-related standards, and (c) a brief analysis of the exigency causing the grant of waiver.

No waiver may be considered perfected unless the Awarding Authority fully complies with the provisions of this sub-section.

1.5 Data Collection and Report

Any Awarding Authority, vendor, applicant or other interested party may contact the Office of Civil Rights to report any problems, concerns, or suggestions regarding the implementation, compliance, and impacts of these sections, and the Office of Civil Rights shall log every comment received with a summary of the comment and shall keep on file any written comments. Subsequent to logging any comment, the Office of Civil Rights may refer a complaint to the CHSB and shall notify the relevant Awarding Authority. The Office of Civil Rights shall prepare a written report including, but not limited to, a summary of the granted waivers, a summary of any feedback regarding CORI-related policies and/or practices, and any other information or analysis deemed noteworthy by the Directory of the Office of Civil Rights. The Office of Civil Rights shall file the report with the Boston Town Council via the Boston Town Clerk every six (6) months from the implemenation date of these sections.

1.6 Applicability

If any provision of these sections imposes greater restrictions or obligations than those

imposed by any other general law, special law, regulation, rule, ordinance, order, or policy then the provisions of these sections shall control.

1.7 Regulatory Authority

The Office of Civil Rights shall have the authority to promulgate rules and regulations necessary to implement and enforce these sections and may promulgate a form of the affadavit.

1.8 Severability

If a provision of these sections shall be held to be invalid by a court of competent jurisdiction, then such provision shall be considered separately and apart from the remaining provisions, which shall remain in full force and effect.

CM FORM 15A: CORI COMPLIANCE

The Town of Arlington intends to ensure that persons and businesses supplying goods and/or services to the Town deploy fair policies relating to the screening and identification of person with criminal backgrounds through the CORI system. Vendors entering into contracts with the town must affirm that their policies regarding CORI information are consistent with the standards set by the Town of Arlington.

CERTIFICATION

The undersigned certifies under penalties of perjury that the vendor is in compliance with the Town of Arlington as currently in effect. **All Vendors must check one of the three lines below.**

1. ____ CORI checks are not performed on any Applicants.

2. ____ CORI checks are performed on some or all Applicants. The Vendor, by affixing a signature below, affirms under penalties of perjury that its CORI policy is consistent with the standards set forth on the attached CM Form 15B.

3. ____ CORI checks are performed on some or all Applicants. The Vendor's CORI policy is not consistent with the standards set forth on the attached CM Form 15B (a copy of the Vendor's written CORI policy must accompany this form).

_____ _____

(Typed or printed name of person signing quotation, bid or proposal) Signature

_____

(Name of Business)

NOTE:
The Awarding Authority may grant a waiver of CBC 4-7.3 under exigent circumstance on a contract-by-contract basis.

Instructions for Completing CM Form 15B:
A Vendor should not check Line 1 unless it performs NO CORI checks on ANY applicant. A Vendor who checks Lines 2 certifies that the Vendor's CORI policy conforms to the standards set forth in CM Form 15B. A Vendor with a CORI policy that does NOT conform to the standards set forth on CM Form 15B must check Line 3. Vendors who check Line 3 will not be permitted to enter into contracts with the City, absent a waiver, as provided for in CBC 4-7.4. For any waiver to be granted, a completed CM Form 15C must be completed by the awarding authority and attached hereto.

CM FORM 15B: CORI COMPLIANCE STANDARDS

By checking line 2 on the foregoing CM Form 15A, the Vendor affirms that its CORI-related policies, practices, and standards are consistent with the following standards:

1. The Vendor does not conduct a CORI check on an Applicant unless a CORI check is required by law or the Vendor has made a good faith determination that the relevant position is of such sensitivity that a CORI report is warranted.

2. The Vendor reviews the qualifications of an Applicant and determines that an Applicant is otherwise qualified for the relevant position before the Vendor conducts a CORI check. The Vendor does not conduct a CORI check for an Applicant that is not otherwise qualified for a relevant position.

3. If the Vendor has been authorized by the CHSB to receive CORI reports consisting solely of conviction and case-pending information and the CORI report received by the Vendor contains other information (i.e. cases disposed favorably for the Applicant such as Not Guilty, Dismissal) then the Vendor informs the Applicant and provides the Applicant with a copy of CHSB's information for the Applicant to pursue correction.

4. When the Vendor receives a proper CORI report of an Applicant that contains only the CORI information that the Vendor is authorized to receive and the Vendor is inclined to refuse, rescind, or revoke the offer of a position to an Applicant, then the Vendor complies with 803 CMR 6.11 by, including, but not limited to, notifying the Applicant of the potential adverse employment action, providing the Applicant with a photocopy of the CORI report received by the Vendor, informing the Applicant of the specific parts of the CORI report that concern the Vendor, providing an opportunity for the Applicant to discuss the CORI report with the Vendor including an opportunity for the Applicant to present information rebutting the accuracy and/or relevance of the CORI report, reviewing any information and documentation received from the Applicant, and documenting all steps taken to comply with 803 CMR 6.11.

5. The Vendor makes final employment-related decisions based on all of the information available to the Vendor, including the seriousness of the crime(s), the relevance of the crime(s), the age of the crime(s), and the occurrences in the life of the Applicant since the crime(s). If the final decision of the Vendor is adverse to the Applicant and results in the refusal, rescission, or revocation of a position with the Vendor then the Vendor promptly notifies the Applicant of the decision and the specific reasons therefor.

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared by

ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

Issued and Published Jointly By

PROFESSIONAL ENGINEERS IN PRIVATE PRACTICE
a practice division of the
NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

AMERICAN CONSULTING ENGINEERS COUNCIL

AMERICAN SOCIETY OF CIVIL ENGINEERS

This document has been approved and endorsed by

The Associated General Contractors of America

Construction Specifications Institute

EJCDC No. 1910-8 (1996 Edition)

TABLE OF CONTENTS

GENERAL CONDITIONS

ARTICLE 1 - DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Contract Documents and printed with initial or all capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof.

1. *Addenda*--Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the Contract Documents.

2. *Agreement*--The written instrument which is evidence of the agreement between OWNER and CONTRACTOR covering the Work.

3. *Application for Payment*--The form acceptable to ENGINEER which is to be used by CONTRACTOR during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Asbestos*--Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.

5. *Bid*--The offer or proposal of a bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

6. *Bidding Documents*--The Bidding Requirements and the proposed Contract Documents (including all Addenda issued prior to receipt of Bids).

7. *Bidding Requirements*--The Advertisement or Invitation to Bid, Instructions to Bidders, Bid security form, if any, and the Bid form with any supplements.

8. *Bonds*--Performance and payment bonds and other instruments of security.

9. *Change Order*--A document recommended by ENGINEER which is signed by CONTRACTOR and OWNER and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.

10. *Claim*--A demand or assertion by OWNER or CONTRACTOR seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.

11. *Contract*--The entire and integrated written agreement between the OWNER and CONTRACTOR concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

12. *Contract Documents*--The Contract Documents establish the rights and obligations of the parties and include the Agreement, Addenda (which pertain to the Contract Documents), CONTRACTOR's Bid (including documentation accompanying the Bid and any post Bid documentation submitted prior to the Notice of Award) when attached as an exhibit to the Agreement, the Notice to Proceed, the Bonds, these General Conditions, the Supplementary Conditions, the Specifications and the Drawings as the same are more specifically identified in the Agreement, together with all Written Amendments, Change Orders, Work Change Directives, Field Orders, and ENGINEER's written interpretations and clarifications issued on or after the Effective Date of the Agreement. Approved Shop Drawings and the reports and drawings of subsurface and physical conditions are not Contract Documents. Only printed or hard copies of the items listed in this paragraph are Contract Documents. Files in electronic media format of text, data, graphics, and the like that may be furnished by OWNER to CONTRACTOR are not Contract Documents.

13. *Contract Price*--The moneys payable by OWNER to CONTRACTOR for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of paragraph 11.03 in the case of Unit Price Work).

14. *Contract Times*--The number of days or the dates stated in the Agreement to: (i) achieve Substantial Completion; and (ii) complete the Work so that it is ready for final payment as evidenced by ENGINEER's written recommendation of final payment.

15. *CONTRACTOR*--The individual or entity with whom OWNER has entered into the Agreement.

16. *Cost of the Work*--See paragraph 11.01.A for definition.

17. *Drawings*--That part of the Contract Documents prepared or approved by ENGINEER which graphically shows the scope, extent, and character of the Work to be performed by CONTRACTOR. Shop Drawings and other CONTRACTOR submittals are not Drawings as so defined.

18. *Effective Date of the Agreement*--The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.

19. *ENGINEER*--The individual or entity named as such in the Agreement.

20. *ENGINEER's Consultant*--An individual or entity having a contract with ENGINEER to furnish services as ENGINEER's independent professional associate or consultant with respect to the Project and who is identified as such in the Supplementary Conditions.

21. *Field Order*--A written order issued by ENGINEER which requires minor changes in the Work but which does not involve a change in the Contract Price or the Contract Times.

22. *General Requirements*--Sections of Division 1 of the Specifications. The General Requirements pertain to all sections of the Specifications.

23. *Hazardous Environmental Condition*--The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto in connection with the Work.

24. *Hazardous Waste*--The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.

25. *Laws and Regulations; Laws or Regulations*--Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

26. *Liens*--Charges, security interests, or encumbrances upon Project funds, real property, or personal property.

27. *Milestone*--A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.

28. *Notice of Award*--The written notice by OWNER to the apparent successful bidder stating that upon timely compliance by the apparent successful bidder with the conditions precedent listed therein, OWNER will sign and deliver the Agreement.

29. *Notice to Proceed*--A written notice given by OWNER to CONTRACTOR fixing the date on which the Contract Times will commence to run and on which CONTRACTOR shall start to perform the Work under the Contract Documents.

30. *OWNER*--The individual, entity, public body, or authority with whom CONTRACTOR has entered into the Agreement and for whom the Work is to be performed.

31. *Partial Utilization*--Use by OWNER of a substantially completed part of the Work for the purpose for which it is intended (or a related purpose) prior to Substantial Completion of all the Work.

32. *PCBs*--Polychlorinated biphenyls.

33. *Petroleum*--Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.

34. *Project*--The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part as may be indicated elsewhere in the Contract Documents.

35. *Project Manual*--The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.

36. *Radioactive Material*--Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.

37. *Resident Project Representative*--The authorized representative of ENGINEER who may be assigned to the Site or any part thereof.

38. *Samples*--Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.

39. *Shop Drawings*--All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for CONTRACTOR and submitted by CONTRACTOR to illustrate some portion of the Work.

40. *Site*--Lands or areas indicated in the Contract Documents as being furnished by OWNER upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by OWNER which are designated for the use of CONTRACTOR.

41. *Specifications*--That part of the Contract Documents consisting of written technical descriptions of materials, equipment, systems, standards, and workmanship as applied to the Work and certain administrative details applicable thereto.

42. *Subcontractor*--An individual or entity having a direct contract with CONTRACTOR or with any other Subcontractor for the performance of a part of the Work at the Site.

43. *Substantial Completion*--The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of ENGINEER, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

44. *Supplementary Conditions*--That part of the Contract Documents which amends or supplements these General Conditions.

45. *Supplier*--A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with CONTRACTOR or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by CONTRACTOR or any Subcontractor.

46. *Underground Facilities*--All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

47. *Unit Price Work*--Work to be paid for on the basis of unit prices.

48. *Work*--The entire completed construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

49. *Work Change Directive*--A written statement to CONTRACTOR issued on or after the Effective Date of the Agreement and signed by OWNER and recommended by ENGINEER ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

50. *Written Amendment*--A written statement modifying the Contract Documents, signed by OWNER and CONTRACTOR on or after the Effective Date of the Agreement and normally dealing with the nonengineering or nontechnical rather than strictly construction-related aspects of the Contract Documents.

1.02 *Terminology*

A. *Intent of Certain Terms or Adjectives*

1. Whenever in the Contract Documents the terms "as allowed," "as approved," or terms of like effect or import are used, or the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of ENGINEER as to the Work, it is intended that such action or determination will be solely to evaluate, in general, the completed Work for compliance with the requirements of and information in the Contract Documents and conformance with the design concept of the completed Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective shall not be effective to assign to ENGINEER any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of paragraph 9.10 or any other provision of the Contract Documents.

B. *Day*

1. The word "day" shall constitute a calendar day of 24 hours measured from midnight to the next midnight.

C. *Defective*

1. The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it does not conform to the Contract Documents or does not meet the requirements of any inspection, reference standard, test, or approval referred to in the Contract Documents, or has been damaged prior to ENGINEER's recommendation of final payment (unless responsibility for the protection thereof has been assumed by OWNER at Substantial Completion in accordance with paragraph 14.04 or 14.05).

D. *Furnish, Install, Perform, Provide*

1. The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words "perform" or "provide," when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.

4. When "furnish," "install," "perform," or "provide" is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of CONTRACTOR, "provide" is implied.

E. Unless stated otherwise in the Contract Documents, words or phrases which have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 - PRELIMINARY MATTERS

2.01 *Delivery of Bonds*

A. When CONTRACTOR delivers the executed Agreements to OWNER, CONTRACTOR shall also deliver to OWNER such Bonds as CONTRACTOR may be required to furnish.

2.02* *Copies of Documents*

A. OWNER shall furnish to CONTRACTOR up to ten copies of the Contract Documents. Additional copies will be furnished upon request at the cost of reproduction.

2.03 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Agreement. In no event will the Contract Times com-

mence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Agreement, whichever date is earlier.

2.04 *Starting the Work*

A. CONTRACTOR shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to the date on which the Contract Times commence to run.

*See Supplementary Conditions

2.05* *Before Starting Construction*

A. *CONTRACTOR's Review of Contract Documents:* Before undertaking each part of the Work, CONTRACTOR shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. CONTRACTOR shall promptly report in writing to ENGINEER any conflict, error, ambiguity, or discrepancy which CONTRACTOR may discover and shall obtain a written interpretation or clarification from ENGINEER before proceeding with any Work affected thereby; however, CONTRACTOR shall not be liable to OWNER or ENGINEER for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless CONTRACTOR knew or reasonably should have known thereof.

B. *Preliminary Schedules:* Within ten days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), CONTRACTOR shall submit to ENGINEER for its timely review:

1. a preliminary progress schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents;

2. a preliminary schedule of Shop Drawing and Sample submittals which will list each required submittal and the times for submitting, reviewing, and processing such submittal; and

3. a preliminary schedule of values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

* C. *Evidence of Insurance:* Before any Work at the Site is started, CONTRACTOR and OWNER shall each deliver to the other, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance which either of them or any additional insured may reasonably request) which CONTRACTOR and OWNER respectively are required to purchase and maintain in accordance with Article 5.

2.06 *Preconstruction Conference*

A. Within 20 days after the Contract Times start to run, but before any Work at the Site is started, a conference attended by CONTRACTOR, ENGINEER, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in paragraph 2.05.B, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.

2.07 *Initial Acceptance of Schedules*

A. Unless otherwise provided in the Contract Documents, at least ten days before submission of the first Application for Payment a conference attended by CONTRACTOR, ENGINEER, and others as appropriate will be held to review for acceptability to ENGINEER as provided below the schedules submitted in accordance with paragraph 2.05.B. CONTRACTOR shall have an additional ten days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to CONTRACTOR until acceptable schedules are submitted to ENGINEER.

1. The progress schedule will be acceptable to ENGINEER if it provides an orderly progression of the Work to completion within any specified Milestones and the Contract Times. Such acceptance will not impose on ENGINEER responsibility for the progress schedule, for sequencing, scheduling, or progress of the Work nor interfere with or relieve CONTRACTOR from CONTRACTOR's full responsibility therefor.

2. CONTRACTOR's schedule of Shop Drawing and Sample submittals will be acceptable to ENGINEER if it provides a workable arrangement for reviewing and processing the required submittals.

3. CONTRACTOR's schedule of values will be acceptable to ENGINEER as to form and substance if it provides a reasonable allocation of the Contract Price to component parts of the Work.

*See Supplementary Conditions

ARTICLE 3 - CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01* *Intent*

A. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that may reasonably be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the intended result will be provided whether or not specifically called for at no additional cost to OWNER.

C. Clarifications and interpretations of the Contract Documents shall be issued by ENGINEER as provided in Article 9.

3.02 *Reference Standards*

A. *Standards, Specifications, Codes, Laws, and Regulations*

1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard, specification, manual or code, or any instruction of a Supplier shall be effective to change the duties or responsibilities of OWNER, CONTRACTOR, or ENGINEER, or any of their subcontractors, consultants, agents, or employees from those set forth in the Contract Documents, nor shall any such provision or instruction be effective to assign to OWNER, ENGINEER, or any of ENGINEER's Consultants, agents, or employees any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of - the Contract Documents.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

1. If, during the performance of the Work, CONTRACTOR discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents or between the Contract Documents and any provision of any Law or Regulation applicable to the performance of the Work or of any standard, specification, manual or code, or of any instruction of any Supplier, CONTRACTOR shall report it to ENGINEER in writing at once. CONTRACTOR shall not proceed with the Work affected thereby (except in an emergency as required by paragraph 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in paragraph 3.04; provided, however, that CONTRACTOR shall not be liable to OWNER or ENGINEER for failure to report any such conflict, error, ambiguity, or discrepancy unless CONTRACTOR knew or reasonably should have known thereof.

B. *Resolving Discrepancies*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:

a. the provisions of any standard, specification, manual, code, or instruction (whether or not specifically incorporated by reference in the Contract Documents); or

b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Amending and Supplementing Contract Documents*

A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof in one or

*See Supplementary Conditions

B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways: (i) a Field Order; (ii) ENGINEER's approval of a Shop Drawing or Sample; or (iii) ENGINEER's written interpretation or clarification.

3.05 *Reuse of Documents*

A. CONTRACTOR and any Subcontractor or Supplier or other individual or entity performing or furnishing any of the Work under a direct or indirect contract with OWNER: (i) shall not have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of ENGINEER or ENGINEER's Consultant, including electronic media editions; and (ii) shall not reuse any of such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of OWNER and ENGINEER and specific written verification or adaption by ENGINEER. This prohibition will survive final payment, completion, and acceptance of the Work, or termination or completion of the Contract. Nothing herein shall preclude CONTRACTOR from retaining copies of the Contract Documents for record purposes.

ARTICLE 4 - AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; REFERENCE POINTS

4.01 *Availability of Lands*

A. OWNER shall furnish the Site. OWNER shall notify CONTRACTOR of any encumbrances or restrictions not of general application but specifically related to use of the Site with which CONTRACTOR must comply in performing the Work. OWNER will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities. If CONTRACTOR and OWNER are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, as a result of any delay in OWNER's furnishing the Site, CONTRACTOR may make a Claim therefor as provided in paragraph 10.05.

B. Upon reasonable written request, OWNER shall furnish CONTRACTOR with a current statement of record legal title and legal description of the lands upon which the Work is to be performed and OWNER's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. CONTRACTOR shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

4.02* *Subsurface and Physical Conditions*

A.* *Reports and Drawings:* The Supplementary Conditions identify:

1. those reports of explorations and tests of subsurface conditions at or contiguous to the Site that ENGINEER has used in preparing the Contract Documents; and

2. those drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) that ENGINEER has used in preparing the Contract Documents.

B. *Limited Reliance by CONTRACTOR on Technical Data Authorized:* CONTRACTOR may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," CONTRACTOR may not rely upon or make any Claim against OWNER, ENGINEER, or any of ENGINEER's Consultants with respect to:

1. the completeness of such reports and drawings for CONTRACTOR's purposes, includ-

ing, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by CONTRACTOR, and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any CONTRACTOR interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.

*See Supplementary Conditions

4.03 *Differing Subsurface or Physical Conditions*

A. *Notice:* If CONTRACTOR believes that any subsurface or physical condition at or contiguous to the Site that is uncovered or revealed either:

1. is of such a nature as to establish that any "technical data" on which CONTRACTOR is entitled to rely as provided in paragraph 4.02 is materially inaccurate; or

2. is of such a nature as to require a change in the Contract Documents; or

3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents; then CONTRACTOR shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by paragraph 6.16.A), notify OWNER and ENGINEER in writing about such condition. CONTRACTOR shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

B. *ENGINEER's Review:* After receipt of written notice as required by paragraph 4.03.A, ENGINEER will promptly review the pertinent condition, determine the necessity of OWNER's obtaining additional exploration or tests with respect thereto, and advise OWNER in writing (with a copy to CONTRACTOR) of ENGINEER's findings and conclusions.

C. *Possible Price and Times Adjustments*

1. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in CONTRACTOR's cost of, or time required for, performance of the Work; subject, however, to the following:

a. such condition must meet any one or more of the categories described in paragraph 4.03.A; and

b. with respect to Work that is paid for on a Unit Price Basis, any adjustment in Contract Price will be subject to the provisions of paragraphs 9.08 and 11.03.

2. CONTRACTOR shall not be entitled to any adjustment in the Contract Price or Contract Times if:

a. CONTRACTOR knew of the existence of such conditions at the time CONTRACTOR made a final commitment to OWNER in respect of Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or

b. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for CONTRACTOR prior to CONTRACTOR's making such final commitment; or

c. CONTRACTOR failed to give the written notice within the time and as required by paragraph 4.03.A.

3. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be

made therefor as provided in paragraph 10.05. However, OWNER, ENGINEER, and ENGINEER's Consultants shall not be liable to CONTRACTOR for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by CONTRACTOR on or in connection with any other project or anticipated project.

4.04 *Underground Facilities*

A. *Shown or Indicated:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to OWNER or ENGINEER by the owners of such Underground Facilities, including OWNER, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

1. OWNER and ENGINEER shall not be responsible for the accuracy or completeness of any such information or data; and

2. the cost of all of the following will be included in the Contract Price, and CONTRACTOR shall have full responsibility for:

a. reviewing and checking all such information and data,

b. locating all Underground Facilities shown or indicated in the Contract Documents,

c. coordination of the Work with the owners of such Underground Facilities, including OWNER, during construction, and

d. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

B. *Not Shown or Indicated*

1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, CONTRACTOR shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by paragraph 6.16.A), identify the owner of such Underground Facility and give written notice to that owner and to OWNER and ENGINEER. ENGINEER will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. During such time, CONTRACTOR shall be responsible for the safety and protection of such Underground Facility.

2. If ENGINEER concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued to reflect and document such consequences. An equitable adjustment shall be made in the Contract Price of Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or indicated or not shown or indicated with reasonable accuracy in the Contract Documents and that CONTRACTOR did not know of and could not reasonably have been expected to be aware of or to have anticipated. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment in Contract Price or Contract Times, OWNER or CONTRACTOR may make a Claim therefor as provided in paragraph 10.05.

4.05* *Reference Points*

A. OWNER shall provide engineering surveys to establish reference points for construction which in ENGINEER's judgment are necessary to enable CONTRACTOR to proceed with the Work. CONTRACTOR shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of OWNER. CONTRACTOR shall report to ENGINEER whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.06 *Hazardous Environmental Condition at Site*

A. *Reports and Drawings:* Reference is made to the Supplementary Conditions for the identification of those reports and drawings relating to a Hazardous Environmental Condition identified at the Site, if any, that have been utilized by the ENGINEER in the preparation of the Contract Documents.

B. *Limited Reliance by CONTRACTOR on Technical Data Authorized:* CONTRACTOR may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," CONTRACTOR may not rely upon or make any Claim against OWNER, ENGINEER or any of ENGINEER's Consultants with respect to:

1. the completeness of such reports and drawings for CONTRACTOR's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by CONTRACTOR and safety precautions and programs incident thereto; or

*See Supplementary Conditions

2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or

3. any CONTRACTOR interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions or information.

C. CONTRACTOR shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. CONTRACTOR shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by CONTRACTOR, Subcontractors, Suppliers, or anyone else for whom CONTRACTOR is responsible.

D. If CONTRACTOR encounters a Hazardous Environmental Condition or if CONTRACTOR or anyone for whom CONTRACTOR is responsible creates a Hazardous Environmental Condition, CONTRACTOR shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by paragraph 6.16); and (iii) notify OWNER and ENGINEER (and promptly thereafter confirm such notice in writing). OWNER shall promptly consult with ENGINEER concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

E. CONTRACTOR shall not be required to resume Work in connection with such condition or in any affected area until after OWNER has obtained any required permits related thereto and delivered to CONTRACTOR written notice: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or (ii) specifying any special conditions under which such Work may be resumed safely. If OWNER and CONTRACTOR cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by CONTRACTOR, either party may make a Claim therefor as provided in paragraph 10.05.

F. If after receipt of such written notice CONTRACTOR does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then OWNER may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. If OWNER and CONTRACTOR cannot agree as to entitlement to or on the amount or extent, if any, of an adjustment in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a Claim therefor as provided in paragraph 10.05. OWNER may have such deleted portion of the Work performed by OWNER's own forces or others in accordance with Article 7.

G. To the fullest extent permitted by Laws and Regulations, OWNER shall indemnify and hold harmless CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants and the officers, directors, partners, employees, agents, other consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition: (i) was not shown or indicated in the Drawings or

Specifications or identified in the Contract Documents to be included within the scope of the Work, and (ii) was not created by CONTRACTOR or by anyone for whom CONTRACTOR is responsible. Nothing in this paragraph 4.06.E shall obligate OWNER to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

H. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, ENGINEER, ENGINEER's Consultants, and the officers, directors, partners, employees, agents, other consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by CONTRACTOR or by anyone for whom CONTRACTOR is responsible. Nothing in this paragraph 4.06.F shall obligate CONTRACTOR to indemnify any individual or entity from and against the consequences of that individual's or entity's own negli- gence.

I. The provisions of paragraphs 4.02, 4.03, and 4.04 are not intended to apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

*See Supplementary Conditions

ARTICLE 5 - BONDS AND INSURANCE

5.01* *Performance, Payment, and Other Bonds*

A. CONTRACTOR shall furnish performance and payment Bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all CONTRACTOR's obligations under the Contract Documents. These Bonds shall remain in effect at least until one year after the date when final payment becomes due, except as provided otherwise by Laws or Regulations or by the Contract Documents. CONTRACTOR shall also furnish such other Bonds as are required by the Contract Documents.

B.* All Bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All Bonds signed by an agent must be accompanied by a certified copy of such agent's authority to act.

C. If the surety on any Bond furnished by CONTRACTOR is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of paragraph 5.01.B, CONTRACTOR shall within 20 days thereafter substitute another Bond and surety, both of which shall comply with the requirements of paragraphs 5.01.B and 5.02.

5.02 *Licensed Sureties and Insurers*

A. All Bonds and insurance required by the Contract Documents to be purchased and maintained by OWNER or CONTRACTOR shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue Bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

5.03 *Certificates of Insurance*

A. CONTRACTOR shall deliver to OWNER, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by OWNER or any other additional insured) which CONTRACTOR is required to purchase and maintain. OWNER shall deliver to CONTRACTOR, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by CONTRACTOR or any other additional insured) which OWNER is required to purchase and maintain.

5.04* *CONTRACTOR's Liability Insurance*

A. CONTRACTOR shall purchase and maintain such liability and other insurance as is appropriate for the Work being performed and as will provide protection from claims set forth below which may arise out of or result from CONTRACTOR's performance of the Work and CONTRACTOR's other obligations under the Contract Documents, whether it is to be performed by CONTRACTOR, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to

perform any of the Work, or by anyone for whose acts any of them may be liable:

1. claims under workers' compensation, disability benefits, and other similar employee benefit acts;

2. claims for damages because of bodily injury, occupational sickness or disease, or death of CONTRACTOR's employees;

3. claims for damages because of bodily injury, sickness or disease, or death of any person other than CONTRACTOR's employees;

4. claims for damages insured by reasonably available personal injury liability coverage which are sustained: (i) by any person as a result of an offense directly or indirectly related to the employment of such person by CONTRACTOR, or (ii) by any other person for any other reason;

5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and

6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.

B. The policies of insurance so required by this paragraph 5.04 to be purchased and maintained shall:

*See Supplementary Conditions

1. with respect to insurance required by paragraphs 5.04.A.3 through 5.04.A.6 inclusive, include as additional insureds (subject to any customary exclusion in respect of professional liability) OWNER, ENGINEER, ENGINEER's Consultants, and any other individuals or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds, and include coverage for the respective officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;

2. include at least the specific coverages and be written for not less than the limits of liability provided in the Supplementary Conditions or required by Laws or Regulations, whichever is greater;

3. include completed operations insurance;

4. include contractual liability insurance covering CONTRACTOR's indemnity obligations under paragraphs 6.07, 6.11, and 6.20;

5. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least thirty days prior written notice has been given to OWNER and CONTRACTOR and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the CONTRACTOR pursuant to paragraph 5.03 will so provide);

6. remain in effect at least until final payment and at all times thereafter when CONTRACTOR may be correcting, removing, or replacing defective Work in accordance with paragraph 13.07; and

7. with respect to completed operations insurance, and any insurance coverage written on a claims-made basis, remain in effect for at least two years after final payment (and CONTRACTOR shall furnish OWNER and each other additional insured identified in the Supplementary Conditions, to whom a certificate of insurance has been issued, evidence satisfactory to OWNER and any such additional insured of continuation of such insurance at final payment and one year thereafter).

5.05 *OWNER's Liability Insurance*

A.* In addition to the insurance required to be provided by CONTRACTOR under paragraph 5.04, OWNER, at OWNER's option, may purchase and maintain at OWNER's expense OWNER's own liability insurance as will protect OWNER against claims which may arise from operations under the Contract Documents.

5.06* *Property Insurance*

A. Unless otherwise provided in the Supplementary Conditions, OWNER shall purchase and maintain property

insurance upon the Work at the Site in the amount of the full replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:

1. include the interests of OWNER, CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as an additional insured;

2. be written on a Builder's Risk "all-risk" or open peril or special causes of loss policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, false work, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage, and such other perils or causes of loss as may be specifically required by the Supplementary Conditions;

3. include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects);

*See Supplementary Conditions

4. cover materials and equipment stored at the Site or at another location that was agreed to in writing by OWNER prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by ENGINEER;

5. allow for partial utilization of the Work by OWNER;

6. include testing and startup; and

7. be maintained in effect until final payment is made unless otherwise agreed to in writing by OWNER, CONTRACTOR, and ENGINEER with 30 days written notice to each other additional insured to whom a certificate of insurance has been issued.

B.* OWNER shall purchase and maintain such boiler and machinery insurance or additional property insurance as may be required by the Supplementary Conditions or Laws and Regulations which will include the interests of OWNER, CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants, and any other individuals or entities identified in the Supplementary Conditions, each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured.

C.* All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with paragraph 5.06 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 30 days prior written notice has been given to OWNER and CONTRACTOR and to each other additional insured to whom a certificate of insurance has been issued and will contain waiver provisions in accordance with paragraph 5.07.

D.* OWNER shall not be responsible for purchasing and maintaining any property insurance specified in this paragraph 5.06 to protect the interests of CONTRACTOR, Subcontractors, or others in the Work to the extent of any deductible amounts that are identified in the Supplementary Conditions. The risk of loss within such identified deductible amount will be borne by CONTRACTOR, Subcontractors, or others suffering any such loss, and if any of them wishes property insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser's own expense.

E.* If CONTRACTOR requests in writing that other special insurance be included in the property insurance policies provided under paragraph 5.06, OWNER shall, if possible, include such insurance, and the cost thereof will be charged to CONTRACTOR by appropriate Change Order or Written Amendment. Prior to commencement of the Work at the Site, OWNER shall in writing advise CONTRACTOR whether or not such other insurance has been procured by OWNER.

5.07 *Waiver of Rights*

A.* OWNER and CONTRACTOR intend that all policies purchased in accordance with paragraph 5.06 will protect OWNER, CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants, and all other

individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them) in such policies and will provide primary coverage for all losses and damages caused by the perils or causes of loss covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insureds or additional insureds thereunder. OWNER and CONTRAC- TOR waive all rights against each other and their respective officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them for all losses and damages caused by, arising out of or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Subcontractors, ENGINEER, ENGINEER's Consultants, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them) under such policies for losses and damages so caused.

None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by OWNER as trustee or otherwise payable under any policy so issued.

B. OWNER waives all rights against CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants, and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them for:

*See Supplementary Conditions

1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to OWNER's property or the Work caused by, arising out of, or resulting from fire or other peril whether or not insured by OWNER; and

2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by OWNER during partial utilization pursuant to paragraph 14.05, after Substantial Completion pursuant to paragraph 14.04, or after final payment pursuant to paragraph 14.07.

C. Any insurance policy maintained by OWNER covering any loss, damage or consequential loss referred to in paragraph 5.07.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against CONTRACTOR, Subcontractors, ENGINEER, or ENGINEER's Consultants and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them.

5.08* *Receipt and Application of Insurance Proceeds*

A.* Any insured loss under the policies of insurance required by paragraph 5.06 will be adjusted with OWNER and made payable to OWNER as fiduciary for the insureds, as their interests may appear, subject to the requirements of any applicable mortgage clause and of paragraph 5.08.B. OWNER shall deposit in a separate account any money so received and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof, and the Work and the cost thereof covered by an appropriate Change Order or Written Amendment.

B.* OWNER as fiduciary shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within 15 days after the occurrence of loss to OWNER's exercise of this power. If such objection be made, OWNER as fiduciary shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement among the parties in interest is reached, OWNER as fiduciary shall adjust and settle the loss with the insurers and, if required in writing by any party in interest, OWNER as fiduciary shall give bond for the proper performance of such duties.

5.09* *Acceptance of Bonds and Insurance; Option to Replace*

A.* If either OWNER or CONTRACTOR has any objection to the coverage afforded by or other provisions of the Bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of non-conformance with the Contract Documents, the objecting party shall so notify the other party in writing within 10 days after receipt of the

certificates (or other evidence requested) required by paragraph 2.05.C. OWNER and CONTRACTOR shall each provide to the other such additional information in respect of insurance provided as the other may reasonably request. If either party does not purchase or maintain all of the Bonds and insurance required of such party by the Contract Documents, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent Bonds or insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

5.10 *Partial Utilization, Acknowledgment of Property Insurer*

A. If OWNER finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in paragraph 14.05, no such use or occupancy shall commence before the insurers providing the property insurance pursuant to paragraph 5.06 have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy.

ARTICLE 6 - CONTRACTOR'S RESPONSIBILITIES

6.01 *Supervision and Superintendence*

A. CONTRACTOR shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with

*See Supplementary Conditions

the Contract Documents. CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences,
and procedures of construction, but CONTRACTOR shall not be responsible for the negligence of OWNER or ENGINEER in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents. CONTRACTOR shall be responsible to see that the completed Work complies accurately with the Contract Documents.

B. At all times during the progress of the Work, CONTRACTOR shall assign a competent resident superintendent thereto who shall not be replaced without written notice to OWNER and ENGINEER except under extraordinary circumstances. The superintendent will be CONTRACTOR's representative at the Site and shall have authority to act on behalf of CONTRACTOR. All communications given to or received from the superintendent shall be binding on CONTRACTOR.

6.02 *Labor; Working Hours*

A. CONTRACTOR shall provide competent, suitably qualified personnel to survey, lay out, and construct the

Work as required by the Contract Documents. CONTRACTOR shall at all times maintain good discipline and order at the Site.

B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours, and CONTRACTOR will not permit overtime work or the performance of Work on Saturday, Sunday, or any legal holiday without OWNER's written consent (which will not be unreasonably withheld) given after prior written notice to ENGINEER.

6.03 *Services, Materials, and Equipment*

A. Unless otherwise specified in the General Requirements, CONTRACTOR shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start-up, and completion of the Work.

B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. All warranties and guarantees specifically called for by the Specifications shall expressly

run to the benefit of OWNER. If required by ENGINEER, CONTRACTOR shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

6.04 *Progress Schedule*

A. CONTRACTOR shall adhere to the progress schedule established in accordance with paragraph 2.07 as it may be adjusted from time to time as provided below.

1. CONTRACTOR shall submit to ENGINEER for acceptance (to the extent indicated in paragraph 2.07) proposed adjustments in the progress schedule that will not result in changing the Contract Times (or Milestones). Such adjustments will conform generally to the progress schedule then in effect and additionally will comply with any provisions of the General Requirements applicable thereto.

2. Proposed adjustments in the progress schedule that will change the Contract Times (or Milestones) shall be submitted in accordance with the requirements of Article 12. Such adjustments may only be made by a Change Order or Written Amendment in accordance with Article 12.

6.05 *Substitutes and "Or-Equals"*

A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or-equal" item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be submitted to ENGINEER for review under the circumstances described below.

1. *"Or-Equal" Items:* If in ENGINEER's sole discretion an item of material or equipment proposed by CONTRACTOR is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by ENGINEER as an "or-equal" item, in which case review and approval of the proposed item may, in ENGINEER's sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this paragraph 6.05.A.1, a proposed item of material or equipment will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment ENGINEER determines that: (i) it is at least equal in quality, durability, appearance, strength, and design characteristics; (ii) it will reliably perform at least equally well the function imposed by the design concept of the completed Project as a functioning whole, and;

b. CONTRACTOR certifies that: (i) there is no increase in cost to the OWNER; and (ii) it will conform substantially, even with deviations, to the detailed requirements of the item named in the Contract Documents.

2. Substitute Items

a. If in ENGINEER's sole discretion an item of material or equipment proposed by CONTRACTOR does not qualify as an "or-equal" item under paragraph 6.05.A.1, it will be considered a proposed substitute item.

b. CONTRACTOR shall submit sufficient information as provided below to allow ENGINEER to determine that the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Requests for review of proposed substitute items of material or equipment will not be accepted by ENGINEER from anyone other than CONTRACTOR.

c. The procedure for review by ENGINEER will be as set forth in paragraph 6.05.A.2.d, as supplemented in the General Requirements and as ENGINEER may decide is appropriate under the circumstances.

d. CONTRACTOR shall first make written application to ENGINEER for review of a proposed substitute item of material or equipment that CONTRACTOR seeks to furnish or use. The application shall certify

that the proposed substitute item will perform adequately the functions and achieve the results called for by the general design, be similar in substance to that specified, and be suited to the same use as that specified. The application will state the extent, if any, to which the use of the proposed substitute item will prejudice CONTRACTOR's achievement of Substantial Completion on time, whether or not use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with OWNER for work on the Project) to adapt the design to the proposed substitute item and whether or not incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty. All variations of the proposed substitute item from that specified will be identified in the application, and available engineering, sales, maintenance, repair, and replacement services will be indicated. The application will also contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change, all of which will be considered by ENGINEER in evaluating the proposed substitute item. ENGINEER may require CONTRACTOR to furnish additional data about the proposed substitute item.

B. *Substitute Construction Methods or Procedures:* If a specific means, method, technique, sequence, or procedure of construction is shown or indicated in and expressly required by the Contract Documents, CONTRACTOR may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by ENGINEER. CONTRACTOR shall submit sufficient information to allow ENGINEER, in ENGINEER's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The procedure for review by ENGINEER will be similar to that provided in subparagraph 6.05.A.2.

C. *Engineer's Evaluation:* ENGINEER will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to paragraphs 6.05.A and 6.05.B. ENGINEER will be the sole judge of acceptability. No "or-equal" or substitute will be ordered, installed or utilized until ENGINEER's review is complete, which will be evidenced by either a Change Order for a substitute or an approved Shop Drawing for an "or equal." ENGINEER will advise CONTRACTOR in writing of any negative determination.

D. *Special Guarantee:* OWNER may require CONTRACTOR to furnish at CONTRACTOR's expense a special performance guarantee or other surety with respect to any substitute.

E. *ENGINEER's Cost Reimbursement:* ENGINEER will record time required by ENGINEER and ENGINEER's Consultants in evaluating substitute proposed or submitted by CONTRACTOR pursuant to paragraphs 6.05.A.2 and 6.05.B and in making changes in the Contract Documents (or in the provisions of any other direct contract with OWNER for work on the Project) occasioned thereby. Whether or not ENGINEER approves a substitute item so proposed or submitted by CONTRACTOR, CONTRACTOR shall reimburse OWNER for the charges of ENGINEER and ENGINEER's Consultants for evaluating each such proposed substitute.

F. *CONTRACTOR's Expense:* CONTRACTOR shall provide all data in support of any proposed substitute or "or-equal" at CONTRACTOR's expense.

6.06 *Concerning Subcontractors, Suppliers, and Others*

A. CONTRACTOR shall not employ any Subcontractor, Supplier, or other individual or entity (including those acceptable to OWNER as indicated in paragraph 6.06.B), whether initially or as a replacement, against whom OWNER may have reasonable objection. CONTRACTOR shall not be required to employ any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against whom CONTRACTOR has reasonable objection.

B. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to OWNER in advance for acceptance by OWNER by a specified date prior to the Effective Date of the Agreement, and if CONTRACTOR has submitted a list thereof in accordance with the Supplementary Conditions, OWNER's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of any such Subcontractor, Supplier, or other individual or entity so identified may be revoked on the basis of reasonable objection after due investigation. CONTRACTOR shall submit an acceptable replacement

for the rejected Subcontractor, Supplier, or other individual or entity, and the Contract Price will be adjusted by the difference in the cost occasioned by such replacement, and an appropriate Change Order will be issued or Written Amendment signed. No acceptance by OWNER of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of any right of OWNER or ENGINEER to reject defective Work.

C. CONTRACTOR shall be fully responsible to OWNER and ENGINEER for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as CONTRACTOR is responsible for CONTRACTOR's own acts and omissions. Nothing in the Contract Documents shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between OWNER or ENGINEER and any such Subcontractor, Supplier or other individual or entity, nor shall it create any obligation on the part of OWNER or ENGINEER to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

D. CONTRACTOR shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with CONTRACTOR.

E. CONTRACTOR shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with ENGINEER through CONTRACTOR.

F. The divisions and sections of the Specifications and the identifications of any Drawings shall not control CONTRACTOR in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

G. All Work performed for CONTRACTOR by a Subcontractor or Supplier will be pursuant to an appropriate agreement between CONTRACTOR and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of OWNER and ENGINEER. Whenever any such agreement is with a Subcontractor or Supplier who is listed as an additional insured on the property insurance provided in paragraph 5.06, the agreement between the CONTRACTOR and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against OWNER, CONTRACTOR, ENGINEER, ENGINEER's Consultants, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them) for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, CONTRACTOR will obtain the same.

6.07 *Patent Fees and Royalties*

A. CONTRACTOR shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if to the actual knowledge of OWNER or ENGINEER its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by OWNER in the Contract Documents. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, ENGINEER, ENGINEER's Consultants, and the officers, directors, partners, employees or agents, and other consultants of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

6.08 *Permits*

A. Unless otherwise provided in the Supplementary Conditions, CONTRACTOR shall obtain and pay for all construction permits and licenses. OWNER shall assist CONTRACTOR, when necessary, in obtaining such permits and licenses. CONTRACTOR shall pay all governmental charges and inspection fees necessary for

the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. CONTRACTOR shall pay all charges of utility owners for connections to the Work, and OWNER shall pay all charges of such utility owners for capital costs related thereto, such as plant investment fees.

6.09 *Laws and Regulations*

A. CONTRACTOR shall give all notices and comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither OWNER nor ENGINEER shall be responsible for monitoring CONTRACTOR's compliance with any Laws or Regulations.

B. If CONTRACTOR performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, CONTRACTOR shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work; however, it shall not be CONTRACTOR's primary responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve CONTRACTOR of CONTRACTOR's obligations under paragraph 3.03.

C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work may be the subject of an adjustment in Contract Price or Contract Times. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in paragraph 10.05.

6.10* *Taxes*

A. CONTRACTOR shall pay all sales, consumer, use, and other similar taxes required to be paid by CONTRACTOR in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

6.11* *Use of Site and Other Areas*

A.* *Limitation on Use of Site and Other Areas*

1. CONTRACTOR shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations,

*See Supplementary Conditions

and shall not unreasonably encumber the Site and other areas with construction equipment or other materials or equipment. CONTRACTOR shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas resulting from the performance of the Work.

2. Should any claim be made by any such owner or occupant because of the performance of the Work, CONTRACTOR shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law.

3. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, ENGINEER, ENGINEER's Consultant, and the officers, directors, partners, employees, agents, and other consultants of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against OWNER, ENGINEER, or any other party indemnified hereunder to the extent caused by or based upon CONTRACTOR's performance of the Work.

B. *Removal of Debris During Performance of the Work:* During the progress of the Work CONTRACTOR shall keep the Site and other areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.

C. *Cleaning:* Prior to Substantial Completion of the Work CONTRACTOR shall clean the Site and make it ready for utilization by OWNER. At the completion of the Work CONTRACTOR shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. *Loading Structures:* CONTRACTOR shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall CONTRACTOR subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

6.12 *Record Documents*

A. CONTRACTOR shall maintain in a safe place at the Site one record copy of all Drawings, Specifications, Addenda, Written Amendments, Change Orders, Work Change Directives, Field Orders, and written interpretations and clarifications in good order and annotated to show changes made during construction. These record documents together with all approved Samples and a counterpart of all approved Shop Drawings will be available to ENGINEER for reference. Upon completion of the Work, these record documents, Samples, and Shop Drawings will be delivered to ENGINEER for OWNER.

6.13 *Safety and Protection*

A. CONTRACTOR shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. CONTRACTOR shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

B. CONTRACTOR shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. CONTRACTOR shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property. All damage, injury, or loss to any property referred to in paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by CONTRACTOR, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by CONTRACTOR (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of OWNER or ENGINEER or ENGINEER's Consultant, or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of CONTRACTOR or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them). CONTRACTOR's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and ENGINEER has issued a notice to OWNER and CONTRACTOR in accordance with paragraph 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

6.14 *Safety Representative*

A. CONTRACTOR shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

6.15 *Hazard Communication Programs*

A. CONTRACTOR shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

6.16 *Emergencies*

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, CONTRACTOR is obligated to act to prevent threatened damage, injury, or loss. CONTRACTOR shall give ENGINEER prompt written notice if CONTRACTOR believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If ENGINEER determines that a change in the Contract Documents is required because of the action taken by CONTRACTOR in response to such an emergency, a Work Change Directive or Change Order will be issued.

6.17* *Shop Drawings and Samples*

A.* CONTRACTOR shall submit Shop Drawings to ENGINEER for review and approval in accordance with the acceptable schedule of Shop Drawings and Sample submittals. All submittals will be identified as ENGINEER may require and in the number of copies specified in the General Requirements. The data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show ENGINEER the services, materials, and equipment CONTRACTOR proposes to provide and to enable ENGINEER to review the information for the limited purposes required by paragraph 6.17.E.

B.* CONTRACTOR shall also submit six (6) Samples to ENGINEER for review and approval in accordance with the acceptable schedule of Shop Drawings and Sample submittals. Each Sample will be identified clearly as to material, Supplier, pertinent data such as catalog numbers, and the use for which intended and otherwise as ENGINEER may require to enable ENGINEER to review the submittal for the limited purposes required by paragraph 6.17.E. The numbers of each Sample to be submitted will be as specified in the Specifications.

C. Where a Shop Drawing or Sample is required by the Contract Documents or the schedule of Shop Drawings and Sample submittals acceptable to ENGINEER as required by paragraph 2.07, any related Work performed prior to ENGINEER's review and approval of the pertinent submittal will be at the sole expense and responsibility of CONTRACTOR.

D. *Submittal Procedures*

1. Before submitting each Shop Drawing or Sample, CONTRACTOR shall have determined and verified:

a. all field measurements, quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

b. all materials with respect to intended use, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work;

c. all information relative to means, methods, techniques, sequences, and procedures of construction and safety precautions and programs incident thereto; and

d. CONTRACTOR shall also have reviewed and coordinated each Shop Drawing or

*See Supplementary Conditions

Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents.

2. Each submittal shall bear a stamp or specific written indication that CONTRACTOR has satisfied CONTRACTOR's obligations under the Contract Documents with respect to CONTRACTOR's review and approval of that submittal.

3. At the time of each submittal, CONTRACTOR shall give ENGINEER specific written notice of such variations, if any, that the Shop Drawing or Sample submitted may have from the requirements of the Contract Documents, such notice to be in a written communication separate from the submittal; and, in addition, shall cause a specific notation to be made on each Shop Drawing and Sample submitted to ENGINEER for review and approval of each such variation.

E. *ENGINEER's Review*

1. ENGINEER will timely review and approve Shop Drawings and Samples in accordance with the schedule of Shop Drawings and Sample submittals acceptable to ENGINEER. ENGINEER's review and approval will be only to determine if the items covered by the submittals

will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. ENGINEER's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

3. ENGINEER's review and approval of Shop Drawings or Samples shall not relieve CONTRACTOR from responsibility for any variation from the requirements of the Contract Documents unless CONTRACTOR has in writing called ENGINEER's attention to each such variation at the time of each submittal as required by paragraph 6.17.D.3 and ENGINEER has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample approval; nor will any approval by ENGINEER relieve CONTRACTOR from responsibility for complying with the requirements of paragraph 6.17.D.1.

F. *Resubmittal Procedures*

1. CONTRACTOR shall make corrections required by ENGINEER and shall return the required number of corrected copies of Shop Drawings and submit as required new Samples for review and approval. CONTRACTOR shall direct specific attention in writing to revisions other than the corrections called for by ENGINEER on previous submittals.

6.18 *Continuing the Work*

A. CONTRACTOR shall carry on the Work and adhere to the progress schedule during all disputes or disagreements with OWNER. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by paragraph 15.04 or as OWNER and CONTRACTOR may otherwise agree in writing.

6.19 *CONTRACTOR's General Warranty and Guarantee*

A. CONTRACTOR warrants and guarantees to OWNER, ENGINEER, and ENGINEER's Consultants that all Work will be in accordance with the Contract Documents and will not be defective. CONTRACTOR's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, modification, or improper maintenance or operation by persons other than CONTRACTOR, Subcontractors, Suppliers, or any other individual or entity for whom CONTRACTOR is responsible; or

2. normal wear and tear under normal usage.

B. CONTRACTOR's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of CONTRACTOR's obligation to perform the Work in accordance with the Contract Documents:

1. observations by ENGINEER;

2. recommendation by ENGINEER or payment by OWNER of any progress or final payment;

3. the issuance of a certificate of Substantial Completion by ENGINEER or any payment related thereto by OWNER;

4. use or occupancy of the Work or any part thereof by OWNER;

5. any acceptance by OWNER or any failure to do so;

6. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by ENGINEER;

7. any inspection, test, or approval by others; or

8. any correction of defective Work by OWNER.

6.20 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, ENGINEER, ENGINEER's Consultants, and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the perfor- mance of the Work, provided that any such claim, cost, loss, or damage:

1. is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom; and

2. is caused in whole or in part by any negligent act or omission of CONTRACTOR, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable, regardless of whether or not caused in part by any negligence or omission of an individual or entity indemnified hereunder or whether liability is imposed upon such indemnified party by Laws and Regulations regard less of the negligence of any such individual or entity.

B. In any and all claims against OWNER or ENGI- NEER or any of their respective consultants, agents, officers, directors, partners, or employees by any employ- ee (or the survivor or personal representative of such employee) of CONTRACTOR, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under paragraph 6.20.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for CONTRACTOR or any such Subcontractor, Suppli- er, or other individual or entity under workers' compen- sation acts, disability benefit acts, or other employee benefit acts.

C. The indemnification obligations of CONTRAC- TOR under paragraph 6.20.A shall not extend to the liability of ENGINEER and ENGINEER's Consultants or to the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them arising out of:

1. the preparation or approval of, or the failure to prepare or approve, maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or

2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

ARTICLE 7 - OTHER WORK

7.01 *Related Work at Site*

A. OWNER may perform other work related to the Project at the Site by OWNER's employees, or let other direct contracts therefor, or have other work performed by utility owners. If such other work is not noted in the Con- tract Documents, then:

1. written notice thereof will be given to CONTRACTOR prior to starting any such other work; and

2. if OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times that should be allowed as a result of such other work, a Claim may be made therefor as provided in paragraph 10.05.

B. CONTRACTOR shall afford each other contractor who is a party to such a direct contract and each utility owner (and OWNER, if OWNER is performing the other work with OWNER's employees) proper and safe access to the Site and a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work and shall properly coordinate the Work with theirs. Unless otherwise provided in the Contract Documents, CONTRACTOR shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. CONTRACTOR shall not endanger any work of others by cutting, excavating, or otherwise altering their work and will only cut or alter their work with the written consent of ENGINEER and the others whose work will be affected. The duties and responsibilities of CONTRACTOR under this paragraph are for the benefit of

such utility owners and other contractors to the extent that there are comparable provisions for the benefit of CONTRACTOR in said direct contracts between OWNER and such utility owners and other contractors.

C. If the proper execution or results of any part of CONTRACTOR's Work depends upon work performed by others under this Article 7, CONTRACTOR shall inspect such other work and promptly report to ENGINEER in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of CONTRACTOR's Work. CONTRACTOR's failure to so report will constitute an acceptance of such other work as fit and proper for integration with CONTRACTOR's Work except for latent defects and deficiencies in such other work.

7.02 *Coordination*

A. If OWNER intends to contract with others for the performance of other work on the Project at the Site, the following will be set forth in Supplementary Conditions:

1. the individual or entity who will have authority and responsibility for coordination of the activities among the various contractors will be identified;

2. the specific matters to be covered by such authority and responsibility will be itemized; and

3. the extent of such authority and responsibilities will be provided.

B. Unless otherwise provided in the Supplementary Conditions, OWNER shall have sole authority and responsibility for such coordination.

ARTICLE 8 - OWNER'S RESPONSIBILITIES

8.01 *Communications to Contractor*

A. Except as otherwise provided in these General Conditions, OWNER shall issue all communications to CONTRACTOR through ENGINEER.

8.02 *Replacement of ENGINEER*

A. In case of termination of the employment of ENGINEER, OWNER shall appoint an engineer to whom CONTRACTOR makes no reasonable objection, whose status under the Contract Documents shall be that of the former ENGINEER.

8.03 *Furnish Data*

A. OWNER shall promptly furnish the data required of OWNER under the Contract Documents.

8.04 *Pay Promptly When Due*

A. OWNER shall make payments to CONTRACTOR promptly when they are due as provided in paragraphs 14.02.C and 14.07.C.

8.05 *Lands and Easements; Reports and Tests*

A. OWNER's duties in respect of providing lands and easements and providing engineering surveys to establish reference points are set forth in paragraphs 4.01 and 4.05. Paragraph 4.02 refers to OWNER's identifying and making available to CONTRACTOR copies of reports of explorations and tests of subsurface conditions and drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site that have been utilized by ENGINEER in preparing the Contract Documents.

*See Supplementary Conditions

8.06* *Insurance*

A.* OWNER's responsibilities, if any, in respect to purchasing and maintaining liability and property insurance are set forth in Article 5.

8.07 *Change Orders*

A. OWNER is obligated to execute Change Orders as indicated in paragraph 10.03.

8.08 *Inspections, Tests, and Approvals*

A. OWNER's responsibility in respect to certain inspections, tests, and approvals is set forth in paragraph 13.03.B.

8.09 *Limitations on OWNER's Responsibilities*

A. The OWNER shall not supervise, direct, or have control or authority over, nor be responsible for, CONTRACTOR's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the performance of the Work. OWNER will not be responsible for CONTRACTOR's failure to perform the Work in accordance with the Contract Documents.

8.10 *Undisclosed Hazardous Environmental Condition*

A. OWNER's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in paragraph 4.06.

8.11 *Evidence of Financial Arrangements*

A. If and to the extent OWNER has agreed to furnish CONTRACTOR reasonable evidence that financial arrangements have been made to satisfy OWNER's obligations under the Contract Documents, OWNER's responsibility in respect thereof will be as set forth in the Supplementary Conditions.

ARTICLE 9 - ENGINEER'S STATUS DURING CONSTRUCTION

9.01 *OWNER'S Representative*

A. ENGINEER will be OWNER's representative during the construction period. The duties and responsibilities and the limitations of authority of ENGINEER as OWNER's representative during construction are set forth in the Contract Documents and will not be changed without written consent of OWNER and ENGINEER.

9.02 *Visits to Site*

A. ENGINEER will make visits to the Site at intervals appropriate to the various stages of construction as ENGINEER deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of CONTRACTOR's executed Work. Based on information obtained during such visits and observations, ENGINEER, for the benefit of OWNER, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. ENGINEER will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. ENGINEER's efforts will be directed toward providing for OWNER a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, ENGINEER will keep OWNER informed of the progress of the Work and will endeavor to guard OWNER against defective Work.

B. ENGINEER's visits and observations are subject to all the limitations on ENGINEER's authority and responsibility set forth in paragraph 9.10, and particularly, but without limitation, during or as a result of ENGINEER's visits or observations of CONTRACTOR's Work ENGINEER will not supervise, direct, control, or have authority over or be responsible for CONTRACTOR's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the performance of the Work.

9.03* *Project Representative*

A. If OWNER and ENGINEER agree, ENGINEER will furnish a Resident Project Representative to assist ENGINEER in providing more extensive observation of the Work. The responsibilities and authority and limitations thereon of any such Resident Project Representative and assistants will be as provided in paragraph 9.10 and in the Supplementary Conditions. If OWNER designates another representative or agent to represent OWNER at the Site who is not ENGINEER's Consultant, agent or employee,

*See Supplementary Conditions

the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

9.04 *Clarifications and Interpretations*

A. ENGINEER will issue with reasonable promptness such written clarifications or interpretations of the requirements of the Contract Documents as ENGINEER may determine necessary, which shall be consistent with the intent of and reasonably inferable from the Contract Docu-

ments. Such written clarifications and interpretations will be binding on OWNER and CONTRACTOR. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a written clarification or interpretation, a Claim may be made therefor as provided in paragraph 10.05.

9.05 *Authorized Variations in Work*

A. ENGINEER may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on OWNER and also on CONTRACTOR, who shall perform the Work involved promptly. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, as a result of a Field Order, a Claim may be made therefor as provided in paragraph 10.05.

9.06 *Rejecting Defective Work*

A. ENGINEER will have authority to disapprove or reject Work which ENGINEER believes to be defective, or that ENGINEER believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. ENGINEER will also have authority to require special inspection or testing of the Work as provided in paragraph 13.04, whether or not the Work is fabricated, installed, or completed.

9.07 *Shop Drawings, Change Orders and Payments*

A. In connection with ENGINEER's authority as to Shop Drawings and Samples, see paragraph 6.17.

B. In connection with ENGINEER's authority as to Change Orders, see Articles 10, 11, and 12.

C. In connection with ENGINEER's authority as to Applications for Payment, see Article 14.

9.08 *Determinations for Unit Price Work*

A. ENGINEER will determine the actual quantities and classifications of Unit Price Work performed by CONTRACTOR. ENGINEER will review with CONTRACTOR the ENGINEER's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). ENGINEER's written decision thereon will be final and binding (except as modified by ENGINEER to reflect changed factual conditions or more accurate data) upon OWNER and CONTRACTOR, subject to the provisions of paragraph 10.05.

9.09 *Decisions on Requirements of Contract Documents and Acceptability of Work*

A. ENGINEER will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. Claims, disputes and other matters relating to the acceptability of the Work, the quantities and classifications of Unit Price Work, the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, and Claims seeking changes in the Contract Price or Contract Times will be referred initially to ENGINEER in writing, in accordance with the provisions of paragraph 10.05, with a request for a formal decision.

B. When functioning as interpreter and judge under this paragraph 9.09, ENGINEER will not show partiality to OWNER or CONTRACTOR and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity. The rendering of a decision by ENGINEER pursuant to this paragraph 9.09 with respect to any such Claim, dispute, or other matter (except any which have been waived by the making or acceptance of final payment as provided in paragraph 14.07) will be a condition precedent to any exercise by OWNER or CONTRACTOR of such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any such Claim, dispute, or other matter.

*See Supplementary Conditions

9.10 *Limitations on ENGINEER's Authority and Responsibilities*

A. Neither ENGINEER's authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by ENGINEER in good faith either to exercise or not exercise such

authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by ENGINEER shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by ENGINEER to CONTRACTOR, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. ENGINEER will not supervise, direct, control, or have authority over or be responsible for CONTRACTOR's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the performance of the Work. ENGINEER will not be responsible for CONTRACTOR's failure to perform the Work in accordance with the Contract Documents.

C. ENGINEER will not be responsible for the acts or omissions of CONTRACTOR or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. ENGINEER's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, Bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by paragraph 14.07.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals that the results certified indicate compliance with, the Contract Documents.

E. The limitations upon authority and responsibility set forth in this paragraph 9.10 shall also apply to ENGINEER's Consultants, Resident Project Representative, and assistants. See Article 18.

ARTICLE 10 - CHANGES IN THE WORK; CLAIMS

10.01 *Authorized Changes in the Work*

A. Without invalidating the Agreement and without notice to any surety, OWNER may, at any time or from time to time, order additions, deletions, or revisions in the Work by a Written Amendment, a Change Order, or a Work Change Directive. Upon receipt of any such document, CONTRACTOR shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).

B. If OWNER and CONTRACTOR are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefor as provided in paragraph 10.05.

10.02 *Unauthorized Changes in the Work*

A. CONTRACTOR shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents as amended, modified, or supplemented as provided in paragraph 3.04, except in the case of an emergency as provided in paragraph 6.16 or in the case of uncovering Work as provided in paragraph 13.04.B.

10.03 *Execution of Change Orders*

A. OWNER and CONTRACTOR shall execute appropriate Change Orders recommended by ENGINEER (or Written Amendments) covering:

1. changes in the Work which are: (i) ordered by OWNER pursuant to paragraph 10.01.A, (ii) required because of acceptance of defective Work under paragraph 13.08.A or OWNER's correction of defective Work under paragraph 13.09, or (iii) agreed to by the parties;

2. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive; and

3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by ENGINEER pursuant to paragraph 10.05; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, CONTRACTOR shall carry on the Work and adhere to the progress schedule as provided in paragraph 6.18.A.

10.04 *Notification to Surety*

A. If notice of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times) is required by the provisions of any Bond to be given to a surety, the giving of any such notice will be CONTRACTOR's responsibility. The amount of each applicable Bond will be adjusted to reflect the effect of any such change.

10.05 *Claims and Disputes*

A. *Notice:* Written notice stating the general nature of each Claim, dispute, or other matter shall be delivered by the claimant to ENGINEER and the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto. Notice of the amount or extent of the Claim, dispute, or other matter with supporting data shall be delivered to the ENGINEER and the other party to the Contract within 60 days after the start of such event (unless ENGINEER allows additional time for claimant to submit additional or more accurate data in support of such Claim, dispute, or other matter). A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of paragraph 12.01.B. A Claim for an adjustment in Contract Time shall be prepared in accordance with the provisions of paragraph 12.02.B. Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The opposing party shall submit any response to ENGINEER and the claimant within 30 days after receipt of the claimant's last submittal (unless ENGINEER allows additional time).

B. *ENGINEER's Decision:* ENGINEER will render a formal decision in writing within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any. ENGINEER's written decision on such Claim, dispute, or other matter will be final and binding upon OWNER and CONTRACTOR unless:

1. an appeal from ENGINEER's decision is taken within the time limits and in accordance with the dispute resolution procedures set forth in Article 16; or

2. if no such dispute resolution procedures have been set forth in Article 16, a written notice of intention to appeal from ENGINEER's written decision is delivered by OWNER or CONTRAC- TOR to the other and to ENGINEER within 30 days after the date of such decision, and a formal proceeding is instituted by the appealing party in a forum of competent jurisdiction within 60 days after the date of such decision or within 60 days after Substantial Completion, whichever is later (unless otherwise agreed in writing by OWNER and CONTRACTOR), to exercise such rights or remedies as the appealing party may have with respect to such Claim, dispute, or other matter in accordance with applicable Laws and Regulations.

C. If ENGINEER does not render a formal decision in writing within the time stated in paragraph 10.05.B, a decision denying the Claim in its entirety shall be deemed to have been issued 31 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any.

D. No Claim for an adjustment in Contract Price or Contract Times (or Milestones) will be valid if not submitted in accordance with this paragraph 10.05.

ARTICLE 11 - COST OF THE WORK; CASH ALLOWANCES; UNIT PRICE WORK

11.01 *Cost of the Work*

A. *Costs Included:* The term Cost of the Work means the sum of all costs necessarily incurred and paid by CONTRACTOR in the proper performance of the Work. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to CONTRACTOR will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as otherwise may be agreed to in writing by OWNER, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall include only the following items, and shall not include any of the costs itemized in paragraph 11.01.B.

1. Payroll costs for employees in the direct employ of CONTRACTOR in the performance of the Work under schedules of job classifications agreed upon by OWNER and CONTRACTOR. Such employees shall include without limitation superintendents, foremen, and other personnel employed full time at the Site. Payroll costs for employees not employed full time on the Work

shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by OWNER.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to CONTRACTOR unless OWNER deposits funds with CONTRACTOR with which to make payments, in which case the cash discounts shall accrue to OWNER. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to OWNER, and CONTRACTOR shall make provisions so that they may be obtained.

3. Payments made by CONTRACTOR to Subcontractors for Work performed by Subcontractors. If required by OWNER, CONTRACTOR shall obtain competitive bids from subcontractors acceptable to OWNER and CONTRACTOR and shall deliver such bids to OWNER, who will then determine, with the advice of ENGINEER, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as CONTRACTOR's Cost of the Work and fee as provided in this paragraph 11.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.

5. Supplemental costs including the following:

a. The proportion of necessary transportation, travel, and subsistence expenses of CONTRACTOR's employees incurred in discharge of duties connected with the Work.

b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the perfomance of the Work, and cost, less market value, of such items used but not consumed which remain the property of CONTRACTOR.

c. Rentals of all construction equipment and machinery, and the parts thereof whether rented from CONTRACTOR or others in accordance with rental agreements approved by OWNER with the advice of ENGINEER, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

d. Sales, consumer, use, and other similar taxes related to the Work, and for which CONTRACTOR is liable, imposed by Laws and Regulations.

e. Deposits lost for causes other than negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by CONTRACTOR in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with paragraph 5.06.D), provided such losses and damages have resulted from causes other than the negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of OWNER. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining CONTRACTOR's fee.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as telegrams, long distance telephone calls, telephone service at the Site, expressage, and similar petty cash items in connection with the Work.

i. When the Cost of the Work is used to determine the value of a Change Order or of a Claim, the cost of premiums for additional Bonds and insurance required because of the changes in the Work or caused by the event giving rise to the Claim.

j. When all the Work is performed on the basis of cost-plus, the costs of premiums for all Bonds and insurance CONTRACTOR is required by the Contract Documents to purchase and maintain.

B. *Costs Excluded:* The term Cost of the Work shall not include any of the following items:

1. Payroll costs and other compensation of CONTRACTOR's officers, executives, principals (of partnerships and sole proprietorships), general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by CONTRACTOR, whether at the Site or in CONTRACTOR's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in paragraph 11.01.A.1 or specifically covered by paragraph 11.01.A.4, all of which are to be considered administrative costs covered by the CONTRACTOR's fee.

2. Expenses of CONTRACTOR's principal and branch offices other than CONTRACTOR's office at the Site.

3. Any part of CONTRACTOR's capital expenses, including interest on CONTRACTOR's capital employed for the Work and charges against CONTRACTOR for delinquent payments.

4. Costs due to the negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in paragraphs 11.01.A and 11.01.B.

C. *CONTRACTOR's Fee:* When all the Work is performed on the basis of cost-plus, CONTRACTOR's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, CONTRACTOR's fee shall be determined as set forth in paragraph 12.01.C.

D. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to paragraphs 11.01.A and 11.01.B, CONTRACTOR will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to ENGINEER an itemized cost breakdown together with supporting data.

11.02 *Cash Allowances*

A. It is understood that CONTRACTOR has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums as may be acceptable to OWNER and ENGINEER. CONTRACTOR agrees that:

1. the allowances include the cost to CONTRACTOR (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. CONTRACTOR's costs for unloading and handling on the Site, labor, installation costs, overhead, profit, and other expenses contemplated for the allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.

B. Prior to final payment, an appropriate Change Order will be issued as recommended by ENGINEER to reflect actual amounts due CONTRACTOR on account of

Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

11.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by CONTRACTOR will be made by ENGINEER subject to the provisions of paragraph 9.08.

B. Each unit price will be deemed to include an amount considered by CONTRACTOR to be adequate to cover CONTRACTOR's overhead and profit for each separately identified item.

C. OWNER or CONTRACTOR may make a Claim for an adjustment in the Contract Price in accordance with paragraph 10.05 if:

1. the quantity of any item of Unit Price Work performed by CONTRACTOR differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

2. there is no corresponding adjustment with respect any other item of Work; and

3. if CONTRACTOR believes that CONTRACTOR is entitled to an increase in Contract Price as a result of having incurred additional expense or OWNER believes that OWNER is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease.

ARTICLE 12 - CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

12.01* *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order or by a Written Amendment. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by the party making the Claim to the ENGINEER and the other party to the Contract in accordance with the provisions of paragraph 10.05.

B.* The value of any Work covered by a Change Order or of any Claim for an adjustment in the Contract Price will be determined as follows:

1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of paragraph 11.03); or

2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with paragraph 12.01.C.2); or

3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under paragraph 12.01.B.2, on the basis of the Cost of the Work (determined as provided in paragraph 11.01) plus a CONTRACTOR's fee for overhead and profit (determined as provided in paragraph 12.01.C).

C. *CONTRACTOR's Fee:* The CONTRACTOR's fee for overhead and profit shall be determined as follows:

1. a mutually acceptable fixed fee; or

2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

a. for costs incurred under paragraphs 11.01.A.1 and 11.01.A.2, the CONTRACTOR's fee shall be 15 percent;

b. for costs incurred under paragraph 11.01.A.3, the CONTRACTOR's fee shall be five percent;

c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of paragraph 12.01.C.2.a is that the Subcon- tractor who actually performs the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by such Subcontractor under paragraphs 11.01.A.1 and 11.01.A.2 and that any higher tier Subcontractor and CON- TRACTOR will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor;

*See Supplementary Conditions

d. no fee shall be payable on the basis of costs itemized under paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B;

e. the amount of credit to be allowed by CONTRACTOR to OWNER for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in CONTRACTOR's fee by an amount equal to five percent of such net decrease; and

f. when both additions and credits are involved in any one change, the adjustment in CONTRACTOR's fee shall be computed on the basis of the net change in accordance with paragraphs 12.01.C.2.a through 12.01.C.2.e, inclusive.

12.02 *Change of Contract Times*

A. The Contract Times (or Milestones) may only be changed by a Change Order or by a Written Amendment. Any Claim for an adjustment in the Contract Times (or Milestones) shall be based on written notice submitted by the party making the claim to the ENGINEER and the other party to the Contract in accordance with the provisions of paragraph 10.05.

B. Any adjustment of the Contract Times (or Milestones) covered by a Change Order or of any Claim for an adjustment in the Contract Times (or Milestones) will be determined in accordance with the provisions of this Article 12.

12.03 *Delays Beyond CONTRACTOR's Control*

A. Where CONTRACTOR is prevented from completing any part of the Work within the Contract Times (or Milestones) due to delay beyond the control of CONTRACTOR, the Contract Times (or Milestones) will be extended in an amount equal to the time lost due to such delay if a Claim is made therefor as provided in paragraph 12.02.A. Delays beyond the control of CONTRACTOR shall include, but not be limited to, acts or neglect by OWNER, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions, or acts of God.

12.04 *Delays Within CONTRACTOR's Control*

A. The Contract Times (or Milestones) will not be extended due to delays within the control of CONTRACTOR. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of CONTRACTOR.

12.05 *Delays Beyond OWNER's and CONTRACTOR's Control*

A. Where CONTRACTOR is prevented from completing any part of the Work within the Contract Times (or Milestones) due to delay beyond the control of both OWNER and CONTRACTOR, an extension of the Contract Times (or Milestones) in an amount equal to the time lost due to such delay shall be CONTRACTOR's sole and exclusive remedy for such delay.

12.06 *Delay Damages*

A. In no event shall OWNER or ENGINEER be liable to CONTRACTOR, any Subcontractor, any Supplier, or any other person or organization, or to any surety for or employee or agent of any of them, for damages arising out of or resulting from:

1. delays caused by or within the control of CONTRACTOR; or

2. delays beyond the control of both OWNER and CONTRACTOR including but not limited to fires, floods, epidemics, abnormal weather conditions, acts of God, or acts or neglect by utility

owners or other contractors performing other work as contemplated by Article 7.

B. Nothing in this paragraph 12.06 bars a change in Contract Price pursuant to this Article 12 to compensate CONTRACTOR due to delay, interference, or disruption directly attributable to actions or inactions of OWNER or anyone for whom OWNER is responsible.

ARTICLE 13 - TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.01 *Notice of Defects*

A. Prompt notice of all defective Work of which OWNER or ENGINEER has actual knowledge will be given to CONTRACTOR. All defective Work may be rejected, corrected, or accepted as provided in this Article 13.

13.02* *Access to Work*

A. OWNER, ENGINEER, ENGINEER's Consultants, other representatives and personnel of OWNER, independent testing laboratories, and governmental agencies with jurisdictional interests will have access to the Site and the Work at reasonable times for their observation, inspecting, and testing. CONTRACTOR shall provide them proper and safe conditions for such access and advise them of CONTRACTOR's Site safety procedures and programs so that they may comply therewith as applicable.

13.03* *Tests and Inspections*

A. CONTRACTOR shall give ENGINEER timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

B.* OWNER shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:

1. for inspections, tests, or approvals covered by paragraphs 13.03.C and 13.03.D below;

2. that costs incurred in connection with tests or inspections conducted pursuant to paragraph 13.04.B shall be paid as provided in said paragraph 13.04.B; and

3. as otherwise specifically provided in the Contract Documents.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, CONTRACTOR shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish ENGINEER the required certificates of inspection or approval.

D. CONTRACTOR shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for OWNER's and ENGINEER's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to CONTRACTOR's purchase thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to OWNER and ENGINEER.

E. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by CONTRACTOR without written concurrence of ENGINEER, it must, if requested by ENGINEER, be uncovered for observation.

F. Uncovering Work as provided in paragraph 13.03.E shall be at CONTRACTOR's expense unless CONTRACTOR has given ENGINEER timely notice of CONTRACTOR's intention to cover the same and ENGINEER has not acted with reasonable promptness in response to such notice.

13.04 *Uncovering Work*

A. If any Work is covered contrary to the written request of ENGINEER, it must, if requested by ENGINEER, be uncovered for ENGINEER's observation and replaced at CONTRACTOR's expense.

B. If ENGINEER considers it necessary or advisable that covered Work be observed by ENGINEER or inspected or tested by others, CONTRACTOR, at ENGINEER's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as ENGINEER may require, that portion of the Work in

question, furnishing all necessary labor, material, and equipment. If it is found that such Work is defective, CONTRACTOR shall pay all Claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and OWNER shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, OWNER may make a Claim therefor as provided in paragraph 10.05. If, however, such Work is not found to be defective, CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Times (or Milestones), or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, CONTRACTOR may make a Claim therefor as provided in paragraph 10.05.

*See Supplementary Conditions

13.05 *OWNER May Stop the Work*

A. If the Work is defective, or CONTRACTOR fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, OWNER may order CONTRACTOR to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of OWNER to stop the Work shall not give rise to any duty on the part of OWNER to exercise this right for the benefit of CONTRACTOR, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

13.06 *Correction or Removal of Defective Work*

A. CONTRACTOR shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by ENGINEER, remove it from the Project and replace it with Work that is not defective. CONTRACTOR shall pay all Claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others).

13.07 *Correction Period*

A. If within one year after the date of Substantial Completion or such longer period of time as may be prescribed by Laws or Regulations or by the terms of any applicable special guarantee required by the Contract Documents or by any specific provision of the Contract Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for CONTRACTOR's use by OWNER or permitted by Laws and Regulations as contemplated in paragraph 6.11.A is found to be defective, CONTRACTOR shall promptly, without cost to OWNER and in accordance with OWNER's written instructions: (i) repair such defective land or areas, or (ii) correct such defective Work or, if the defective Work has been rejected by OWNER, remove it from the Project and replace it with Work that is not defective, and (iii) satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom. If CONTRACTOR does not promptly comply with the terms of such instructions, or in an emergency where delay would cause serious risk of loss or damage, OWNER may have the defective Work corrected or repaired or may have the rejected Work removed and replaced, and all Claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by CONTRACTOR.

B. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications or by Written Amendment.

C. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph 13.07, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

D. CONTRACTOR's obligations under this paragraph 13.07 are in addition to any other obligation or warranty. The provisions of this paragraph 13.07 shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitation or repose.

13.08 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, OWNER (and, prior to ENGINEER's recommendation of final payment, ENGINEER) prefers to accept it, OWNER may do so. CONTRACTOR shall pay all Claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) attributable to OWNER's evaluation of and determination to accept such defective Work (such costs to be approved by ENGINEER as to reasonableness) and the diminished value of the Work to the extent not otherwise paid by CONTRACTOR pursuant to this sentence. If any such acceptance occurs prior to ENGINEER's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and OWNER shall be entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work so accepted. If the parties are unable to agree as to the amount thereof, OWNER may make a Claim therefor as provided in paragraph 10.05. If the acceptance occurs after such recommendation, an appropriate amount will be paid by CONTRACTOR to OWNER.

13.09 *OWNER May Correct Defective Work*

A. If CONTRACTOR fails within a reasonable time after written notice from ENGINEER to correct defective Work or to remove and replace rejected Work as required by ENGINEER in accordance with paragraph 13.06.A, or if CONTRACTOR fails to perform the Work in accordance with the Contract Documents, or if CONTRACTOR fails to comply with any other provision of the Contract Documents, OWNER may, after seven days written notice to CONTRACTOR, correct and remedy any such deficiency.

B. In exercising the rights and remedies under this paragraph, OWNER shall proceed expeditiously. In connection with such corrective and remedial action, OWNER may exclude CONTRACTOR from all or part of the Site, take possession of all or part of the Work and suspend CONTRACTOR's services related thereto, take possession of CONTRACTOR's tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and equipment stored at the Site or for which OWNER has paid CONTRACTOR but which are stored elsewhere. CONTRACTOR shall allow OWNER, OWNER's representatives, agents and employees, OWNER's other contractors, and ENGINEER and ENGINEER's Consultants access to the Site to enable OWNER to exercise the rights and remedies under this paragraph.

C. All Claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred or sustained by OWNER in exercising the rights and remedies under this paragraph 13.09 will be charged against CONTRACTOR, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and OWNER shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount of the adjustment, OWNER may make a Claim therefor as provided in paragraph 10.05. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of CONTRACTOR's defective Work.

D. CONTRACTOR shall not be allowed an extension of the Contract Times (or Milestones) because of any delay in the performance of the Work attributable to the exercise by OWNER of OWNER's rights and remedies under this paragraph 13.09.

ARTICLE 14 - PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 *Schedule of Values*

A. The schedule of values established as provided in paragraph 2.07.A will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to ENGINEER. Progress payments on account of Unit Price Work will be based on the number of units completed.

14.02 *Progress Payments*

A.* *Applications for Payments*

1. At least 20 days before the date established for each progress payment (but not more often than once a month), CONTRACTOR shall submit to ENGINEER for review an Application for Payment filled out and signed by CONTRACTOR covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that OWNER has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect OWNER's interest therein, all of which must be satisfactory to OWNER.

2. Beginning with the second Application for Payment, each Application shall include an affidavit of CONTRACTOR stating that all previous progress payments received on account of the Work have been applied on account to discharge CONTRACTOR's legitimate obligations associated with prior Applications for Payment.

3. The amount of retainage with respect to pro-gress payments will be as stipulated in the Agreement.

*See Supplementary Conditions

B. *Review of Applications*

1. ENGINEER will, within 10 days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to OWNER or return the Application to CONTRACTOR indicating in writing ENGINEER's reasons for refusing to recommend payment. In the latter case, CONTRACTOR may make the necessary corrections and resubmit the Application.

2. ENGINEER's recommendation of any payment requested in an Application for Payment will constitute a representation by ENGINEER to OWNER, based on ENGINEER's observations on the Site of the executed Work as an experienced and qualified design professional and on ENGINEER's review of the Application for Payment and the accompanying data and schedules, that to the best of ENGINEER's knowledge, information and belief:

a. the Work has progressed to the point indicated;

b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Comple tion, to the results of any subsequent tests called for in the Contract Documents, to a final determination of quantities and classifications for Unit Price Work under paragraph 9.08, and to any other qualifications stated in the recommendation); and

c. the conditions precedent to CONTRACTOR's being entitled to such payment appear to have been fulfilled in so far as it is ENGINEER's responsibility to observe the Work.

3. By recommending any such payment ENGINEER will not thereby be deemed to have represented that: (i) inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to ENGINEER in the Contract Documents; or (ii) that there may not be other matters or issues between the parties

that might entitle CONTRACTOR to be paid additionally by OWNER or entitle OWNER to withhold payment to CONTRACTOR.

4. Neither ENGINEER's review of CONTRACTOR's Work for the purposes of recommending payments nor ENGINEER's recommendation of any payment, including final payment, will impose responsibility on ENGINEER to supervise, direct, or control the Work or for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for CONTRACTOR's failure to comply with Laws and Regulations applicable to CONTRACTOR's performance of the Work. Additionally, said review or recommendation will not impose responsibility on ENGINEER to make any examination to ascertain how or for what purposes CONTRACTOR has used the moneys paid on account of the Contract Price, or to determine that title to any of the Work, materials, or equipment has passed to OWNER free and clear of any Liens.

5. ENGINEER may refuse to recommend the whole or any part of any payment if, in ENGINEER's opinion, it would be incorrect to make the representations to OWNER referred to in paragraph 14.02.B.2. ENGINEER may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in ENGINEER's opinion to protect OWNER from loss because:

a. the Work is defective, or completed Work has been damaged, requiring correction or replacement;

b. the Contract Price has been reduced by Written Amendment or Change Orders;

c. OWNER has been required to correct defective Work or complete Work in accordance with paragraph 13.09; or

d. ENGINEER has actual knowledge of the occurrence of any of the events enumerated in paragraph 15.02.A.

C. *Payment Becomes Due*

1. Ten days after presentation of the Application for Payment to OWNER with ENGINEER's recommendation, the amount recommended will (subject to the provisions of paragraph 14.02.D) become due, and when due will be paid by OWNER to CONTRACTOR.

D. *Reduction in Payment*

1. OWNER may refuse to make payment of the full amount recommended by ENGINEER because:

a. claims have been made against OWNER on account of CONTRACTOR's performance or furnishing of the Work;

b. Liens have been filed in connection with the Work, except where CONTRACTOR has delivered a specific Bond satisfactory to OWNER to secure the satisfaction and discharge of such Liens;

c. there are other items entitling OWNER to a set-off against the amount recommended; or

d. OWNER has actual knowledge of the occurrence of any of the events enumerated in paragraphs 14.02.B.5.a through 14.02.B.5.c or paragraph 15.02.A.

2. If OWNER refuses to make payment of the full amount recommended by ENGINEER, OWNER must give CONTRACTOR immediate written notice (with a copy to ENGINEER) stating the reasons for such action and promptly pay CONTRACTOR any amount remaining after deduction of the amount so withheld. OWNER shall promptly pay CONTRACTOR the amount so withheld, or any adjustment thereto agreed to by OWNER and CONTRACTOR, when CONTRACTOR corrects to OWNER's satisfaction the reasons for such action.

3. If it is subsequently determined that OWNER's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by paragraph 14.02.C.1.

14.03 *CONTRACTOR's Warranty of Title*

A. CONTRACTOR warrants and guarantees that title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to OWNER no later than the time of payment free and clear of all Liens.

14.04 *Substantial Completion*

A. When CONTRACTOR considers the entire Work ready for its intended use CONTRACTOR shall notify OWNER and ENGINEER in writing that the entire Work is substantially complete (except for items specifically listed by CONTRACTOR as incomplete) and request that ENGINEER issue a certificate of Substantial Completion. Promptly thereafter, OWNER, CONTRACTOR, and ENGINEER shall make an inspection of the Work to determine the status of completion. If ENGINEER does not consider the Work substantially complete, ENGINEER will notify CONTRACTOR in writing giving the reasons therefor. If ENGINEER considers the Work substantially complete, ENGINEER will prepare and deliver to OWNER a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. OWNER shall have seven days after receipt of the tentative certificate during which to make written objection to ENGINEER as to any provisions of the certificate or attached list. If, after considering such objections, ENGINEER concludes that the Work is not substantially complete, ENGINEER will within 14 days after submission of the tentative certificate to OWNER notify CONTRACTOR in writing, stating the reasons therefor. If, after consideration of OWNER's objections, ENGINEER considers the Work substantially complete, ENGINEER will within said 14 days execute and deliver to OWNER and CONTRACTOR a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as ENGINEER believes justified after consideration of any objections from OWNER. At the time of delivery of the tentative certificate of Substantial Completion ENGINEER will deliver to OWNER and CONTRACTOR a written recommendation as to division of responsibilities pending final payment between OWNER and CONTRACTOR with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless OWNER and CONTRACTOR agree otherwise in writing and so inform ENGINEER in writing prior to ENGINEER's issuing the definitive certificate of Substantial Completion, ENGINEER's aforesaid recommendation will be binding on OWNER and CONTRACTOR until final payment.

B. OWNER shall have the right to exclude CONTRACTOR from the Site after the date of Substantial Completion, but OWNER shall allow CONTRACTOR reasonable access to complete or correct items on the tentative list.

14.05 *Partial Utilization*

A. Use by OWNER at OWNER's option of any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which OWNER, ENGINEER, and CONTRACTOR agree constitutes a separately functioning and usable part of the Work that can be used by OWNER for its intended purpose without significant interference with CONTRACTOR's performance of the remainder of the Work, may be accomplished prior to Substantial Completion of all the Work subject to the following conditions.

1. OWNER at any time may request CONTRACTOR in writing to permit OWNER to use any such part of the Work which OWNER believes to be ready for its intended use and substantially complete. If CONTRACTOR agrees that such part of the Work is substantially complete, CONTRACTOR will certify to OWNER and ENGINEER that such part of the Work is substantially complete and request ENGINEER to issue a certificate of Substantial Completion for that part of the Work. CONTRACTOR at any time may notify OWNER and ENGINEER in writing that CONTRACTOR considers any such part of the Work ready for its intended use and substantially complete and request ENGINEER to issue a certificate of Substantial Completion for that part of the Work. Within a reasonable time after either such request, OWNER, CONTRACTOR, and ENGINEER shall make an inspection of that part of the Work to determine its status of completion. If ENGINEER does not consider that part of the Work to be substantially complete, ENGINEER will notify OWNER and CONTRACTOR in writing giving the reasons therefor. If ENGINEER considers that part of the Work to be substantially complete, the provisions of paragraph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

2. No occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of paragraph 5.10 regarding property insurance.

14.06 *Final Inspection*

A. Upon written notice from CONTRACTOR that the entire Work or an agreed portion thereof is complete, ENGINEER will promptly make a final inspection with OWNER and CONTRACTOR and will notify CONTRACTOR in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. CONTRACTOR shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

14.07 *Final Payment*

A. *Application for Payment*

1. After CONTRACTOR has, in the opinion of ENGINEER, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, Bonds, certificates or other evidence of insurance certificates of inspection, marked-up record documents (as provided in paragraph 6.12), and other documents, CONTRACTOR may make application for final payment following the procedure for progress payments.

2. The final Application for Payment shall be accompanied (except as previously delivered) by: (i) all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by subparagraph 5.04.B.7; (ii) consent of the surety, if any, to final payment; and (iii) complete and legally effective releases or waivers (satisfactory to OWNER) of all Lien rights arising out of or Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in paragraph 14.07.A.2 and as approved by OWNER, CONTRACTOR may furnish receipts or releases in full and an affidavit of CONTRACTOR that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which OWNER or OWNER's property might in any way be responsible have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, CONTRACTOR may furnish a Bond or other collateral satisfactory to OWNER to indemnify OWNER against any Lien.

B. *Review of Application and Acceptance*

1. If, on the basis of ENGINEER's observation of the Work during construction and final inspection, and ENGINEER's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, ENGINEER is satisfied that the Work has been completed and CONTRACTOR's other obligations under the Contract Documents have been fulfilled, ENGINEER will, within ten days after receipt of the final Application for Payment, indicate in writing ENGINEER's recommendation of payment and present the Application for Payment to OWNER for payment. At the same time ENGINEER will also give written notice to OWNER and CONTRACTOR that the Work is acceptable subject to the provisions of paragraph 14.09. Otherwise, ENGINEER will return the Application for Payment to CONTRACTOR, indicating in writing the reasons for refusing to recommend final payment, in which case CONTRACTOR shall make the necessary corrections and resubmit the Application for Payment.

C. *Payment Becomes Due*

1. Thirty days after the presentation to OWNER of the Application for Payment and accompanying documentation, the amount recommended by ENGINEER will become due and, when due, will be paid by OWNER to CONTRACTOR.

14.08 *Final Completion Delayed*

A. If, through no fault of CONTRACTOR, final completion of the Work is significantly delayed, and if ENGINEER so confirms, OWNER shall, upon receipt of CONTRACTOR's final Application for Payment and recommendation of ENGINEER, and without terminating the Agreement, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by OWNER for Work not

fully completed or corrected is less than the retainage stipulated in the Agreement, and if Bonds have been furnished as required in paragraph 5.01, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by CONTRACTOR to ENGINEER with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, exc ept that it shall not constitute a waiver of Claims.

14.09 *Waiver of Claims*

A. The making and acceptance of final payment will constitute:

1. a waiver of all Claims by OWNER against CONTRACTOR, except Claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to paragraph 14.06, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from CONTRACTOR's continuing obligations under the Contract Documents; and

2. a waiver of all Claims by CONTRACTOR against OWNER other than those previously made in writing which are still unsettled.

ARTICLE 15 - SUSPENSION OF WORK AND TERMINATION

15.01 OWNER May Suspend Work

A. At any time and without cause, OWNER may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by notice in writing to CONTRACTOR and ENGINEER which will fix the date on which Work will be resumed. CONTRACTOR shall resume the Work on the date so fixed. CONTRACTOR shall be allowed an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if CONTRACTOR makes a Claim therefor as provided in paragraph 10.05.

15.02 *OWNER May Terminate for Cause*

A. The occurrence of any one or more of the following events will justify termination for cause:

1. CONTRACTOR's persis tent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the progress schedule established under paragraph 2.07 as adjusted from time to time pursuant to paragraph 6.04);

2. CONTRACTOR's disregard of Laws or Regulations of any public body having jurisdiction;

3. CONTRACTOR's disregard of the authority of ENGINEER; or

4. CONTRACTOR's violation in any substantial way of any provisions of the Contract Documents.

B. If one or more of the events identified in paragraph 15.02.A occur, OWNER may, after giving CONTRACTOR (and the surety, if any) seven days written notice, terminate the services of CONTRACTOR, exclude CONTRACTOR from the Site, and take possession of the Work and of all CONTRACTOR's tools, appliances, construction equipment, and machinery at the Site, and use the same to the full extent they could be used by CONTRACTOR (without liability to CONTRACTOR for trespass or conversion), incorporate in the Work all materials and equipment stored at the Site or for which OWNER has paid CONTRACTOR but which are stored elsewhere, and finish the Work as OWNER may deem expedient. In such case, CONTRACTOR shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds all claims , costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by OWNER arising out of or relating to completing the Work, such excess will be paid to CONTRACTOR. If such claims, costs, losses, and damages exceed such unpaid balance, CONTRACTOR shall pay the difference to OWNER. Such claims, costs, losses, and damages incurred by OWNER will be reviewed by ENGINEER as to their reasonableness and, when so approved by ENGINEER, incorporated in a Change Order. When exercising any rights or remedies under this paragraph OWNER shall not be required to obtain the lowest price for the Work performed.

C. Where CONTRACTOR's services have been so terminated by OWNER, the termination will not affect any rights or remedies of OWNER against CONTRACTOR then existing or which may thereafter accrue. Any retention or payment of moneys due CONTRACTOR by OWNER will not release CONTRACTOR from liability.

15.03 *OWNER May Terminate For Convenience*

A. Upon seven days written notice to CONTRACTOR and ENGINEER, OWNER may, without cause and without prejudice to any other right or remedy of OWNER, elect to terminate the Contract. In such case, CONTRACTOR shall be paid (without duplication of any items):

1. for completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. for expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;

3. for all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred in settlement of terminated contracts with Subcontractors, Suppliers, and others; and

4. for reasonable expenses directly attributable to termination.

B. CONTRACTOR shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

15.04 *CONTRACTOR May Stop Work or Terminate*

A. If, through no act or fault of CONTRACTOR, the Work is suspended for more than 90 consecutive days by OWNER or under an order of court or other public authority, or ENGINEER fails to act on any Application for Payment within 30 days after it is submitted, or OWNER fails for 30 days to pay CONTRACTOR any sum finally determined to be due, then CONTRACTOR may, upon seven days written notice to OWNER and ENGINEER, and provided OWNER or ENGINEER do not remedy such suspension or failure within that time, terminate the Contract and recover from OWNER payment on the same terms as provided in paragraph 15.03. In lieu of terminating the Contract and without prejudice to any other right or remedy, if ENGINEER has failed to act on an Application for Payment within 30 days after it is submitted, or OWNER has failed for 30 days to pay CONTRACTOR any sum finally determined to be due, CONTRACTOR may, seven days after written notice to OWNER and ENGINEER, stop the Work until payment is made of all such amounts due CONTRACTOR, including interest thereon. The provisions of this paragraph 15.04 are not intended to preclude CONTRACTOR from making a Claim under paragraph 10.05 for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to CONTRACTOR's stopping the Work as permitted by this paragraph.

ARTICLE 16 - DISPUTE RESOLUTION*

16.01 *Methods and Procedures*

A. Dispute resolution methods and procedures, if any, shall be as set forth in the Supplementary Conditions. If no method and procedure has been set forth, and subject to the provisions of paragraphs 9.09 and 10.05, OWNER and CONTRACTOR may exercise such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any dispute.

ARTICLE 17 - MISCELLANEOUS*

17.01 *Giving Notice*

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

17.02 *Computation of Times*

A. When any period of time is referred to in the Contract Documents by days, it will be computed to

exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

17.03 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract Documents, and the provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

17.04 *Survival of Obligations*

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accor- dance with the Contract Documents, as well as all continu- ing obligations indicated in the Contract Documents, will survive final payment, completion, and acceptance of the Work or termination or completion of the Agreement.

17.05 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

PAGE LEFT INTENTIONALLY BLANK

SUPPLEMENTARY CONDITIONS

TABLE OF CONTENTS

SUPPLEMENTARY CONDITIONS

AMENDMENTS TO GENERAL CONDITIONS

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract (No. 1910-8, 1996 edition) and other provisions of the Contract Documents as indicated below. All provisions which are not so amended or supplemented remain in full force and effect.

ARTICLE I. DEFINITIONS AND TERMINOLOGY

Add the following language at the beginning of definition I.QI A.12 entitled "Contract Documents" in the General-Conditions:

> "The Advertisement for Bids, Instructions to Bidders, State Regulations, ..."

Delete the words "The individual or entity named as such in the Agreement" in 1.01.A.19 and insert the following in their place:

> "The individual or entity duly appointed by the Owner to undertake the duties and powers herein assigned to the Engineer, acting either directly or through duly appointed representatives."

Delete the words "and who is identified as such in the Supplementary Conditions" at the end of definition 1.01 A.20, entitled "ENGINEER'S Consultant."

Delete definition 1.01 A.41 entitled "Specifications" in the General Conditions in its entirety and insert the following in its place:

> "Sections included under Division 1 through Division 16 of the Contract Documents:"

ARTICLE 2. PRELIMINARY MATTERS

SC-2.05

Delete paragraph 2.0SC of the General Conditions in its entirety and insert the following in its place:

"C. Evidence of Insurance: CONTRACTOR shall deliver to OWNER, with a copy to the ENGINEER, Certificates of Insurance within 1O days after receipt of the notice of the acceptance of bid (and other evidence requested by OWNER) which CONTRACTOR is required to purchase and maintain in accordance with the requirements of Article 5."

ARTICLE 3. CONTRACT DOCUMENTS: INTENT, AMENDI NG, REUSE
SC-3.0

Add the following sentence at the end of Paragraph 3.01A of the General Conditions:

"...by all. Each and every provision of law and clause required by law to be inserted in these Contract Documents shall be deemed to be inserted herein, and they shall be read and enforced as though it were included herein, and if through mistake or otherwise, any such provision is not inserted, or if not correctly inserted, then upon the application of either party, the Contract Documents shall forthwith be physically amended to make such insertion."

ARTICLE 4. AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; REFERENCE POINTS

SC-4.02

Delete the term "Supplementary Conditions" of paragraph 4.02 A of the General Conditions and replace it with "Contract Documents".

SC-4.04

Change "of' to "or" on line 6 of paragraph 4.04 B.2 of the General Conditions. Delete the following words from lines 8 and 9 of paragraph 4.04 82 of the General Conditions:

"...Or not shown or indicated with reasonable accuracy..."

SC-4.05

Add a new paragraph immediately after paragraph 4.05A of the General Conditions which is to read as follows:

A. ENGINEER may check the lines elevations and reference marks set by CONTRACTOR, and CONTRACTOR shall correct any errors disclosed by such check. Such a check shall not be considered" as approval of CONTRACTOR'S work and shall not relieve CONTRACTOR of the responsibility for construction of the entire Work in accordance with the Contract Documents. CONTRACTOR shall furnish personnel to assist ENGINEER in checking lines and grades."

SC-4.06

Delete the term Supplementary Conditions in paragraph 4.06A of the General Conditions and replace it with "Contract Documents".

ARTICLE 5. BOND AND INSURANCE

NOTICE TO CONTRACTOR:

1. Proof of Insurance coverage shall be furnished to the OWNER in accordance with the schedule for submittal of Bonds and Agreements.

2. Additionally, refer to Article 2. PRELIMINARY MATTERS, Paragraph SC-2.05.C

SC-5.01

Insert these sentences following SC-5.01.A: The Surety Company providing the bonds shall have a rating of A or better within the Best Key Rating Guide and be licensed by the Massachusetts Division of Insurance. The contractor shall pay the premiums for such Bonds.

SC-5.03

Delete the second sentence following SC-5.03.A: of the General Conditions, which beings "OWNER shall deliver to..."

SC-5.04

The limits of liability for the insurance required by paragraph 5.04A of the General Conditions shall provide coverage for not less than the following amounts or greater where required by law:

5.4 A.1 and 5.04 A.2 Worker's Compensation

(1) Worker's Compensation	Statutory Requirements
(2) Coverage B - Employer's Liability	$100,000/$500,000/$100,000

5.04 A.3, 5.04 A.4, and 5.04 A.5 Commercial General Liability Limits shall include Coverage for... independent Contractors, Personal Injury, Owners and Contractors Protective Liability, Explosion, Underground and Collapse, Broad Form Property Damage, Blanket Contractual Liability per locations/project endorsement.

Commercial General Liability	$1,000,000/$2,000,000
Products/completed Operations	$2,000,000 Aggregate

5.4 A.6 Automobile Liability for owned, hired and non-owned vehicles:

(1) Bodily injury:	$1,000,000/$1,000,000	Each person
	$1,000,000/$1,000,000	Each accident
(2) Property damage	$1,000,000	Each occurrence

The following indemnity agreement: shall be made part of this contract:

1. To the fullest extent permitted by law, Contractor(s) hereby acknowledges and agrees that it shall indemnify, hold harmless and defend the Engineer, the Owner, the Engineer and any of their officers, directors, employees, agents, affiliates, subsidiaries and partners from and against all-claims, damages, losses and expenses, including but not limited to, attorney's fees, arising out of or resulting from the performance of the contractor's work under this contract, provided that any such claim, damage, loss or expense (1) is attributable to bodily injury to or destruction of tangible property (other than to the work itself) including loss of use resulting therefrom, and (2) is (CAUSED) in whole or in part by any

negligent acts omissions of the contractor, its employees, agents or contractors or anyone directly or indirectly employed by any of them, or anyone whose acts any of them may be liable.

2. The Contractor hereby acknowledges its obligation under the foregoing paragraph to indemnify the Engineer and Owner against judgments suffered because of the contractor's work and to assume the cost of defending the Engineer and Owner against claims as described in the foregoing paragraph.

A. Engineer and Owner shall be named as Additional Insured on contractors General Liability and Umbrella Liability Contractors.

The Contractual Liability required by paragraph s.04n.4 of the General Conditions shall provide coverage for not less than the following amounts:

(1) Bodily injury:	$1,000,000 Each occurrence $1,000,000 Annual aggregate
(2) Property damage, including explosion, collapse and underground coverage:	$1,000,000 Each occurrence $1,000,000 Annual aggregate

SC-5.04
Add two new paragraphs immediately after paragraph·5.04B of the General Conditions, which are to read as follows:

"C. The CONTRACTOR shall also provide:

1. CONTRACTOR shall, as a minimum, purchase and maintain excess liability insurance in the umbrella form with a combined single limit of not less than $5,000,000 per claim and in the aggregate. Evidence of such excess liability shall be delivered to OWNER in accordance with paragraph 2.0SC in the form of a certificate indicating the policy numbers and limits of liability of all underlying insurance.

A. General Liability, Workers' Compensation, Automobile Liability and Umbrella Liability Policies will contain waivers of subrogation in favor of the Engineer and Owner.

2. If the aggregate limits of liability indicated in CONTRACTOR' insurance provided in accordance with paragraphs 5.03 and 5.04 are not sufficient to cover all claims for damages arising from his operations under this Contract and from any other work performed by him or if policies of insurance do not provide that the aggregate limits of liability for bodily injury and property damage apply to each contract or project separately, CONTRACTOR shall have such policies amended so that the aggregate limits of liability required by this Contract will be available to cover all claims for damages due to operations under this Contract."

SC-5.05

Delete paragraph 5 .05 of the General Conditions in its entirety.

SC-5.06

Delete Paragraph 5.06 A of the General Conditions in its entirety and insert the following in its place:

"A. CONTRACTOR shall purchase and maintain, until final payment, property insurance upon the Work at the site in an amount equal to the total bid price for the completed construction. This insurance shall include the interests of OWNER, CONTRACTOR, Subcontractors, ENGINEER and ENGINEERS consultants in the Work, shall insure against the perils of fire and extended coverage, shall include "all risk" insurance for physical loss and damage including theft, vandalism and malicious mischief, collapse and water damage, and shall include damages, losses and expenses rising out of or resulting from any insured loss or incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers, architects, attorneys and other professionals). This insurance shall be provided on the completed value form.' If not covered under the "all risk" insurance or otherwise provided in these Supplementary Conditions, CONTRACTOR shall purchase and maintain similar property insurance on portions of the Work stored on and off the site or in transit when such portions of the Work are to be included in an Application for Payment." A $20,000 deductible shall be acceptable. Any other deductible amount shall be approved in advance by the OWNER and any deductible amount shall be borne by the CONTRACTOR.

Delete paragraph 5.068 of the General Conditions in its entirety.

Delete Paragraph 5.06C of the General Conditions in its entirety and insert the following in its place:

"C. All the policies of insurance (or the certificates or other evidence thereof) required to be purchased and maintained by CONTRACTOR in accordance with paragraphs 5.06 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least thirty days' prior written notice has been given to OWNER by certified mail and will contain waiver provisions in accordance with paragraph 5.078. The words **"Endeavor to**" shall be struck from the Certificate of Insurance in the Cancellation Statement"

Delete paragraph 5.06D of the General Conditions in its entirety.

Delete paragraph 5.06E of the General Conditions in its entirety. SC-

5.07

Amend the last sentence of paragraph 5.07A of the General Conditions by striking out the words "held by OWNER as trustee or." As so amended, paragraph 5.07A remains in effect.

SC-5.08

Delete paragraph 5.08A of the General Conditions in its entirety.

Delete paragraph 5.0813 of the General Conditions in its entirety.

SC-5.09

Delete paragraph 5.09A of the General Conditions in its entirety and insert the following in its place:

"A. If OWNER has any objection Ito the coverage afforded by or other provisions of the insurance required to be purchased and maintained by CONTRACTOR in accordance with this Article 5 on the basis of its not complying with the Contract Documents, OWNER will notify CONTRACTOR in writing thereof within thirty days of the date of delivery of such certificates to OWNER in accordance with paragraph 2.0SC. CONTRACTOR will provide such additional information in respect of insurance provided by him as OWNER may reasonably request."

ARTICLE 6. CONTRACTOR'S RESPONSIBILTIES

SC-6.01

Delete paragraph 6.01B of the General Conditions in its entirety and replace with the following:

"B. At the site of the Work the CONTRACTOR shall employ a full-time construction superintendent or foreman who shall have full authority to act for the CONTRACTOR. It is understood that such representative shall be acceptable to the ENGINEER and shall be one who will be continued in the capacity for the particular job involved unless the representative ceases to be on the CONTRACTOR'S payroll. If at any time during the Work the representative is deemed by the ENGINEER to be no longer acceptable, the representative shall be promptly replaced by the CONTRACTOR. All communications to the superintendent shall be as binding as if given to the CONTRACTOR."

SC-6.04

Add the following paragraph after paragraph 6.04 A.2 of the General Conditions: -

"B. The CONTRACTOR's resident superintendent shall attend monthly progress meetings at the site of the work with the ENGINEER and others as appropriate to review schedule status and such other pertinent subjects as may be listed on the agenda by the ENGINEER."

SC-6.17

In paragraph 6.17 E.1 of the General Conditions, delete the word "timely" from the first line.

SC-6.20

Delete paragraph 6.20A of the General Conditions in its entirety and replace with the following:

"A. To the fullest extent permitted by law, the CONTRACTOR shall indemnify and hold harmless the OWNER, the ENGINEER, ENGINEER'S consultants, and their agents and employees from and against all claims, damages, losses, and expenses, including but not limited to attorney's fees, arising out of or resulting from the performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness,

disease or death, or to injury to or destruction of tangible property (other than the Work itself) including loss of use resulting therefrom, but only to the extent caused in whole or in part by acts or omissions of the CONTRACTOR, a subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall apply to any such claims, damages, losses, and expenses which arise and/or are incurred by any person or entity either during the performance of the Work and/or alter completion of construction. Nothing in this paragraph shall be construed to negate, abridge, or reduce other rights or obligations of indemnity or contribution which would otherwise exist as to a party or person indemnified hereunder. CONTRACTOR hereby assumes the responsibility and liability for injury to or death of any and all persons, including the. CONTRACTOR's employees, and for any and all damage to property caused by, resulting from, or arising out of any act, omission or neglect on the part of the CONTRACTOR, or of any Subcontractor or of anyone directly or indirectly employed by any of them or of anyone for whose acts, any of them may be liable."

Delete paragraph 6.20C of the General Conditions in its entirety.

ARTICLE 8. OWNER'S RESPONSIBILITIES

SC-8.06

Delete paragraph 8.06A of the General Conditions in its entirety.

ARTICLE 9. ENGINEER'S STATUS DURING CONSTRUCTION

SC-9.01

Add a new paragraph 9.0113 after paragraph 9.01A of the General Conditions, which is to read as follows:

"B. Nothing contained in the Contract Documents shall be construed to create a contractual relationship of any kind (1) between the ENGINEER and CONTRACTOR, (2) between the OWNER and a Subcontractor or Subcontractors, or (3) between any person or entities other than the OWNER and CONTRACTOR. The ENGINEER shall, however, be entitled to performance and enforcement of obligations under the CONTRACT DOCUMENTS intended to facilitate performance of the ENGINEERS duties."

ARTICLE 11. COST OF THE WORK; CASH ALLOWANCES; UNIT PRICE WORK

Delete Article 11 of the General Conditions in its entirety and replace with the following:

"A. The unit price of an item of Unit Price work shall be subject to reevaluation and adjustment under the following conditions:

(1) If the total extended bid price [Estimated Quantity times the Bid Unit Price] of a particular item of Unit Price Work amounts to 5 percent or more of the Original Contract Price and the variation in the quantity of the particular item of Unit Price Work performed by CONTRACTOR differs by more than 15 percent from the estimated quantity of such item indicated in the Agreement;
and

(2) If there is no corresponding adjustment with respect to any other item of work; and

(3) If CONTRACTOR believes that CONTRACTOR has incurred additional expense as a result thereof, CONTRACTOR may make a claim for an adjustment in the Contract Price in accordance with Article 11- if the parties am unable to agree as to the effect of any such variations in the quantity of Unit Price Work performed. If OWNER believes that the quantity variation entitles OWNER to an adjustment in the unit price, OWNER shall be entitled to an adjustment in the unit price in an amount determined by the ENGINEER. ENGINEER shall not be liable in connection with any determination relating to adjustments which is rendered in good faith."

ARTICLE 12. CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

SC-12.06

Add the following new paragraphs after paragraph 12.06 of the General Conditions:

"12.07 Liquidated Damages:

A. If the CONTRACTOR shall neglect, fail or refuse to complete the work within the time herein specified, or any proper extension thereof granted by the OWNER, then the CONTRACTOR does hereby agree, as a part consideration for the awarding of this Contract, to pay to the OWNER the amount specified in the Contract, not as a penalty but as liquidated damages for such breach of contract as hereinafter set forth, for each and every calendar day that the Contract shall be in default after the time stipulated in the Contract for completing the work. Such damages may be retained from time to time by the OWNER from progress payments or any amounts owing to the CONTRACTOR, or otherwise collected.

B. The said amount is fixed and agreed upon by and between the CONTRACTOR and the OWNER because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the OWNER would in such event sustain, and said amount is agreed to be the amount of damages which the OWNER would sustain and said amount shall be retained from time to time by the OWNER from current periodical estimates.

C. It is further agreed that time is of the essence of each and every portion of this Contract and of the specifications wherein as definite and certain length of times if fixed for the performance of any act whatsoever; and where under the Contract an additional time is allowed for the completion of any work, the new time limit fixed by such extension shall be of the essence of this Contract. Provided that the CONTRACTOR shall not be charged with liquidated damages of any excess cost when the OWNER determines that the CONTRACTOR is without fault and the CONTRACTOR'S reasons for the time extension are acceptable to the OWNER; Provided, further, that the CONTRACTOR shall not be charged with liquidated damages or any excess cost when the delay in completion of the work is due:

1) to any preference, priority or allocation order duly issued by the Government;

2) to unforeseeable cause beyond the control and without the fault or negligence of the CONTRACTOR, including, but not restricted to, acts of God, or of the public enemy, acts of the OWNER, acts of another CONTRACTOR in the performance of a contract with the OWNER, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and severe weather; and

3) to any delays of subcontractors or suppliers occasioned by any of the causes specified in subsections C(1) and C(2) above;

D. Provided, further, that the CONTRACTOR shall, within ten (10) days from the beginning of such delay, unless the OWNER shall grant a further period of time prior to the date of final settlement of the Contract, notify the OWNER, in writing, of the causes of the delay, who shall ascertain the facts and extent of the delay and notify the CONTRACTOR within a reasonable time of its decision in the matter."

ARTICLE 13. TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

SC-13.07

Delete paragraph 3.07A of the General Conditions and insert the following in its place:

"A. If within one year alter the date of Substantial Completion or such longer period of time as may be prescribed by Laws or Regulations or by the terms of any applicable special guarantee required by the Contract Documents or by any specific provision of the Contract Documents, any work is found. to be defective, CONTRACTOR shall promptly, without cost to OWNER and in accordance with OWNER's written instructions: (i) correct such defective work, or, if it has been rejected by OWNER, remove it front the site and replace it with work that is not defective, and (ii) satisfactorily con-cot or remove and replace any damage to other work or the work of others therefrom. If CONTRACTOR does not begin the repairs ten (10) days of receipt of written notification and promptly comply with the terms of OWNER's written instructions, or in an emergency when delay would cause serious risk, loss or damage, OWNER may have the defective work corrected or the rejected work removed and replaced, and all claims, costs, losses and damages caused by or resulting from such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by CONTRACTOR."

SC-13.09

Revise paragraph 13.09A of the General Conditions

A. Delete the word "seven" and replace it with the word "ten" so that it reads "alter ten days written notice to CONTRACTOR."

ARTICLE 14. PAYMENTS TO CONTRACTOR AND COMPLETION

SC-14.02

Delete paragraph 14.02A.3 and insert the following in its place:

"3. Retainage with respect to progress payments will be five percent or, if stipulated, the maximum allowed by law."

Add Paragraph 4. to read as follows:

"4. The CONTRACTOR shall submit Weekly Payroll Records Report and Statement of

Compliance verifying compliance with the Minimum Prevailing Wage Law, MGL Ch. 149, Sections 26-27H. "These Statements of Compliance shall be submitted as a condition of payment for work performed during the period the reports apply."

SC-14.03

Delete paragraph 14.03A in its entirety and insert the following in its place:

"A CONTRACTOR warrants and guarantees that title to all work, material and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to OWNER no later than at the time of Application for Payment free and clear of all liens. CONTRACTOR shall provide written transfer of title and a certified paid invoice provided by the supplier."

ARTICLE 15. SUSPENSION OF WORK AND TERMINATION

SC-15.02

Add a new paragraph immediately after paragraph 15.02 AA of the General Conditions which is to read as follows:

"5. If the Work to be done under this Contract shall be abandoned, or if this Contract or any part thereof shall be sublet, without the previous written consent of OWNER, or if the contract or any claim thereunder shall be assigned by CONTRACTOR otherwise than as herein specified;"

ARTICLE 17. MISCELLANEOUS

SC-17.06, 17.07, 17.08, 17.09

Add the following new paragraphs after paragraph 17.05 of the General Conditions:

"17.06 Assignment:

A. The CONTRACTOR shall not assign the whole or any part of this Contract or any moneys due or to become due hereunder until thirty (30) days prior notice in writing has been given to the OWNER of the intention to assign, which notice shall state the identity and address of the prospective assignee. No assignment shall be made without the OWNER's prior written consent. Such consent shall not be unreasonably withheld. In case the CONTRACTOR assigns all or any part of the moneys due or to become due under this Contract, the instrument of assignment shall contain a clause substantially to the effect that it is agreed that the right of the assignee in and to any moneys due or to become due to the CONTRACTOR shall be subject to prior claims of all persons, firms and corporations of services rendered or materials supplied for the performance of the work called for in this Contract."

17.7 Liability

1t is understood and agreed that members of the OWNER or the ENGINEER' or any agent or employees of the OWNER signing this Agreement shall not be personally liable hereunder for any action incurred in connection with this Agreement.

17.8 State Statutes and Regulations

See Superseding Changes to General & Supplementary Conditions 12/29/04 for further modifications of the General Conditions due to state statutes and regulations.

17.9 Severability

If any provision of this Agreement shall be invalid or unenforceable to any extent or in any application, then the remainder of this Agreement and of such terms and conditions, except to such extent or in such application, shall not be affected thereby, and each and every term and condition of this Agreement shall be valid and enforced to the fullest extent and in the broadest application permitted by law."

END OF SECTION

STATE STATUTES AND REGULATIONS
COMMONWEALTH OF MASSACHUSETTS

A. REVISIONS TO GENERAL CONDITIONS

1. Definitions

2. Subsurface Conditions Found Different

3. Subcontracting

4. Permits

5. Contractor Records

6. Massachusetts Sales and Use Tax

7. Clarifications and Interpretations

8. Change of Contract Price

9. Payments

10. Suspension of Work and Termination

11. Labor Classification and Minimum Wage Rates

B. OTHER REGULATORY REQUIREMENTS

1. Working Hours

2. DEP Community Sound Level Criteria

ATTACHMENT A – Wage Rates

ATTACHMENT B

Excerpts from Chapter 149 and Chapter 30 of the Massachusetts General Law

ATTACHMENT C

Special Provisions for Minority/Women Business Enterprises and the Commonwealth of Massachusetts Supplemental Equal Employment Opportunity Anti-Discrimination and Affirmative Action Program.

ATTACHMENT D--

Change Orders

A. REVISIONS TO GENERAL CONDITIONS:

1. Definitions

The term "AWARDING AUTHORITY," as used herein, shall be considered to be synonymous with the term "OWNER," described in definition 1.01 A.30.

Delete definition 1.01 A.43 entitled "Substantial Completion" in the General Conditions in its entirety and insert the following in its place:

"Substantial Completion shall be interpreted in accordance with Massachusetts General Law Chapter 30, Section 39G or -39K as appropriate."

2. Subsurface Conditions Found Different

Add the following sentence to the end of paragraph 4.03A of the General Conditions:

"...to do so. Adjustments resulting from subsurface or latent physical conditions will be in accordance with Massachusetts General Law Chapter 30, Section 39N."

3. Subcontracting

Add the following language at the end of paragraph 6.06F of the General Conditions:

"Except as required otherwise by Massachusetts General Law Chapter 149, Section 44F, for Work governed by Chapter 149, sections 44A through 44H."

4. Permits

Delete paragraph 6.08A of the General Conditions in its entirety and insert the following in its place:

"A. The AWARDING AUTHORITY shall be responsible for identifying and obtaining all federal, state, and local permits required by the nature and location of construction, including but not limited to railroad permits, building construction permits, and permits for street and highway cuts and openings. CONTRACTOR shall be responsible for obtaining all permits required of his equipment, work force, or particular operations (such as blasting) in the performance of the Work and not otherwise specified to be obtained by the AWARDING AUTHORITY. These permit fees shall be paid by CONTRACTOR. CONTRACTOR shall pay all governmental charges and inspection fees necessary for the prosecution of the Work, which are applicable at the time of opening of bids, or, if there are no Bids, on the Effective Date of the Agreement."

5. Contractor Records

Add a new paragraph immediately after paragraph 6.09C of the General Conditions, which is to read as follows:

"D. The CONTRACTOR shall comply with all applicable provisions Chapter 30, Section 39R of the Massachusetts General Laws Regarding, CONTRACTOR'S records."

6. Massachusetts Sales and Use Tax

Add the following paragraph after paragraph 6.1OA of the General Conditions:

"B. The material and supplies to be used by the CONTRACTOR in the Work of this Contract are exempt from the Sales and Use Tax of the Commonwealth of Massachusetts. The AWARDING AUTHORITY tax exemption certificate number will be furnished to the CONTRACTOR."

7. Clarifications and Interpretations

Add the following language at the end of paragraph 9.04A of the General Conditions:

"The ENGINEER'S interpretation will be made in accordance with the requirements of Massachusetts General Law Chapter 30, Section 39P."

8. Change of Contract Price

Delete paragraphs 11.01,11.02, and 12.01 of the General Conditions, having to do with Change of Contract Price. Changes in contract price will be governed by the section called "Change Orders" in Attachment D, Section XXX and Article 11 in the Supplementary Conditions.

9. Payments

Delete paragraph 12.028.1 of the General Conditions, in its entirety and insert the following in its place:

"1. Progress Payments will be made in accordance with the Massachusetts General Law Chapter 30, Section 39G or 39K, as applicable."

Add the following new paragraph following paragraph 14.02C.1 of the General Conditions:

"2. The CONTRACTOR shall make payments to Subcontractors in accordance with the requirements of Massachusetts General Law Chapter 30, Section 39F."

Delete paragraph 14.07B of the General Conditions in its entirety and insert the following in its place:

"1. If, on the basis of the ENGINEER's observation of the Work during construction and final inspection and, upon the ENGINEER's review of the final Application for Payment and accompanying documentation, the ENGINEER is satisfied that the Work has been completed and that the CONTRACTOR's other obligations under the Contract Documents have been fulfilled, the ENGINEER will indicate in writing his recommendation of payment and present the Application to the AWARDI NG AUTHORITY for payment. Thereupon the ENGINEER will give written notice to the AWARDING AUTHORITY and the CONTRACTOR that the Work is acceptable subject to the provisions of paragraph 14.15. Otherwise, the ENGINEER will return the Application to CONTRACTOR, indicating in writing the reasons for refusing to recommend final payment. In such case the CONTRACTOR shall make the

necessary corrections and resubmit the Application. If the Application and accompanying documentation are appropriate as to form and substance, the AWARDING AUTHORITY shall in accordance with the applicable Massachusetts General Law, pay the CONTRACTOR the amount recommended by the ENGINEER."

10. Suspension of Work and Termination

Delete paragraph 15.01A of the General Conditions in its entirety and insert the following in its place:

"A. The AWARDING AUTHORITY may order, at any time and without cause, the CONTRACTOR to suspend or delay the Work in accordance with Massachusetts General Law Chapter 30, Section 39-0."

11. Labor Classifications and Minimum Wage Rates

Add the following paragraphs under the heading "Wage Rates" after paragraph 17.10 of the Supplementary Conditions:

"17.11 Wage Rates

A. Minimum wage rates as determined by the Commissioner of the Department of Labor and Industries under the provisions of Massachusetts General Laws Chapter 149, Sections 26-270 apply to this project. A copy of the wage schedule is included in the front end of the specifications under Federal Minimum Wage Rates. If, after the Notice of Award, it becomes necessary to employ any person in a trade or occupation not classified in the wage determinations, such person shall be paid at not less than such rates as shall be determined by the Commissioner. Such approved minimum rate shall be retro-active to the time of the initial employment of such person in such trade or occupation. The CONTRACTOR shall notify the AWARDING AUTHORITY of its intention to employ persons in trades or occupations not classified in the wage determinations as soon as possible in order to allow sufficient time for the AWARDING AUTHORITY to obtain approved rates for such trades or occupations.

B. The schedule of wages referred to above are minimum rates only, and the AWARDING AUTHORITY will not consider any claims for additional compensation made by CONTRACTOR because of payment by the CONTRACTOR of any wage rate in excess of the applicable rate contained in the Contract.

C. The said schedule of wages shall continue to be the minimum rates to be paid during the life of this Agreement and a legible copy of said schedule shall be kept posted in a conspicuous place at the site of the Work.

D. CONTRACTOR and subcontractors shall submit a copy of weekly payroll records to the AWARDING AUTHORITY and the AWARDING AUTHORITY shall retain the records of a minimum of three years."

B. OTHER REGULATORY REQUIREMENTS:

1. Working Hours

No laborer, workman, mechanic, foreman, or inspector, working within the Commonwealth, in the employ of the CONTRACTOR, subcontractor, or other person doing or contracting to do the whole or a part of the work contemplated by this contract, shall be required or permitted to work more than eight hours in any one day or more than forty-eight hours in any one week, or more than six days in any one week, except in cases of emergency.

2. DEP Community sound Level Criteria

The Community Sound Level Criteria as established by the Commonwealth of Massachusetts Department of Environmental Protection (DEP) must be conformed to prior to the AWARDING AUTHORITY's acceptance of the structure. The following sound level criteria must be met at the construction site:

A. The increase in the broad band noise level shall not be in excess often (10) dB(A) above ambient at the station boundary. The ambient level is defined as the A-weighted noise level that is exceeded ninety (90) percent of the time measured during the period in question.

B. The primary noise source(s) shall not produce a puretone condition. Puretone is any given octave band center frequency that exceeds the two adjacent center frequencies by three (3) or more decibels.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SUPERSEDING CHANGES TO GENERAL AND SUPPLEMENTARY CONDITIONS

1. GENERAL CONDITIONS

2.06A - insert at end: Said conference shall be scheduled and arranged by the Contractor. I

4.01B - delete

4.06G - delete

5.07B - delete

6.17E - restore the word "timely" in the first line. Delete the word "only" from the 5'" line. Where "only" has been deleted, insert "to determine their general conformance with the contract documents, in accordance with good and accepted engineering practices, and".

8.02A - delete "to whom contractor makes no reasonable objection'.

9.02A - Insert, after "Work" in the 6'" line, "While construction is active at the project, said visits and inspections will take place at least once per week."

12.06 - delete subparts A and B, and replace with the following: "The Contractor hereby agrees that the Contractor shall have no claim for damages of any kind against the Owner or the Engineer on account of any delay in the commencement of the Work and/or any delay in, or suspension of any portion of the Work, whether such delay is caused by the Owner, the Engineer, or otherwise. The Contractor acknowledges that the Contractor's sole remedy for any such delay and/or suspension will be an extension of time as provided in these general conditions.

No claims shall be allowed on account of the failure of the Engineer to furnish Drawings, specifications or instructions or to return Shop Drawings or Samples until the expiration of the applicable time period referenced in Mass. Gen. L. c. 30, §39P, and not then unless such claim be reasonable.

No extension of time shall be granted because of seasonable or abnormal variations in temperature, humidity or precipitation, which conditions shall be wholly at the risk of the Contract, whether occurring within the time originally scheduled for completion, or within any period of extension granted. There shall be no increase in the Contract Sum on account of any additional costs or operations or conditions resulting therefrom.

14.02C - change 'Ten" to "Twenty-One"

14.07A(3) - delete the first three lines through the word "Owner,". In the third line, after Contractor, substitute "shall" for "may". In the fourth line, after the word "full" insert "on behalf of both Contractor and all of its Subcontractors,".

14.09A(1) - delete -

15.03B - add after "termination" ", with respect to this project or any other project of the Contractor."

Add "15.03C. If this Contract is terminated by Owner with or without cause, and regardless of whether said termination is rightful or wrongful, in no event shall the Contractor be paid a sum which, together with prior payments to Contractor, exceeds the sum payable to Contractor under the Agreement (Section 00520), as adjusted by any agreed change orders.

II. SUPPLEMENTARY CONDITIONS

Article V - Bonds and Insurance

Employer's liability coverage must be $2 million per accident, $2 million disease limits, and $2 million per employee disease limits.

General liability insurance limits must be $5 million aggregate, $2 million dollars' products/completed operations aggregate; $2 million personal injury and advertising; and $2 million per occurrence.

The contractual liability insurance coverage must have limits corresponding to the foregoing. At 5.04A.6, the following changes should be made to paragraph I of the indemnity clause: four lines from the bottom, the parenthesis should be removed from the word "CAUSED" and the word "CAUSED" should be changed to lower-case (caused). Also, in the last line of said clause, insert the word "for" after the word "anyone."

At SC-5.04C 1 - insert the following sentence at the end: "The Contractor's excess liability insurance coverage must follow from with its underlying liability coverages."

SC-6.20A - insert the word "defend" after the word "shall" in the first line.

SC-14.02A.3 - insert the following sentence at the end: "Retainage for the entire project will be withheld until substantial completion of the entire project, at which time retainage shall be accounted for, subject to all of the other terms and conditions of payment at the time of substantial completion.

Add the following Article SC-18.

SC-I 8 Arbitration - J

18.1 Controversies and Claims Subject to Arbitration. Any Claim arising out of or related to the Contract, or the breach thereof, except claims relating to aesthetic effect, shall be settled by arbitration, subject to the provisions of Subparagraph 18.7. Arbitration will be conducted in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association and judgment upon the award rendered by the Arbitrator or Arbitrators may be entered in any Court having jurisdiction thereof. In any such arbitration in which the amount stated in the demand is $100,000 or less, a single arbitrator shall be appointed in accordance with the procedures set forth in the American Arbitration Association Construction Industry Arbitration Rules. In any such arbitration in which the amount stated in the demand is in excess of $100,000, a panel of three arbitrators shall be appointed in accordance with the procedures set forth in the American Arbitration Association Construction Industry Arbitration Rules. The patties may agree to use any arbitration service. In the absence of such agreement, the American Arbitration Association shall be utilized.

18.2 Rules for Arbitration. If the neutral arbitrator is appointed by the American Arbitration

Association, the said Association shall administer the arbitration and its Construction Industry Arbitration Rules shall govern all aspects of the proceeding including the enforcement of any award. Ifthe neutral arbitrator is not appointed by the American Arbitration Association, then the panel of arbitrators shall act as the administrator of the arbitration, but the Construction Industry Arbitration Rules of the Association shall nonetheless govern all aspects of the proceeding, including the enforcement of any award. The arbitration. panel shall have all the powers and duties conferred on the Association pursuant to said rules.

In addition, the following rules shall govern the selection of arbitrators and the proceedings:

18.2.1 Neither party may appoint as arbitrator an employee or an owner of that party, nor the parent, spouse or child of an employee or owner of that party.

18.2.2 Alter the neutral arbitrator has been appointed, neither party may engage in ex parte communication with the arbitrator appointed by that party.

18.2.3 Contract Performance During Arbitration. During arbitration proceedings, the Owner and Contractor shall otherwise continue their performances hereunder.

I

18.3 When a written decision of the Engineer states that the decision is final, any demand for arbitration of the matter covered by such decision must be made within two months after substantial completion of the project, as determined by the Engineer in accordance with the provisions hereof. The failure to demand arbitration within said two month period will result in the Engineer's decision becoming final and binding upon the Owner and the Contractor.

18.4 A Demand for arbitration shall be made with the time limits specified in Subparagraph 18.3, and in no event shall be made after the date when the institution of legal or equitable proceedings based on such Claim would be barred by the applicable statute of limitations.

18.5 Claims and Timely Assertion of Claims. A party who files a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded. When a party fails to include a claim through oversight, inadvertence or excusable neglect, or when a Claim has matured or been acquired subsequently, the arbitrator or arbitrators may permit amendment.

18.6 Judgment on Final Award. The award rendered by the arbitrator or arbitrators shall be final, and the judgment maybe entered upon it in accordance with applicable law in any court having jurisdiction thereof.

18.7 Notwithstanding any provision contained in this Paragraph 18 or elsewhere in the Contract Documents, the Owner reserves the following right in connection with claims and disputes between the Owner and Contractor:

1. the right to institute the legal action against the Contractor in any court of competent jurisdiction in-lieu of demanding arbitration pursuant to this paragraph 18, in which case the dispute or disputes which are the subject of such action shall be decided by such court, and not by arbitration.

2. the right to obtain from any court of competent jurisdiction a stay of any arbitration instituted by the Contractor, provided that the application for such stay is made before the appointment of the neutral arbitrator in such arbitration, in which case the dispute or disputes which are the subject of such arbitration shall be decided by such court, and not by arbitration;

3. the right to require the Contractor to join as a party in any arbitration between the Owner and Architect relating to the Project in which case the Contractor agrees to be bound by that decision of the arbitrator arbitrators in such arbitration.

In case the Owner elects to proceed in accordance with 18.7.1 or 18.7.2 above, the word "litigation", shall be deemed to replace the word "arbitration" wherever the latter word appears in the Contract Documents.

SC-19 MBE and WBE participation

The Contractor shall comply with the provision of G.L.c. 7 40N, and any associated regulations effective during the time of the project, relative to the participation of minority and women-owned businesses in connection with the project. At present, the current participation goals are 7.4% MBE and 4% WBE.

END OF SECTION

EQUAL OPPORTUNITY REQUIREMENTS

1. EQUAL EMPLOYMENT OPPORTUNITY

A. Equal Employment Plan: The Contractor and each Subcontractor shall implement an effective affirmative action plan to assure equal employment opportunity throughout the performance of work on this project. Do not discriminate against any employee or applicant tor employment because of race, color, sex, religion, age, or national origin. Affirmative action plan shall include, but not be limited to, the following:

1. Employment, upgrading, demotion, or transfer.
2. Recruitment or recruitment advertising.
3. Layoff or termination.
4. Rates of pay or other forms of compensation.
5. Selection for training, including apprenticeship.

B. Rules and Regulations: The Contractor and each Subcontractor shall comply with all applicable local, state and federal laws and regulations regarding equal employment opportunity and with the provisions of the following:

1.. Governors "Executive Order No. 74", dated July 20. 1970. entitled the "Governor's Code of Fair Practices", as amended by the Governor's Executive Order No. 116, dated May 1, 1975.

2. The Fair Employment Practices Law of the Commonwealth, Chapter 1518 of the General Laws of Massachusetts, as amended.

3. The rules and regulations of the Massachusetts Commission Against Discrimination as in force at the dale of the Contract.

4. The rules, regulations and relevant orders of the United States Secretary of Labor, the Commonwealth of Massachusetts Department of Labor and Industries, and other authorities having jurisdiction as in force at the date of the Contract.

5. Governor's 'Executive Order No. 237'.

C. Employment Advertisements: State in all solicitations or advertisements for employees that all qualified applicants will receive consideration tor employment without regard to race, color, sex, religion, age, or national origin.

D. Referral Notices: Direct special effort toward the recruitment of minority workers through the unions and through referral agencies representing the minority community.

E. Advising Labor Unions: Send to each labor union or representative of workers with which the Contractor has a collective bargaining agreement or other contract or understanding, a notice advising the labor union or workers' representative of the Contractors equal employment opportunity commitment and post copies of these notices in conspicuous places available to employees and applicants for employment.

F. Posting: Post copies of equal opportunity employment notices in conspicuous places available to employees and applicants for employment and post notices setting forth the provisions oi this non-discrimination equal employment opportunity clause.

G. Manning Table: Assume and be responsible for the affirmative duty of achieving the range of minority employment and women work force participation set forth in a manning table tor the entire project. Submit a manning table at the request of the Owner and obtain Owners approval prior to the Award of Contract.

H. Percentage Participation: Both Contractor and Sub-contractor shall comply with requirements of Minority and Women Business percentage of Contract percentage participation requirements specified in the Minority and Women Business Enterprise Set Aside Requirements Section.

END OF SECTION

MINORITY AND WOMEN BUSINESS ENTERPRISE SET ASIDE REQUIREMENTS

1. GENERAL

A. All provisions of the Contract Documents shall be subject to all applicable provisions of law, including, without limitation, Federal. State, and Local statutes and ordinances regarding setting aside a portion of the Contract tor qualified Minority and Women Business Enterprises. The Contractor shall recognize that other duties and obligations are required by laws, statutes, and ordinances which may not be provided herein, but must be considered and made a part of this Contract. In case of a conflict between the Contract Documents and applicable laws, statutes, and ordinances, the provisions of law, statutes, and ordinances shall *govern.*

2. MINORITY AND WOMEN OWNED BUSINESS ENTERPRISE SET ASIDE REQUIREMENTS

A. Requirements For minority and women business enterprise set aside requirements, provided to the Architect by the Awarding Authority Follow. The Architect does not warrant or guarantee the completeness or accuracy of this information, and *every* bidder and contractor shall be responsible tor ascertaining the MWBE set aside requirements in the area where the work will be performed.

1. Bidders shall agree to contract with minority and women owned businesses as certified by the State Office of Minority and Women Business Assistance [SOMWBA]. "the amount of participation which shall be reserved for such enterprises shall not be less than fifteen percent [t5%] of the total contract amount, of which at least ten percent [10%] shall be reserved tor minority business enterprises and five percent [5%] shall be reserved tor women-owned business enterprises.

2. The Contractor and each Subcontractor shall furnish to the Awarding Authority, within fifteen days after completion of its portion of the work, a certified 'Statement of Compliance" certifying compliance with minority and women business enterprise set aside requirements. Submit the 'Statement of Compliance' in a form acceptable lo the Awarding Authority.

3. See Massachusetts Executive Order 237 as amended.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

BY-LAWS OF THE TOWN OF ARLINGTON
TITLE I
ARTICLE 16

CONSTRUCTION PROJECTS

Section 1. Women Work Force Participation
Any Town board or official in charge of a construction or reconstruction project is required to include in the contract documents the following:

A. Contractor shall maintain as a goal on this project a not less than five percent ratio of women work force to total project hours in both the general contract and each individual filed sub-bid contract, if applicable. The preceding sentence shall be included in all construction contracts whether entered into by the Town pursuant to the provisions of M.G.L. c. 149 or M.G. L. c 30, §39M et. seq. provided however, that if entered into under Chapter 30 same shall not be deemed to apply where the projected bid price as determined by the Director of Public Works is not likely to exceed $200,000.

B. A Labor Scheduling Table which will be used as a tool for achieving a range of women work force participation for the entire project in both the general contract and each individual filed sub-bid contract.

Section 2. Equal Opportunity Goal Compliance
Any Town board or official in charge of a construction or reconstruction project is required to include in the contract documents the following:

A. Before starting work, the contractors (includes the general contractor, for itself and its subcontractors, as well as all filed sub-bid contractors, if applicable) will submit plans for achievement of the equal opportunity goals of the contract. All contractors will be required to make a good faith effort to achieve these goals. The plan will indicate if the contractors expect to achieve the requirements during the first quarter. If there are reasons why the contractors do not expect to achieve the requirements during the first quarter year of the contract construction phase, then the contractors shall provide a plan calculated to address, to the extent reasonably possibly, these obstacles to a good faith effort to achieve such goals.

B. Not more than ten days following the end of each work quarter, the contractors will report on the achievement of the goals, detailing the good faith efforts that have been made and will continue to be made and any other appropriate efforts not yet undertaken.

C. All reports will be signed by an officer or principal of the company who has the authority to contractually obligate the company.

Section 3. Recruitment and Training
Any board, officer, committee, or other agency of the Town, which acts on behalf of the Town in making or supervising any contract, in an amount exceeding the sum of $100,000 for the purchase of goods or services or for the construction, renovation, or repair of buildings or other improvement of real estate, may make arrangements with contractors and other interested agencies for special programs of recruitment and training in connection with the work to be performed on such contract, with the objective of promoting equal employment opportunity for members of minority groups protected by the fair employment laws of the Commonwealth and the United States. Any board, officer, committee or other Town agency may expend Town funds in carrying them out provided that appropriations specifically designed for such purposes have been voted by the Town Meeting.

TOWN OF ARLINGTON
EQUAL OPPORTUNITY ADVISORY COMMITTEE
730 MASSACHUSETTS AVENUE, ARLINGTON, MA 02476
PHONE (781) 316-3120 FAX: (781) 316-3129

TRICIA O'DONOGHUE, CHAIR
BARBARA BOLTZ
AUGUSTA HAYDOCK
JACK JONES

CARYN COVE MALLOY
EQUAL OPPORTUNITY OFFICER

CONTRACTOR CERTIFICATION

During the performance of the Contract, the Contractor and all subcontractors (hereafter collectively referred to as "the Contractor") for a town construction contract or town assisted construction contract, for him/herself, his/her assignees and successors in interest, agree to comply with all applicable equal employment opportunity, non-discrimination and affirmative action requirements, including but not limited to the following:

The Contractor shall comply with the provisions of Town of Arlington Bylaws, Anti-Discrimination policies and Chapter 151B of the Massachusetts General Laws, as amended, and all other applicable anti-discrimination and equal opportunity laws, all of which are herein incorporated by reference and made a part of this contract.

In connection with the performance of work under this contract, the Contractor shall undertake, in good faith, affirmative action measures to eliminate any discriminatory barrier in the terms and conditions of employment on the grounds of race, color, religious creed, national origin, sex, gender identity, sexual orientation, age, genetic information, ancestry, children, marital status, veteran status or membership in the armed service, the receiving of public assistance, and handicap. Such affirmative action measures shall entail a list of positive and aggressive measures which shall include but not be limited to, advertising employment opportunities in minority and other community news media; notifying minority women and other community-based organizations of employment opportunities; maintaining a file of names and addresses of each worker referred to the Contractor and what action was taken concerning such worker; and notifying this Committee in writing when a union with whom the Contractor has a collective bargaining agreement has failed to refer a minority or woman worker.

The Contractor shall submit to the Equal Opportunity Advisory Committee, through the Purchasing Director Domenic Lanzillotti, the following Contractor's Certification with all attachments. The Contractor's Certification will be reviewed by the Committee and will inform the Contractor of any deficiencies to be corrected.

CONTRACTOR CERTIFICATION

_____ certifies that they:

(Contractor Name)

1. Will not discriminate in their employment practices.

2. Intend to use, if General Contractor, the following listed construction trades in the work under the contract:

   _____

   _____

   _____

3. If Trade Subcontractor, will provide the following work under the contract:

   _____

   _____

   _____

4. Will make good faith efforts to comply with the minority employee and women employee workforce participation ratio goals of the Town of Arlington and the Commonwealth of Massachusetts and specific affirmative steps contained herein; and to provide evidence of its good faith efforts. Attached hereto, please find:

A. Employment Opportunities advertised in:

   _____

   _____

   _____

B. Notification to Minority/Women/Community based Organizations such as:

   _____

   _____

   _____

C. List of workers referred to Contractor and note on what action was taken:

_____

_____

_____

D. Written notification that Union/Local No. _____ failed to refer a Minority or Female worker during the week of: _____

_____

Signature of Officer Date

_____

Printed Name of Officer and Title

INSURANCE REQUIREMENTS

1. GENERAL

A. This section specifies the Owner's requirements for insurance and relates to the General Conditions of the Contract for Construction and Supplementary Conditions of the Contract for Construction.

B. Provisions of the General Conditions of the Contract for Construction and Supplementary General Conditions of the Contract for Construction, which are not modified by the following insurance Requirements, remain in full effect.

2. INSURANCE REQUIREMENTS

A. Insurance Limits: The insurance required should be written for not less than the limits of liability required by law or the following limits, whichever is greater: State and federal Workmen's Compensation Statutory Benefits required by union contract as required.

GENERAL LIABILITY*	
General Liability- Bodily Injury and Property Damage Each Occurrence	$1,000,000.00
General Liability — Bodily Injury and Property Damage Aggregate	$2,000,000.00

General Liability shall include coverage for the following:

Comprehensive form
Premise/Operations Liability
Explosion, Collapse and Underground (XCU). Products/Completed Operations (aggregate limit $2,000,000.00) Contractual Liability
Independent Contractors Broad Form Property Damage
Personal Injury Including Libel and Slander Coverage Broad Form CGL Endorsement

AUTOMOBILE LIABILITY**	
Comp. Automobile Liability** Bodily Injury and Property Damage Per Accident	$1,000,000.00

**Provide coverage for All Owned, Non-Owned, and Hired vehicles.

EXCESS LIABILITY – Umbrella Form	
Each occurrence	$5,000,000.00
Aggregate	$5,000,000.00

B. Exclusions: The Owner's property insurance shall not cover tools, equipment, shoring, staging, forms, temporary buildings or other equipment owned or rented by the Contractor, its Subcontractors, or any Worker.

C. Named Insured: Each Insurance policy certificate of insurance provided by the Contractor shall name the Town of Arlington as an additional insured. Each insurance policy and certificate of insurance provided by the Contractor shall contain a provision that the Owner shall be notified of cancellation or restrictive amendment at least thirty (30) days prior to the effective date of such cancellation or amendment.

D. Insurance Certificates: Submit insurance certificates for the Owner's review and approval prior to commencement of the work. The Contractor and all subcontractors who are required to provide insurance under the Contract shall provide accurate and bona fide "Certificates of insurance "issued by a responsible agent of the insurance company.

1. Certificate Content: Such "Certificates of Insurance" shall clearly indicate the insurance coverage. Each "Certificate of Insurance" shall be accompanied by a sworn and duly notarized statement from the responsible agent of the insurance company issuing the certificate clearly stating that all insurance specified and required by the Contract Documents is provided and in force, and also a clear statement of all exceptions and deviations, if any, from the Contract Document issuance requirements.

2. Responsibility: The insurance agent issuing and authorizing the "Certificate of Insurance" shall be responsible and liable for the accuracy and validity of the "Certificate of Insurance". Each insured party shall certify by sworn and duly notarized statement that the "Certificate of Insurance" issued for them are bona fide.

3. Disclaimers Prohibited: "Certificates of Insurance" shall not contain any disclaimers such as: "This Certificate is issued as a matter of information only and confers no right upon the certificate holder. This Certificate does not amend, extend, or alter the coverage afforded by the policies listed below." Disclaimers are not acceptable.

4. Certificates of Insurance Can Be Relied Upon: Parties receiving "Certificates of insurance" shall be entitled to rely upon the "Certificates of insurance" and shall have the right to claim the benefits and protection provided by the insurance as it applies to them.

5. Alternate to "Certificates of Insurance": Instead of providing the "Certificates of Insurance" and the sworn statements required above, the insured may provide bona fide and accurate copies of all insurance policies and riders accompanied by a sworn and duly notarized statement from the insured that the policies, riders, and documents submitted are bona fide and valid, and that parties receiving the insurance documents may rely on the documents as satisfaction of the Contract insurance requirements.

E. The Contractor shall provide "builder's risk" insurance as described in the General Conditions of the Contract for Construction and with limits equal to the full insurable completed value of the building under construction. The "Builder's Risk" insurance shall include "all risk" insurance for physical loss and damage including theft, vandalism, and malicious mischief. The "Builder's Risk" insurance shall be amended to delete any and all endorsements relating to cancellation of the policy due to partial occupancy by the Owner.

1. Builder's Risk Deductible Amount: $1,000,000.00

END OF SECTION

SECTION 01 11 00: SUMMARY OF WORK

PART 1 – GENERAL

1.1 LOCATION

A. Arlington Reservoir is located at 210 Lowell Street in Arlington, MA.

1.2 GENERAL REQUIREMENTS

A. The General Conditions, Supplementary Conditions and applicable parts of Division 01 General Requirements are all included as part of this Section. The Contractor is required to examine all other sections of the specifications for requirements that may affect the work of this Section. The Contractor is also required to coordinate the Work with that of all trades affecting or affected by the Work of this Section, and to cooperate with such trades to assure the continued progress of the Work.

B. The intent of the Contract Documents is to require that the Contractor provide all material, labor and equipment needed in order to furnish a complete Project, and that all of the material, labor and equipment be furnished complete in every respect.

1.3 SCOPE OF WORK

A. Work covered by this contract includes but may not be limited to site-work; construction; re-construction; alterations; remodeling or repair of the public works Project described in this paragraph 1.03 including the following major work:

1. Improvements to the existing trail around the Reservoir
2. Removal of existing dead, dying, or other trees
3. Invasive plant management
4. Installation of tree, shrubs, perennial, and groundcover plantings
5. Installation of site furnishings
6. Installation of playground components and safety surfacing
7. Installation of bituminous and concrete walkways, and trail surfaces
8. Installation of porous and permeable pavement systems
9. Restoration of wetland banks
10. Repairs to existing trail surfaces
11. Installation of pre-fabricated picnic pavilion
12. Add Alternates 1 through 6
13. Substantial Completion date is December 1, 2021
14. Final Completion date is May 31, 2022

1.4 DOCUMENTATION

A. Contractor shall cooperate with the Owner and Landscape Architect to record any and all changes to existing conditions or proposed work that deviate from the Contract Documents. The Contractor shall furnish all recorded changes to the Landscape Architect to be used for As-Built documents.

1.5 NOISE CONTROL

A. The Contractor shall adhere to the City ordinances for Noise Control (Article VII, Division 2) throughout the construction period. Noise control will be strictly enforced by the City.

B. No construction shall occur between 7 PM to 7 AM Monday through Saturday, or any time on Sunday. Any exemption to prohibited construction hours must be authorized by a City representative.

C. Contractor shall not permit engine idling on the job site. This shall be enforced through random, unannounced periodic inspections.

PART 2 – MATERIALS

NOT USED

PART 3 – EXECUTION

NOT USED

END OF SECTION

SECTION 01 14 00: COVID-19 WORK REQUIREMENTS

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

All applicable

1.2 REFERENCES

A. It is the responsibility of the Contractor to make themselves aware of the most current and up-to-date procedures and protocols.

B. All applicable safety procedures and hygiene protocols will comply with the state of Massachusetts, Department of Public Health Advisory, state Emergence Orders and Reopening Guidelines.

1. U.S. Centers for Disease Control & Prevention (CDC): CDC Reopening/Disinfecting Guidance https://www.cdc.gov/coronavirus/2019-ncov/community/reopen-guidance.html

2. Commonwealth of Massachusetts
   a. COVID-19 Travel Order: Effective August 1, 2020 https://www.mass.gov/info-details/covid-19-travel-order
   b. Department of Public Health Safer-at-Home Advisory https://www.mass.gov/news/safer-at-home
   c. Department of Public Health Mask up MA!: Effective November 6, 2020 https://www.mass.gov/news/mask-up-ma
   d. Reopening Massachusetts https://www.mass.gov/info-details/reopening-massachusetts

3. Arlington Health Department https://www.arlingtonma.gov/departments/health-human-services/health-department https://www.arlingtonma.gov/departments/health-human-services/health-department/coronavirus-information

1.3 SUBMITTALS

A. The Contractor shall prepare and submit for approval a COVID-19 (Coronavirus Safety Plan for Protocols & Best Practices for Exterior Site Projects.

B. The Safety Plan shall meet all guidelines set forth by the Agencies listed above. At a minimum, the Safety Plan shall include guidelines/protocols on the following:

1. Personal hygiene
2. Job site hygiene
3. Social distancing
4. Commuting to the job site
5. On-site job meetings
6. Personal protective equipment (PPE)
7. What to do in the event of a person showing symptoms

C. The Safety Plan shall be submitted within thirty (30) days of Notice of Award and must be approved by Owner and Landscape Architect before any work shall be allowed to begin on site.

PART 2 – MATERIALS

NOT USED

PART 3 – EXECUTION

NOT USED

END OF SECTION

SECTION 01 22 00: UNIT PRICES

PART 1 – GENERAL

1.1 The Unit Prices set forth herein shall be used to determine any equitable adjustment of the Contract Price in connection with the changes or extra work performed under this Contract as directed by the City.

1.2 It is mutually understood and agreed that such Unit Prices include all items of costs, equipment, taxes and insurance of every kind, overhead, and profit for the Contractor and they shall be used uniformly, without modification for addition and deductions. Prices listed under ADDITIONS and DEDUCTIONS are to be the complete total price billed to and paid by the Owner therefor. There can be no more than fifteen (15) percent difference in price between the additions and deductions.

1.3 Sufficient prior notice shall be given in accordance with the General Conditions so that proper measurements of materials removed or to be replaced may be taken. All quantities used in the determination of additions to or deductions from the Contract Price due to Unit Prices shall only be those that have been determined and approved by the Owner in advance.

A. The unit price bid shall be taken to include all labor and materials necessary to make the item of work complete in place, whether listed or not. All supervision, overhead items, including but not limited to bond, insurance, and labor burden – and profit shall be included. Payment shall fully compensate the Contractor for any other work which is not specified or shown, but which is necessary to complete the work of the item.

B. In case of substitution of items shown on the Drawings or called for in the Contract Documents, the change to the Contract Price for both item deleted and the item added, if of the same class of work, shall be based on the addition column.

1.4 UNIT PRICES FORM

	ITEM DESCRIPTION (All references to items shall correspond to work as described in the relevant portions of the Construction Documents.)	**UNIT**	**COST**	**APPROVED**
1	Construction fencing	LF	$	
2	12” straw wattle, secured in place, per Detail 2 on Sheet LD1	LF	$	
3	Silt sack inlet protection, per Detail 3 on Sheet LD1	EA	$	
4	Tree protection fencing – fence, per Detail 1 on Sheet LD1	LF	$	
5	Tree protection fencing – wood board, per Detail 2 on Sheet LD1	EA	$	
6	Remove tree & dispose of stump, 4” caliper DBH or less	EA	$	
7	Remove tree & dispose of stump, 4” caliper to 8” caliper	EA	$	
8	Remove tree & dispose of stump, 8” caliper DBH or greater	EA	$	
9	Remove shrub planting	EA	$	
10	Crown cleaning of existing tree	EA	$	
11	Crown raising of existing tree	EA	$	
12	Root pruning of existing tree	EA	$	
13	Rock excavation of 3 CY or greater, per specifications	CY	$	
14	Ordinary borrow/clean fill, complete in place	CY	$	
15	Dense graded gravel, complete in place	CY	$	
16	3/4” Crushed stone/drainage stone, complete in place	CY	$	
17	Placed boulders, 18”-24” in size, complete in place	EA	$	
18	Clean screened loam, complete in place	CY	$	
19	Planting soil, complete in place	CY	$	
20	Bituminous concrete paving, per detail and specification	SF	$	
21	5” reinforced concrete paving, complete in place including base and subbase preparation & broom finish	SF	$	
22	Turf seed & loam, per detail and specifications	SF	$	
23	Conservation seeding, per detail and specifications	SF	$	

1.5 GENERAL

A. Sufficient prior notice shall be given in accordance with the General Conditions so that proper measurements of materials removed or to be replaced may be taken. All quantities used in the determination of additions to or deductions from the Contract Price due to Unit Prices shall only be those that have been determined and approved by the City in advance.

B. The unit price bid shall be taken to include all labor and materials necessary to make the item of work complete in place.

C. In case of substitution of items shown on the Drawings or called for in the Contract Documents, the change to the Contract Price for both item deleted and the item added, if of the same class of work, shall be based on the addition column.

PART 2 – MATERIALS

NOT USED

PART 3 – EXECUTION

NOT USED

END OF SECTION

SECTION 01 23 00: ALTERNATES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. All of the Contract Documents, including the conditions and general requirements of the Contract, Division 00 and applicable parts of Division 01, apply to the work under this Section.

B. The Contractor shall carefully examine all the Contract Documents for requirements that affect the work of this Section. The exact scope of this Section cannot be determined without a thorough review of all specification sections and other Contract Documents.

1.2 SUMMARY

A. The Schedule of Alternates included in this Section lists all the Alternates that appear in the Contract Documents, and the specification Sections which are affected by each Alternate.

B. For each of the Alternates scheduled at the end of this Section, bidders shall state the amount in the proposal to be added to or deducted from the Contract Sum for the work.

C. Consult the individual Specification Sections and the Drawings for detailed requirements of each Alternate.

1.3 GENERAL INSTRUCTIONS

A. Each Bidder shall be held fully responsible for examining the scope of the Alternates generally defined herein and for recognizing any modifications to his work caused by any Alternate.

B. The Bid Alternate Price shall be complete cost, including overhead, profit, bonds, insurance, transportation, and all other costs connected with, or incidental to, the work described.

C. Alternates listed below in the Schedule of Alternates are listed in order. The Contract will be awarded on the basis of the Base Bid only, or the Base Bid plus any number of Alternates strictly added in order.

D. All dimensional and quantity estimates provided in the descriptions of the work below (noted with “approx.”) are provided for initial reference only; exact dimensions and quantities for the full extent of the work as described in the Drawings and Specifications shall be confirmed in field by the Contractor before submitting the price. The Contractor shall be responsible for the full extent of the work described, not to be limited by the approximate quantities.

1.4 ALTERNATES

A. Definition: “Alternates” are alternate products, materials, equipment, systems, methods, units of work, or major elements of the construction, which may, at the Authority’s option and under the terms established by the Contract or Agreement, be selected for the work in lieu of the corresponding requirements of the Contract Documents or in addition to the work of the Base Bid as noted.

B. Alternate Requirements: A Schedule of Alternates is included at the end of this Section. Each Alternate is defined using abbreviated language, recognizing that the Contract Documents define the requirements. Coordinate related work to ensure that work affected by each Alternate is complete and properly interfaced with work of each selected Alternate.

C. Provide written proposals for each Alternate on the Bid Form for the Authority’s consideration. Each proposal amount shall include the entire cost of the Alternate portion of the work, including overhead, profit, and other costs including cost of interfacing and coordinating the Alternate with related and adjacent work.

1.5 SCHEDULE OF ALTERNATES

A. Alternate No. 1 – ADD to the Base Bid the following scope: installation of the Overlook – Type 1 in its entirety, as shown on:

1. Sheets L1.3, L2.3, L3.3
2. Details 1, 2, and 3 on sheet LD1.7
3. Sheet X-101
4. In specification Sections 03 00 00 – REINFORCED CONCRETE FOOTINGS, Section 05 05 23 – METAL FASTENINGS, Section 05 50 00 – METAL FABRICATIONS, Section 06 05 73 – WOOD TREATMENT, and Section 06 13 00 – HEAVY TIMBER CONSTRUCTION

B. Alternate No. 2 – ADD to the Base Bid the following scope: clearing of existing vegetation, removal and disposal of select pavements, re-grading, installation of stabilized crushed granite pavement, installation of boulder retaining walls, installation of drainage, seeding, and planting of trees and shrubs, as shown on:

1. Enlargement Plan 1 on Sheets L1.1, L2.1, L3.1, and L4.1

C. Alternate No. 3 – ADD to Base Bid the following scope: multi-use porous court surface, as shown on:

1. Sheet L2.1
2. Detail 1 on sheet LD1.2
3. In specification Section 32 30 00 – SITE IMPROVEMENTS

D. Alternate No. 4 – ADD to the Base Bid the following scope: irrigation to be added to the turf area within the beach, as shown on:

1. Sheet L4.1 and L4.2
2. In specification Section 32 84 13 – IRRIGATION

E. Alternate No. 5 – SUBSTITUTE from the Base Bid the following scope: in lieu of seeding within the beach area, the turf area will have sod laid, as shown on:

1. Sheet L4.1 and L4.2
2. In specification Section 32 91 19 – TURF & GRASSES

F. Alternate No. 6 – SUBSTITUTE from the Base Bid the following scope: 4-foot vinyl-coated chain link fence for ornamental steel picket fence, powder-coated in custom color, as shown on:

1. Details 4, 5, and 6 on Sheet LD1.9
2. In specification Sections 05 05 13 – FACTORY-APPLIED COATINGS FOR METALS and 05 60 00 – SITE METAL FURNISHINGS

G. Alternate No. 7 – SUBSTITUTE to the Base Bid the following scope: stabilized crushed granite pavement for porous rubber pavement system, as shown on:

1. Enlargement Plan 1 on Sheets L2.1, L2.3, L2.4, and L2.5
2. Detail 2 on sheet LD1.2
3. In specification Section 32 12 43.13 - POROUS FLEXIBLE PAVEMENT (Trail)

PART 2 – GENERAL

NOT USED

PART 3 – EXECUTION

NOT USED

END OF SECTION

SECTION 01 31 46: PERMITS

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. The conditions and general requirements of the Contract, Division 01 and applicable parts of Division 31, EARTH MOVING, apply to the work under this Section.

B. The Contractor shall perform the work in accordance with the Contract Documents, and any applicable municipal requirements.

1.2 SCOPE OF WORK

A. The Contractor shall be responsible for obtaining all permits required to complete the work of this contract, to provide all coordination and furnish all bonds, assurances and required warranties. As applicable, the Contractor shall be responsible for any/all fees associated with the securing of permits necessary for the execution of the work of this contract. Should any street work be required, a contractor specifically approved by the Town shall perform it.

1.03 PERMITS BY CONTRACTOR

A. The Contractor shall prepare permit applications and obtain applicable permits after the contract is awarded, bearing all expenses. All required permits shall be obtained, INCLUDING BUT NOT LIMITED TO the following:

1. Electrical Permit
2. Backflow Preventers – Add Alternate
4. Plumbing Permit – Add Alternate
5. Parking Permits as needed and appropriate

1.4 GENERAL

A. Guarantee all work per permit requirements.

1.5 DIG SAFE

A. Contact DIG SAFE seventy-two (72) hours prior to initiating work at #811.

PART 2 – MATERIALS

2.1 GENERAL

A. All materials and equipment shall conform to permit requirements and the Town's standards for utilities, excavation, backfill, patching, and surveying or other work unless otherwise stated in these specifications. Coordinate as necessary with the appropriate Town official and/or private utility.

PART 3 – EXECUTION

3.1 GENERAL

A. Execute all work per permit requirements. All plumbing and electric work to be approved by Town Inspectors; sidewalk ramps to be approved by Town Engineer.

END OF SECTION

SECTION 01 33 00: SUBMITTAL PROCEDURES

PART 1 – GENERAL

1.1 SUMMARY

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SCOPE OF WORK

A. The work to be performed under this Section shall include the compilation and submittal of all required shop drawings, manufacturer's cuts, specifications, and certifications of all materials and equipment for the Landscape Architect's approval. Actual product samples may also be required as stipulated in the technical specifications sections.

B. All submittals shall be submitted within four (4) weeks after the award of the contract and may be made and distributed digitally with the approval of the Owner via email or File Transfer Protocol (FTP) site. Alternatively, submittals may be made in hard copy form; three (3) copies (Contractor, Landscape Architect, and Other City Department) shall be in three (3) submittal packages so that manuals can be prepared for office and field reference.

1.3 GENERAL SUBMITTAL PROCEDURES

A. The Landscape Architect has 10 days to review the submittals and return them to the Contractor, also in PDF format.

B. Transmittal: Include a transmittal with each submittal identifying the item clearly. All transmittals shall coordinate with these Specifications.

PART 2 – PRODUCTS

2.1 REQUIREMENTS

A. References are made throughout the Specifications and Drawings where submittals are required. All finishes, colors, and patterns are to be reviewed and approved by submittal or field sample.

B. Where the Contractor's intention is to furnish the materials or equipment as specified, a list of all such elements, by Specification section, shall accompany the submittals so that the entire submittal is complete for the project.

PART 3 – EXECUTION

3.1 SUBMISSIONS

A. Submit all documents and data either in a collated, manual format, with three (3) manuals to be submitted; OR distributed digitally with the approval of the Owner. Include a Table of Contents of the material for reference. The submittal is to be entire and complete, addressing all furnishings and installation.

B. Submit all required product or material samples concurrent with the materials/equipment information manuals described above. Each submittal shall reference its appropriate specification section, part and paragraph.

END OF SECTION

SECTION 01 35 00: SPECIAL PROJECT PROCEDURES

PART 1 – GENERAL

1.1 SAFETY REGULATIONS

A. This Project is subject to compliance with Public Law 91-596 the "Occupational Safety and Health Act of 1970" (OSHA), as amended, with respect to all rules and regulations pertaining to construction, as amended, and as published by the U.S. Department of Labor.

B. The committing of nuisances on the Site or adjacent property is prohibited.

1.2 SAFETY PRECAUTIONS

A. The Contractor shall take all precautions to safeguard the health and well-being of all workers and all others rightfully on the Project site who may be affected by work done under this Contract. The Contractor is solely responsible for safety on the Site of the Project, both during construction hours and non-construction hours.

B. All safety laws and regulations of the U.S. Department of Labor, the Commonwealth of Massachusetts, and the Town of Arlington applicable to work performed under this Contract shall be adhered to by the Contractor.

1.3 LEGAL RELATIONS/RESPONSIBILITY TO PUBLIC

A. Laws to be Observed:

1. The Contractor shall keep himself fully informed of all existing and future State and National Laws and Municipal ordinances and regulations in any manner affecting those engaged or employed in the Work, or the materials used or employed in the Work, or in any way affecting the conduct of the Work, and all such orders and decrees of bodies or tribunals having any jurisdiction or authority over the same and of all provisions required by Law to be made a part of this Contract, all of which provisions are hereby incorporated by reference and made a part hereof. The Contractor shall cause all Subcontractors, Suppliers, agents, and employees to observe and comply with, all such existing and future Laws, ordinances, regulations, and orders.
2. If the Contractor uses or stores toxic or hazardous substances s/he is subject to certain additional laws and regulations including but not limited to M.G.L. Chapter 111F, Section 2, (the "Right to Know" law) and regulations promulgated by the State Department of Public Health, the Department of Public Safety and those of Town of Boston agencies.

1.4 FIRE PROTECTION & PREVENTION

A. The Contractor shall keep the Project Site free of rubbish and debris at all times.

1. The Contractor shall provide metal barrels located at appropriate areas into which all refuse and garbage shall be deposited. All barrels shall have tight fitting covers.
2. At the end of each work week, the Contractor shall thoroughly clean the Project Site of all rubbish and debris of any nature and remove such from the premises.
3. In addition, to the requirements in this Section, the Contractor shall, until Final Completion of the Work, provide and maintain fire extinguishers ready for use distributed around the Project Site and in and about temporary structures, if any.
4. Gasoline and other flammable liquids shall be stored in and dispensed from UL listed safety containers in conformance with the National Board of Fire Underwriters recommendations and the Commonwealth of Massachusetts Department of Public Safety requirements, and in no event within the confines of the permanent structures.
5. All tarpaulins used shall have UL approval and comply with Federal Specifications CCC-C746. Polyethylene shall not be used.

1.5 RUBBISH REMOVAL

A. The Contractor shall remove all rubbish, waste, tools, equipment, and appurtenances caused by and used in

the execution of the Work; but this shall in no way be construed to relieve the Contractor of his/her primary responsibility for maintaining the Project Site clean and free of debris, leaving all work in a clean condition satisfactory to the Official.

B. Immediately after unpacking, the Contractor shall collect and remove from the Project Site all packing materials, case lumber, excelsior, wrapping, and other rubbish.

1.6 SITE DRAINAGE & PUMPING

A. The Contractor shall be responsible at all times for proper and sufficient site drainage and shall maintain such drainage during the life of the Contract in a manner acceptable to the Designer and so as not to adversely affect the adjacent areas.

B. The Contractor shall provide and maintain all pumps, suction and discharge lines, and power in sufficient number and capacity to keep all excavations, pits, trenches, foundations, and the entire property area free from accumulation of water from any source whatsoever at all times and under all circumstances and contingencies that may arise.

C. For additional requirements of excavation and dewatering, refer to the Division 02 Section, SITE PREPARATION & DEMOLITION, and Division 31 Section EARTH MOVING.

1.7 SNOW & ICE REMOVAL

A. The Contractor shall promptly remove all snow and ice which may impede the Work, damage the finishes or materials, be detrimental to any crafts or trades, or impede trucking, delivery or moving of materials at the Site, or prevent adequate drainage of the Site or adjoining areas.

1.8 WINTER CONSTRUCTION

A. The Contractor shall provide protection against damage to materials and work installed in freezing weather, including special heat and coverings to prevent damage by the elements. The ground surface, under footings, under pipelines, under masonry, under concrete, and other work subject or damage shall be protected against freezing or ice formations.

1.9 TURF AREAS & SITE MAINTENANCE

A. From Notice of Proceed through Final Completion, the Contractor shall be responsible for the following tasks:

1. Removal of all graffiti within 36 hours
2. Timely care and maintenance of existing turf areas including mowing. Turf areas will not be allowed to grow taller than 4 inches.
3. Fall clean-up including leaf and branch removal
4. Spring clean-up including leaf and branch removal

1.10 BROKEN GLASS

A. The Contractor shall be held responsible at all times prior to Substantial Completion of the Work, or occupancy by the Town, whichever occurs first, for all broken or scratched glass, or glass which had been damaged as a result of the Work, or otherwise and, when so directed by the Official, the Contractor shall replace at no increase in Contract Price or Contract Time, all such glass broken, missing, or damaged prior to Substantial Completion.

1.11 CLEANING

A. The Contractor shall at all times keep the site free from accumulation of waste materials or rubbish.

B. Immediately prior to final inspection, the entire Project Site shall be thoroughly cleaned by the Contractor including, without limitation:

1. All construction facilities, tools, equipment, surplus materials, debris, and rubbish shall be removed from

the Project site and the entire Work shall be left broom clean.

2. All finished surfaces shall be left in perfect condition, free of stains, spots, marks, dirt, and other defects. The Contractor shall be responsible for the cleaning and polishing of the Work of all trades, whether or not cleaning by such trades is included in their respective Sections of the Specifications.
3. All metals, hardware, fixtures, and equipment shall be left in undamaged, bright, polished condition. In cleaning items that have a manufacturer's finish, or items previously finished by a Subcontractor, care shall be taken so as not to damage such finish.

C. In cleaning finish surfaces, care shall be taken not to use cleaning agents that may stain any finish materials. Any damage to finishes caused by operations shall be corrected and repaired by the Contractor at no increase in Contract Price.

1.11 OPERATIONS IN OCCUPIED STRUCTURES

A. The Contractor shall segregate all the Work from the public and/or the user group work force. The Contractor shall submit the method of segregation to the Town for approval before the start of any work.

B. The Contractor shall ensure that its agents and employees, including agents and employees of all Subcontractors, do not have any direct and unmonitored contact with children at any time on the Site.

C. In the event that the Contractor believes a portion of the Work cannot be completed without the possibility of direct and unmonitored contact with a child, the Contractor shall notify the Town and obtain prior written consent before proceeding with that portion of the Work. Workers who may have direct and unmonitored contact with children will be subject to verification of their Criminal Offender Record Information (CORI).

PART 2 – MATERIALS

NOT USED

PART 3 – EXECUTION

NOT USED

END OF SECTION

SECTION 01 56 00: TEMPORARY BARRIERS & ENCLOSURES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 GENERAL REQUIREMENTS

A. All references to products by manufacturer, trade name or performance Specifications bearing the connotation "or approved equal" shall be as determined by the Landscape Architect and the City, per MGL c. 30 s. 39M, Part b, Criteria 1.

1.3 WORK INCLUDED

A. Provide all labor, equipment, implements, and materials required to furnish, install, construct and perform all site improvements complete as shown on the Contract Drawings and specified herein; to include, but not be limited to the following:

1. Temporary Construction Perimeter Fencing
2. Tree or Plant Protection Fencing as indicated on the Contract Drawings
3. All other temporary barriers and controls needed for protection of the public during construction.

1.4 REFERENCES

A. Examine all other Sections of the Specifications and all Drawings for the relationship of the work under this Section and the work of other trades. Cooperate with all trades and all departments of the City and coordinate all work under this Section therewith.

B. The following related items are included under the Sections listed below:

1. Division 01 Section – TEMPORARY EROSION & SEDIMENT CONTROL
2. Division 02 Section – SITE PREPARATION & DEMOLITION
3. Division 31 Section – EARTH MOVING
4. Division 31 Section – SITE CLEARING
5. Division 31 Section – TREE PRUNING & REMOVAL
6. Division 32 Section – PLANTING
7. Division 32 Section – TURF & GRASSES

1.5 SUBMITTALS

A. Shop Drawings and Samples

1. Provide complete Shop Drawings and/or samples and catalog cuts for all items called for on the Drawings and as specified and in accordance with applicable requirements under Division 01.

1.6 PRODUCT DELIVERY, STORAGE & HANDLING

A. Deliver materials in manufacturer's original unopened and undamaged packages with labels legible and intact.

B. Store materials in unopened packages in a manner to prevent damage from the environment and construction operations.

C. Handle in accordance with manufacturer's instructions.

D. The Contractor shall be solely responsible for all materials stored on the site once delivered. Any materials left unsecured at the job site shall be solely at the contractor's own risk.

1.7 DEFINITIONS

A. The following items are included herein and shall mean:

1. NCLMA – National Chain Link Manufacturers' Association
2. OSHA – Occupational Safety and Health Act.

PART 2 – MATERIALS

2.1 BARRIERS & BARRICADES

A. Provide barriers to prevent unauthorized entry to construction areas to allow for Owner's use of site, and to protect existing facilities and adjacent properties from damage from construction operations.

1. Comply with standards and code requirements for erection of structurally adequate barriers.
2. Install barriers of a neat and uniform appearance.
3. Provide graphics and signs warning of the hazard being protected against.
4. Where appropriate and needed provide lighting, including flashing red or amber lights.
5. Provide barriers at public rights-of-way and for public access to existing buildings when adjacent to construction operations.

B. Provide barricades with blinking beacon light at all open trenches and other excavations.

C. Provide protection as specified in Division 32 Section, PLANTING for plant life designated to remain.

D. Protect non-owned vehicular traffic, stored materials, site and structures from damage.

2.2 TEMPORARY CONSTRUCTION FENCING

A. Prior to any excavation work the Contractor shall provide temporary construction fencing as shown on the Drawings and/or as required to completely protect the work area and injury to persons or property.

B. The Contractor shall furnish and install temporary fencing of the following type in all areas where existing fencing lengths are inadequate to enclose the construction.

1. Chain link fencing, six feet high min., fabricated from No. 9 gauge galvanized wire woven in a 2-inch diamond mesh with top salvage and having galvanized steel H or pipe intermediate and terminal posts. Post spacing shall not exceed eight feet (8') on center. Cross bracing, reinforcing gates and other parts of fencing shall conform to standard Specifications of the National Chain Link Manufacturers Association. All posts shall be set into temporary concrete footings or on temporary chain link fencing stands as approved by the Landscape Architect.

C. The contractor shall furnish and install matching gates equipped with suitable locks, other hardware, and, where necessary, provide access for construction apparatus or fire-fighting equipment. The Owner shall be provided with a copy of the key used for all locks.

2.3 TEMPORARY WORK IN PUBLIC WAYS

A. Prior to commencing any work in public ways and other areas which are legally used by vehicles or pedestrians, the Contractor shall submit in writing the proposed methods of protection to the Official. Work shall not be commenced in these areas until written approval is received from the Official.

B. In general, all excavations in public ways shall be protected by substantial barriers which will offer complete protection against accidents for pedestrian and vehicular traffic without interrupting the normal flow of traffic. All barriers must be properly lighted with electric or battery powered safety

lights and must be maintained in good working order by the Contractor for the duration of the time such barriers are required.

C. Trenches across sidewalks shall be completely covered with a temporary walkway, comprised of properly supported nominal 2-inch thick lumber laid with butt joints and covered with exterior grade plywood, one-half of an inch minimum thickness. Provide continuous 2 inch by 4 inch (nominal) rails and posts secured to the temporary walkway conforming to the requirements of the Occupational Safety and Health Act (OSHA).

D. Wherever temporary chutes are to be extended over sidewalks or other pedestrian or vehicular traffic areas, the bottom and sides of the chutes shall be provided with continuous dustproof and weatherproof lining, applied to the exterior surfaces.

E. The Contractor will be required to furnish, install, and maintain in good condition, at no increase in Contract Price or Contract Time, all other safety measures which in the judgment of the Official are required to protect the public from accidents due to work performed under this Contract. This requirement is supplementary to the Contractor's rights and obligations to provide and employ safety measures as s/he may deem necessary or as may be required by law or standard safety practices.

2.4 TREE PROTECTION FENCING

A. See Division 31 Section, SITE CLEARING for tree protection fencing requirements.

1. Stake or spray layout of all proposed work under the driplines of existing trees for approval before beginning construction. Install fencing over the greatest extent feasible within the driplines of the trees, allowing for the work.
2. Maintain fencing in sound condition until project completion. Do not relocate installed fencing without the express approval of the Landscape Architect or Owner.

PART 3 – EXECUTION

3.1 BARRIERS, BARRICADES & ENCLOSURES

A. Install temporary items as specified herein and in the Drawings or, where not specified, to level of quality suitable for the intended purpose as judged by the Landscape Architect.

3.2 REMOVAL OF TEMPORARY BARRIERS, ENCLOSURES & PROTECTIONS

A. Remove temporary barriers, barricades, fencing, enclosures, and protections as warranted by the progress of the Work and prior to Substantial Completion.

B. Remove in-ground elements of all temporary barrier installations (if any) completely. Grade site as noted.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore existing facilities used during construction to original condition at start of work or as specified elsewhere in the Contract Documents.

END OF SECTION

SECTION 01 57 13: TEMPORARY EROSION & SEDIMENT CONTROL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SUMMARY

A. Provide all work and take all measures to control soil erosion resulting from construction operations, prevent flow of sediment from construction site, and contain construction materials (including excavation and backfill) within protected working area as to prevent damage to any stream or wetlands.

1. Compost filter sock
2. Drain inlet protection
3. Dust control
4. Turbidity curtain

1.3 REFERENCE

A. The Contractor is responsible for ensuring that all work conducted at the Site, including but not limited to sediment and erosion control, complies with the City Regulations. In addition, all work shall be conducted in accordance with "Processes, Procedures and Methods to Control Pollution Resulting from all Construction Activity", published by the United States Environmental Protection Agency.

1.4 SUBMITTALS

A. Shop Drawings: Submit the following in accordance with Division 01 Section, SUBMITTAL PROCEDURES:

1. Two weeks prior to the start of the work, submit to Landscape Architect, for review, a plan with detailed sketches showing the proposed methods to be used for controlling erosion during construction.

1.5 QUALITY ASSURANCE

A. Use acceptable procedures, including use of water diversion structures, diversion ditches, settling basins, and sediment traps.

B. Operations restricted to areas of work indicated on drawings and area which must be entered for construction of temporary or permanent facilities.

C. If construction materials are washed away during construction, remove materials from fouled areas.

D. Stabilize diversion outlets by means acceptable to Landscape Architect.

E. Landscape Architect has authority to limit surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and fill operations and to direct immediate permanent or temporary pollution control measures to prevent contamination of any stream or wetlands, including construction of temporary berms, dikes, dams, sediment basins, sediment traps, slope drains, and use of temporary mulches, mats, or other control devices or methods as necessary to control erosion.

PART 2 – PRODUCTS

2.1 FILTER TUBE

A. Filter tube shall consist of biodegradable mesh tube filled with wood chips or compost. Filter tube shall be 12 inch diameter. Tubes shall be manufactured by Filtrexx, Silt Sock, or an approved equal.

1. Stakes shall be hardwood.

2.2 INLET PROTECTION

A. Inlet protection for catch basin protection shall be Silt Sack or an approved equal.

2.3 DUST CONTROL MEASURES

A. If the Landscape Architect or Owner decides it is necessary to use calcium chloride for more effective dust control, the Contractor shall furnish and spread the material, as directed herein.

B. Calcium Chloride

1. Calcium chloride shall conform to the requirements of AASHTO-M 144, Type I or Type II and Specification for Calcium Chloride, ASTM D98. The calcium chloride shall be packaged in moisture proof bags or in airtight drums with the manufacturer, name of product, net weight, and percentage of calcium chloride guaranteed by the manufacturer legibly marked on each container.

2. Calcium chloride failing to meet the requirements of the aforementioned specifications or that which has become caked or sticky in shipment, may be rejected by the Landscape Architect.

C. Water shall not be brackish and shall be free from oil, acid, and injurious alkali or vegetable matter.

2.4 TURBIDITY CURTAIN

A. Turbidity curtain to consist of an 18-ounce PVC fabric, 6-inch foam flotation, 1/4-inch steel ballast chain. Height shall be determined by the Contractor; bottom of curtain shall rest on the bottom of the Reservoir. Manufacturer shall be GEI Works, or an approved equal.

PART 3 – EXECUTION

3.1 GENERAL

A. Do not discharge chemicals, fuels, lubricants, bitumen, raw sewage, and other harmful waste into or alongside any body of water or into natural or man-made channels.

3.2 GENERAL INSTALLATION PROCEDURES

A. In the event that sedimentation or siltation prevention measures used by the Contractor provide to be inadequate the Contractor shall be required to adjust their operations to the extent necessary to prevent such sedimentation or siltation from occurring. Any damage or degradation caused by inadequate controls must be restored by the Contractor at no additional cost to the Owner.

B. All sedimentation and erosion control measures shall be in accordance with all permits, regulatory requirements, plans and specifications.

C. Straw wattle and inlet protection shall be installed prior to the start of construction activities. Locate sedimentation barriers, surrounding stored material, approximately 6 feet from material.

D. The Contractor shall keep all drains clear of mud, silt, debris, or other objectionable materials resulting from construction operations.

E. The Contractor shall minimize the amount of bare earth exposed at any one time during construction and minimize the length of time bare earth is exposed.

F. Baled hay and filter materials shall be placed to form temporary water stops, dams, diversions, dikes, berms, and for other uses connected with water pollution control. As directed by the Landscape Architect bales may be disposed by the Contractor as best suits field conditions and requirements.

G. Additional erosion control in the form of hay bales, filter tube, silt fence, etc. shall be employed by the Contractor as required to prevent erosion of topsoil or other materials.

H. Install sedimentation barriers in all locations as directed, surrounding base of all deposits of stored excavated material outside of disturbed area, and where directed by the Landscape Architect.

I. Construct earth berms or diversions to intercept and divert runoff water from critical areas.

J. Protect catch basins from sedimentation by installing straw wattle around the basin or siltation fabric under grating casting.

K. Discharge silt-laden water from excavations onto filter fabric mat and/or straw wattle or sediment traps to ensure that only sediment-free water is returned to waterways.

L. Do not place excavated soil material adjacent to waterway in manner that will cause it to wash away by high water or runoff.

M. Prevent damage to vegetation by excessive watering or silt accumulation in the discharge area.

N. Do not dump spoiled material into any salt marsh, streams, wetlands, surface waters, or unspecified locations.

O. Prevent indiscriminate, arbitrary, or capricious operation of equipment in streams, wetlands, or surface waters.

P. Do not pump silt-laden water from trenches or excavations into salt marsh, surface waters, streams, wetlands, or natural or man-made channels leading thereto.

Q. Prevent damage to vegetation adjacent to or outside of construction area limits.

R. Do not dispose of trees, brush, debris, paints, chemicals, asphalt products, concrete curing compounds, fuels, lubricants, insecticides, wash-water from concrete trucks or hydroseeders, or any other pollutant in streams, wet-lands, surface waters, or natural or man-made channels leading thereto, or unspecified locations.

S. Do not alter flow line of any stream unless indicated or specified.

T. Erosion control shall be reviewed regularly to keep in good condition especially following any rain events.

U. Clean and dispose of debris from sedimentation barriers on a weekly basis.

V. Upon completion of work and upon approval of Landscape Architect, remove and dispose of sedimentation barriers.

3.3 FILTER TUBE INSTALLATION

A. Compost filter tube may be place on bare soil, grass, erosion control blankets, or paved surface.

B. Install perpendicular to storm water flow, across slope, swale, ditch, or channel.

C. Anchor to the ground using a 2-inch by 2-inch (nominal) 36-inch long hardwood post every 10 feet on center. Under concentrated flow conditions stake posts every 5 ft. on center.

D. Stakes shall be driven through the center of the Filter Tube and installed a minimum of 12 inches into the existing soil.

E. Edges of the Filter Tube shall be turned upslope to prevent flow around the ends of the Filter Tube.

F. For 2:1 slopes additional Tubes may be placed every 20-50 feet along the slope to further reduce erosion.

G. 12-inch Filter Tubes may be used for stormwater ditch checks and small channels (additional staking required, every 4 feet on center).

H. Installed height of the Filter Tube in the field shall be 12-inch diameter equals effective height of 9.5 inches.

I. Routinely inspect Compost Filter Tube after installation and runoff events to ensure adequate hydraulic flow-through, proper function and performance. Sediment should be removed once it reaches half the height of the Filter Tube.

J. Contractor shall removal Filter Tube only upon Substantial Completion or approval by Landscape Architect. Unless otherwise directed by Landscape Architect or Owner, compost tubes can be emptied, compost spread on site, and tube disposed of offsite.

3.4 INLET PROTECTION

A. Follow manufacturer's directions for installation.

3.5 DUST CONTROL MEASURES

A. During the progress of the work, the Contractor shall conduct his operations and maintain the area of his activities, including sweeping and sprinkling of streets as necessary, to minimize creation and dispersion of dust. If the Landscape Architect or Owner decides it is necessary to use calcium chloride for more effective dust control, the Contractor shall furnish and spread the material, as directed herein.

B. Application

1. Calcium chloride shall be applied when ordered by the Landscape Architect or Owner's Representative and only in areas which will not be adversely affected by the application.

2. Calcium chloride shall be uniformly applied at the rate of 1-1/2 pounds per square yard or at any other rate as directed by the Landscape Architect. Application shall be by means of a mechanical spreader, or other approved methods. The number and frequency of applications shall be determined by the Landscape Architect and Owner's Representative.

3. Water may be sprinkler applied with equipment including a tank with gauge- equipped pressure pump and a nozzle-equipped spray bar.

4. Water shall be dispersed through the nozzle under a minimum pressure of 20 pounds per square inch, gauge pressure.

END OF SECTION

SECTION 01 58 00: PROJECT SIGNS

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SCOPE OF WORK

A. The Contractor shall furnish and install exterior signs in accordance with the design shown on the Drawings and/or included in the Specifications including:

1. One (1) large (four feet by eight feet) “Pardon our Appearance” temporary construction sign to be posted along Lowell Street near the vehicle entry.
2. Four (4) small (two feet by four feet) “Pardon our Appearance” temporary construction signs to be posted on construction fencing where access is restricted.

B. The signs shall be maintained in good condition by the Contractor for the duration of the Project and removed only with written approval of the Official.

C. No signs, notices, or advertisements shall be displayed without written approval of the Official.

1.3 SUBMITTALS

A. Submit samples of color and a Shop Drawings indicating lettering layouts to Landscape Architect for approval.

1. Electronic file with sign layout to be provided to the Contractor.
2. One graphic shall be produced for all signs. Smaller signs to be reduced in scale.

PART 2 – MATERIALS

2.1 “PARDON OUR APPEARANCE” SIGNS

A. “Pardon Our Appearance” signs shall be 2 feet by 4 feet and shall be mounted on marine grade plywood panel or approved equal, securely mounted to wood posts, as directed by the Landscape Architect. Sign shall be professionally printed.

B. Sign shall be securely mounted with galvanized metal attachments and shall be framed so as to be durable. All attachments and mountings shall be child-safe and vandal resistant.

PART 3 – EXECUTION

3.1 PLACEMENT

A. Signs shall be installed facing the street or access point to the construction area so as to be visible and inform the general public. Where possible, the sign should be located so as not to conflict with the construction activity nor to require moving during the construction process.

B. The construction sign shall be maintained in satisfactory condition during construction and then removed and disposed of legally by the Contractor just prior to the final acceptance of work

END OF SECTION

SECTION 01 71 23: CONSTRUCTION LAYOUT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SCOPE OF WORK

A. The work under this section shall consist of field staking the horizontal and vertical alignment of all essential features and proposed work, including walls, curbs, walkways, fencing, electrical and utility structures, plantings, furnishings, play equipment, and other related features as shown on the plans, by a Massachusetts-registered Professional Engineer or Land Surveyor. The Contractor shall familiarize himself with the existing conditions and shall be responsible for locating or re-establishing survey field ties, property lines, and benchmarks indicated on the plans.

PART 2 – MATERIALS

2.1 LAYOUT AND STAKING

A. The Contractor shall be responsible for furnishing all stakes, pins, and grade markings as required to implement the work of layout and staking and shall make all field adjustments ordered by the Landscape Architect at no extra cost to the Owner.

B. Upon request by the Landscape Architect, the Contractor shall make available to the Owner survey instruments and operator necessary to check the proposed vertical and horizontal alignments at no extra cost.

PART 3 – EXECUTION

3.1 SURVEY LAYOUT

A. The Contractor shall use the alignments shown on the plans to establish the layout of all proposed features and shall perform field adjustments as ordered by the Landscape Architect.

B. All layout shall be by the dimensions noted on the Contract Drawings. Do not scale directly from the plans. If clarification regarding a dimension or intended layout procedure is required, contact the Landscape Architect.

C. All dimensions marked on the Drawings with “+/-“ or “(Confirm)” or “Verify in Field” are intended for confirmation of conformance to the expected conditions and (where applicable) that acceptable slopes and clearances are provided. Once layout has been established using other dimensions, the Contractor shall verify these dimensions (to within a tolerance of 1/2-inch) and report any discrepancy to the Landscape Architect for acceptance or instruction regarding adjustment. These confirmation dimensions should not be used to layout elements.

D. The Surveyor shall lay out the essential or necessary grades and locations of site furnishings, footings, pavements, utilities, structures, and other proposed elements. The surveyor shall verify the location of any existing spikes, stakes, pipes, drill holes, etc. and shall be responsible for their accuracy. Proposed features shall be located in relation to dimensions shown on the drawings and as adjusted by the Landscape Architect.

E. The Contractor shall inform the Landscape Architect when the general layout is completed and shall not begin excavation until the Landscape Architect approves the various alignments. Any discrepancies encountered in field conditions shall be reported to the Landscape Architect immediately and shall be adjusted as directed.

F. The Contractor shall be responsible for maintaining the correct vertical and horizontal alignment of all elements, which responsibility shall not be waived by the Landscape Architect's approval of basic layout and stakeout.

END OF SECTION

SECTION 01 78 00: CLOSEOUT DOCUMENTATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SCOPE OF WORK

A. The work to be performed under this Section shall include the compilation and submittal of all required maintenance manuals, maintenance and repair products, warranty information, detailed procedures, product information, submittal records, as-built drawings, and certifications of all materials and equipment for the Landscape Architect's approval. Additional submissions may also be required as stipulated in the technical specification sections.

B. Upon Final Completion of all park construction, the contractor shall submit: three complete copies of a park maintenance manual, and three copies of an as-built drawing set, with three digital (DVD) copies of the as-built drawings.

C. The Town will not issue the final check for park retainage until the submittal and approval of the maintenance manual and as-built drawings.

PART 2 – SUBMITTALS

2.1 MAINTENANCE MANUAL

A. The Maintenance shall be in the form of a three-ring binder, organized, and tabbed into appropriate sections, and shall include the following items:

1. Play equipment
2. Irrigation system – Add Alternate #4

2.2 PARK MAINTENANCE KIT

A. At the completion of construction, the Contractor shall provide to the Town's Department of Public Works, Parks Maintenance Division, a Maintenance Kit containing all touch-up paint, maintenance instructions, spare parts, and other maintenance materials provided by the manufacturers of all improvements.

B. The Maintenance Kit shall be delivered in a single container clearly labeled with the Park Name, and each item shall be identified as to the source.

2.3 AS-BUILT DRAWINGS

A. As-Built drawing shall be a complete and accurate record that incorporate any and all changes to the construction plan set issued at the time of contract initiation. As- built drawings shall be clearly marked and annotated and shall include but not be limited to: all field changes, change orders, and supplemental drawings provided by the Landscape Architect.

B. As-Built Drawings shall include complete records of all water, drainage, and electric utilities installed, including sizing, location, and inverts of all drainage pipes and structures, and sizing and location of all water service lines and electrical conduits.

C. The DVD shall include an electronic copy of all as-built drawings in AutoCAD version 2018 or earlier. Files shall be in both DWG and PDF formats.

PART 3 – EXECUTION

3.1 SUBMISSIONS

A. Submit all documents and data in a collated, manual format, with three (3) manuals to be submitted. Include a Table of Contents of the material for reference. The submittal is to be entire and complete, addressing all requirements listed above.

END OF SECTION

SECTION 02 41 00: SITE PREPARATION & DEMOLITION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SUMMARY

A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to prepare the site, complete, as indicated on the Contract Documents, as specified, and as follows:

1. Protection of existing structures and utilities
2. Protection of Department of Public Works sidewalks and park pathways, unless otherwise shown on Contract Drawings
3. Salvage, stockpile on-site, and reuse materials
4. Salvage materials and stockpile off-site
5. Removal and disposal of materials
6. Temporary construction fencing

1.3 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 01 Section – TEMPORARY BARRIERS & ENCLOSURES
2. Division 01 Section – TEMPORARY EROSION & SEDIMENT CONTROL
3. Division 31 Section – EARTH MOVING
4. Division 31 Section – SITE CLEARING
5. Division 32 Section – TREE PRUNING & REMOVAL

1.4 REFERENCES

A. The following standards shall apply to the work of this Section.

1. Massachusetts Department of Transportation (MassDOT):
Specifications Standard Specifications for Highways and Bridges

1.5 PROTECTION

A. Do not interfere with use of adjacent residences or facilities. Maintain free and safe passage to and from adjacent buildings and facilities or both and between them and the public way.

B. The Contractor shall be solely responsible for making all necessary arrangements and for performing any necessary work involved in connection with the discontinuance or interruption of all public and private utilities or services.

C. Cease operations and notify Owner immediately if safety of adjacent structures, workers, or the general public appears to be endangered. Take precautions to properly support structures and protect workers and general public. Do not resume operations until safety is restored.

D. Prevent movement, settlement or collapse of adjacent services, sidewalks, driveways, and trees. Assume liability for such movement, settlement, or collapse. Promptly repair damage at no cost to the Owner. Furnish, erect, and maintain fences, planking, bracing, shoring, sheathing, lights

barricades, warning signs, and guards as necessary for the protection of streets, sidewalks, and adjoining property.

E. Trees that are damaged during construction shall be removed by the Contractor at their expense if instructed to do so by the Landscape Architect, and the Contractor shall pay the Town of Arlington for each tree judged by a Massachusetts Certified Arborist to be significantly damaged or injured, whether or not it is removed.

1.6 GENERAL REQUIREMENTS

A. The Contractor shall secure a DIG SAFE permit number for the project to certify notification of gas, electrical and telephone utilities. All other affected utilities shall be contacted by the Contractor who shall secure notification receipts in accordance with requirements of Massachusetts law. The phone number is 811. Contractors shall notify "Dig Safe" of contemplated excavation, demolition, or explosive work in public or private ways, and utility company right-of-way or easement. This notification shall be made at least 72 hours prior to the work, but not more than sixty days before the contemplated work. Such notice shall set forth the name of the street or the route number of said way and an accurate description of the location and nature of the proposed work. The Landscape Architect requires that the notification be sent to "Dig Safe" by certified mail, with copies to the Owner. The Architect requires a copy of the signed receipt of the delivery. "Dig Safe" is required to respond to the notice within 72 hours from the time said notice is received by designating at the locus the location of pipes, mains, wires, and conduits. Contractor shall not commence work until "Dig Safe" has responded as noted above. The work shall then be performed in such a manner, and with reasonable precaution taken to avoid damage to utilities under the surface in said areas of the work.

B. The Contractor shall, prior to any removal of rubbish or debris from the site, furnish written evidence satisfactory to the Landscape Architect that he has an approved dumping location for debris and/or spoil form his removals and excavation activities.

C. On-site cleaning of materials for the purpose of salvage on the site shall not be permitted.

D. The Contractor shall secure all necessary permits from the Town of Arlington before starting this project.

E. The Town of Arlington shall have the right of first refusal on all removed materials, at the direction of the Landscape Architect. All materials refused by the Town shall become the property of the Contractor.

F. For all earthwork, excavation, and removals within the driplines of protected trees (not limited to areas within designated tree protection fencing), the Landscape Architect must be present on the site or have specifically waived that obligation. Provide 48 hours' notice prior to commencement of all such work.

PART 2 – PRODUCTS

2.1 TEMPORARY CONSTRUCTION FENCING

A. Temporary construction fencing shall be provided and paid for under as specified under Division 01 Section, TEMPORARY BARRIERS & ENCLOSURES.

B. Site protection fencing shall include installation and maintenance. Installation shall be suitable to withstand the duration of the project. The Contractor shall be responsible for maintaining the site protection fence in good order and if necessary, must make any adjustments immediately to ensure site safety. The Contractor shall be responsible for maintaining a clean work site including debris, trash, and vegetative material removal along the temporary fence line throughout the duration of the project.

PART 3 – EXECUTION

3.1 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

A. Existing structures, monuments, vegetation, fencing, and utilities not designated to be removed shall be suitably protected from damage, including but not limited to existing pavements and curbs, site walls, lighting, fencing, concrete vault, manholes, and utility lines.

1. Reinforced concrete beam along south, southwest, and southeast edge of Reservoir. This is the concrete I-beam which tops the sheetpile dam and must be protected.
2. Granite bench near beach

B. Provide and install erosion and sedimentation control at all existing catch basins and all other utility structures as identified on the drawings. Protect public right-of-way from the entry of erosion and construction debris.

3.2 SALVAGE, STOCKPILE ON-SITE & REUSE MATERIALS

A. Materials indicated on the Contract Documents or designated by the Landscape Architect in the field to be salvaged shall be carefully removed, protected from damage, and put in temporary storage until being reinstalled on-site, as follows:

1. Salvaged material shall be stockpiled on-site in an area designated by the Landscape Architect.
   a. Granite benches
   b. Granite mile markers
   c. Boulders
   d. Concrete curb stops
   e. Wood posts

3.3 SALVAGE & STOCKPILE OFF-SITE

A. Materials indicated on the Contract Documents or designated by the Landscape Architect in the field to be salvaged and stockpiled for the Owner shall be carefully removed, protected from damage, delivered to Arlington Department of Public Works at 51 Grove Street, Arlington, MA (Contractor to coordinate with DPW staff for delivery) as follows:

1. Salvaged material shall be stockpiled off-site in an area designated by the Landscape Architect. Salvage material shall include but not limited to the following:
   a. Composite benches
   b. Trash bins – These are to be removed by the Owner prior to construction start. If they remain, they are to be delivered to Arlington Department of Public Works.

3.4 REMOVAL & DISPOSAL OF MATERIALS

A. Materials indicated on the Contract Documents or designated by the Landscape Architect in the field to be removed shall be dismantled, removed, and legally disposed of off-site as indicated on the Contract Documents and as specified, performed, and paid for in this SECTION, SITE PREPARATION. Removals include but are not limited to the following:

1. Concrete and bituminous pavement and stairs, as designated on Contract Drawings
2. Concrete ramp and metal handrail at beach
3. Wood benches and any/all associated concrete pads, footings, and base material
4. Play equipment and wood edging
5. Rubber trail and playground surfacing
6. Lifeguard chairs
7. Wood benches
8. Picnic tables
9. Chain link fence and concrete foundation (only as designated on Contract Drawings)
10. Metal pipe rail at bathhouse/concessions building
11. Drinking fountain granite, conduits, pipes, hardware, etc.
12. Wood park signs, as designated on Contract Drawings

13. Concrete pads and footings as noted on Contract Drawings

B. Material resulting from the site preparation work and not scheduled to be salvaged and which is unsuitable for reuse on the project, shall become the property of the Contractor and shall be legally disposed of off-site.

C. Debris, rubbish, and other material shall be disposed of promptly and shall not be left until final cleanup of site.

D. Existing site structures indicated on the Contract Documents to be removed, shall be completely dismantled and removed from the site.

E. Sawcut pavements at the limits shown on the drawings prior to demolition.

F. Removal of concrete walkways shall include subbase material. Park pathways may have varying "subbase" materials (ex. asphalt over concrete, which may be reinforced with rebar, over gravel) as some pathways were previously overlaid. Contractor shall be responsible for removing materials to stable subbase.

3.4 EROSION CONTROL

A. The Contractor shall comply with Town of Arlington regulations and shall plan and execute all operations, particularly those associated with excavation and backfilling, in such a manner as to prohibit excavated and exposed fill or other foreign material to be washed or otherwise carried into streets, drains, or waterways. The water quality of storm drains shall not be degraded due to construction operations.

B. In the event that sedimentation or siltation prevention measures used by the Contractor provide to be inadequate the Contractor shall be required to adjust their operations to the extent necessary to prevent such sedimentation or siltation from occurring. Any damage or degradation caused by inadequate controls must be restored by the Contractor at no additional cost to the Owner.

C. The Contractor shall keep all drains clear of mud, silt, debris, or other objectionable materials resulting from construction operations.

D. The Contractor shall minimize the amount of bare earth exposed at any one time during construction and minimize the length of time bare earth is exposed.

E. Baled hay and filter materials shall be placed to form temporary water stops, dams, diversions, dikes, berms, and for other uses connected with water pollution control. As directed by the Landscape Architect bales may be disposed by the Contractor as best suits field conditions and requirements.

F. Sediment-laden water that is being pumped from trenches or excavations shall not be pumped directly into storm drains or water courses. Sedimentation tanks or other means acceptable to the Landscape Architect shall be used for this purpose.

G. All sedimentation and erosion control measures shall be in accordance with all permits, regulatory requirements, plans and specifications.

H. Inlet protection shall be installed prior to the start of construction activities.

I. Additional erosion control in the form of hay bales, filter tube, silt fence, etc. shall be employed by the Contractor as required to prevent erosion of topsoil or other materials.

J. Erosion control shall be reviewed regularly to keep in good condition especially following any rain events.

3.5 PROTECTION OF EXISTING TREES & VEGETATION

A. The Contractor shall make every effort not to damage existing plant materials to remain. The Contractor is required to install protection as necessary to assure undamaged plant material and adjacent conditions.

B. Vehicles shall not be parked within the dripline or where damage may result to trees to be saved. Construction materials shall not be stored beneath trees to be saved.

C. Repair/replace vegetation that is damaged at no additional cost to Owner. Employ certified arborist to repair damaged trees.

D. No dumping of any kind shall occur under the dripline of trees or shrubs to remain.

END OF SECTION

SECTION 03 00 00: REINFORCED CONCRETE FOOTINGS – Add Alternate

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 GENERAL REQUIREMENTS

A. The work of this section includes all labor, materials, equipment, and supervision necessary to complete work specified in this section.

1.3 SCOPE OF WORK

A. Scope of work of this section includes, but is not necessarily limited to, furnishing, and installing the following:

1. Cast-in-place concrete
   or
2. Precast Concrete
3. Reinforcing steel (epoxy coated)

1.4 RELATED WORK

A. Related work specified elsewhere

1. Division 05 Section – METAL FABRICATIONS – Add Alternate
2. Division 05 Section – METAL FASTENINGS – Add Alternate
3. Division 06 Section – WOOD TREATMENT – Add Alternate
4. Division 06 Section – HEAVY TIMBER CONSTRUCTION – Add Alternate

1.5 REFERENCES

A. Except as noted, work shall conform to the latest edition of the following codes specifications and standards:

1. American Society for Testing and Materials (ASTM)
2. American Concrete Institute (ACI):
   a. "Building Code Requirements for Reinforced Concrete", ACI 318.
   b. "Specifications for Structural Concrete for Buildings", ACI 301.
   c. "Recommended Practice for Measuring, Mixing, and Placing Concrete", ACI 304.
   d. "Recommended Practice for Cold (Hot) Weather Concreting", ACI 306 and ACI 307.
   e. "Recommended Practice for Concrete Formwork", ACI 307.
3. Concrete Reinforcing Steel Institute (CRSI):
   a. Reinforced Concrete - "A Manual of Standard Practice".
   b. "Recommended Practice for Placing Reinforcing Bars".
   c. "Recommended Practice for Placing Reinforcing Bars".
   d. "Guidelines for Inspection and Acceptance of Epoxy-Coated Reinforcing Bars at the

Job Site."

1.6 SUBMITTALS

A. Shop Drawings

1. Reinforcing steel shop drawings
   a. shall be of such detail and completeness that all fabrication and placement at the site can be accomplished without the use of contract drawings for reference.
   b. shall include number of pieces, sizes, and grade of reinforcing steel, accessories, and any other information required for fabrication and placement.
   c. shall show joint layout and design
2. Contractor shall check structural, and site drawings for anchor bolts, anchors, inserts, conduits, sleeves, and any other items which are required to be embedded in concrete, and shall make necessary provisions as required so that reinforcing steel will not interfere with the placement of such embedded items.

B. Concrete mix designs.

1.7 QUALITY ASSURANCE

A. Testing of Concrete

1. Test Specimens: The Contractor will be required to make, cure and have tested, a minimum of one set of four test specimens from the concrete of each day's pour and for each fifty cubic yards of concrete cast in accordance with ASTM Designations C172, C31 and C39. One cylinder shall be broken after seven days and three cylinders after twenty-eight day.
2. Slump: A slump test shall be made for each truckload of concrete in accordance with ASTM Designation C143. Slumps greater than design mix limit will be grounds for rejection of the concrete.
3. Air Content: The Contractor shall make an air content test from each day's pour of concrete by the pressure method in accordance with ASTM Designation C231. Air contents above or below the limits specified will be grounds for rejection of the concrete.
4. Testing: All personnel and laboratories testing concrete shall be licensed by the Commonwealth of Massachusetts.
5. In the event the compressive strength of the cylinders, when tested, is below the specified minimum, the Owner may require test cores of the hardened structure to be taken by the Testing Laboratory in accordance with ASTM C-42. If such test indicates that the core specimen is below the required strength, the concrete in question shall be removed and replaced without cost to the Owner. Any other work damaged as a result of this concrete removal shall be replaced with new materials to the satisfaction of the Owner at no additional cost to the Owner. The cost of coring will be deducted from the contract amount. Where core cylinders have been taken by the Testing Laboratory and the concrete proves to be satisfactory, core holes shall be filled in a manner satisfactory to the Owner at no additional cost to the Owner.

B. The Contractor shall coordinate the date and location of tests with the Owner before any concrete work is started.

1.8 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Reinforcing steel shall be transported to the site, stored, and covered in a manner which will ensure that no damage shall occur to it from moisture, dirt, grease, or any other cause that might impair bond to concrete or chip protective epoxy coating. A sufficient supply of approved reinforcing steel shall be stored on the site at all times to ensure that there will be no delay of the work. Identification of steel shall be maintained after bundles are broken.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Portland Cement: ASTM C 150, Type II of U.S. manufacture. Only one brand of cement shall be used on the project.

B. Aggregates:

1. Fine aggregate. ASTM C 33, clean and graded from 1/4 inch to fines.
2. Coarse aggregate. ASTM C 33, clean and graded from 1/4 inch to maximum sizes hereinafter specified.

C. Air Entraining Agent

Conforming to ASTM C 260 for Air-Entraining Admixtures for Concrete.

D. Water Reducing Agent

Conforming to ASTM C 494 Type A for Chemical Admixtures for Concrete.

E. Water

Clean and potable, free of impurities detrimental to concrete.

F. Reinforcing Bars

New, deformed billet steel bars, conforming to ASTM A 615, Grade 60, with Epoxy-Coating conforming to ASTM A775/A775M.

G. Accessories

Reinforcement accessories, consisting of spacers, chairs, ties, and similar items shall be provided as required for spacing, assembling, and supporting reinforcement in place. All accessories shall be dielectric coated steel or approved plastic accessories, conforming to the applicable requirements of the CRSI Standards hereinbefore specified.

2.2 CONCRETE STRENGTHS AND PROPORTIONS

A. Cast-in-place or precast concrete shall have the following minimum compressive strength at 28 days and shall be proportioned within the following limits:

	Minimum Strength at	Maximum Size of	W/C
Class	28 days	Aggregate	Ratio
A	4000 psi	3/4"	.40

B. The exact proportions for the mix, including amounts admixture (if any), and water, shall be determined by the concrete supplier.

C. The proportions of aggregate to cement for any concrete shall be such as to produce a mixture which will work readily into the corners and angles of the forms and around reinforcement with the method of placing employed not the work, but without permitting the materials to segregate or excess free water to collect on the surface.

D. Air-Entrainment

The air content in all concrete shall be maintained at 5 to 7 percent.

PART 3 - EXECUTION

3.1 CAST-IN-PLACE OR PRECAST CONCRETE

A. Concrete footings shall be placed on sound soil. Prior to placing the footings the contractor shall arrange for the engineer to view the excavation to determine if the soil is satisfactory to support the footings. The engineer may require additional work to prepare the soil for footing placement.

B. Reinforcing Steel

1. General: Reinforcing steel shall be placed in accordance with the drawings and approved shop drawings and the applicable requirements of the "Codes and Standards" here-in-before specified. Install reinforcement accurately and secure against movement, particularly under the weight of workmen and the placement of concrete.

2. Reinforcing Steel Supports: Bars shall be supported on approved plastic or dielectric-coated metal chairs or spacers, accurately placed and securely fastened to forms or steel reinforcement in place. Additional bars shall be supplied, whether specifically shown on the drawings or not, where necessary to securely fasten reinforcement in place. Support legs of accessories in forms without embedding in form surface. Spacing of chairs and accessories shall conform with CRSI's "Recommended Practice for Placing Bar Support". Hooping and stirrups shall be accurately spaced and wired to the reinforcement. No wood will be permitted inside forms. Lifting of welded wire fabric into proper position while concrete is being poured rather than supporting fabric on chairs will not be permitted.

C. Mixing of Concrete

1. All concrete shall be ready-mixed concrete and shall be mixed and delivered in accordance with the "Specification for Ready-Mixed Concrete", ASTM C-94. The batch plant of the concrete producer shall be certified for compliance with the standards established by the National Ready-Mixed Concrete Association.
2. In the event concrete is mixed at a central batching plant, the delivery shall be arranged so that intervals between batches are kept to a minimum, and in any event not more than thirty (30) minutes. Trucks shall be in first class condition and kept in constant rotation during delivery.
3. Concrete shall be placed within 90 minutes after cement has been mixed with aggregate or 45 minutes after addition of water and admixtures.
4. No admixtures, except those mentioned in paragraph 2.1 shall be used. Calcium chloride will not be permitted.
5. Truck delivery slips of all concrete delivered to the job shall indicate the quantity and quality of concrete, additives, date and time of batching and delivery, and the location of placement. Delivery slips shall be forwarded to the Owner at the end of each week.

D. Cold Weather Requirements:

1. Concrete shall not be mixed or placed when the temperature is below 40 degrees F., or when conditions indicate that the temperature will fall below 40 degrees F. within 72 hours unless precautions are taken to protect the concrete.
2. Concrete temperature shall be maintained, when deposited, at not less than 60 degrees F. Reinforcement, forms, and ground which concrete will contact must be completely free of frost.
3. Concrete and formwork must be kept at a temperature of not less than 50 degrees F. for not

less than 96 hours after placing.

4. Calcium chloride shall not be used.

E. Hot Weather Requirements:

1. The maximum temperature of the concrete, when deposited, shall be 85 degrees F. If the weather causes the placing temperature to exceed 85 degrees F., the mix shall be cooled by appropriate methods if approved by the Owner.
2. No concrete shall be deposited when the air temperature is greater than 90 degrees F.

F. Conveying and Placing Concrete

1. Notification
   a. Before placing concrete, forms shall be thoroughly inspected. All chips, dirt, etc., shall be removed, all temporary bracing and cleats taken out, all openings for pipes, etc., properly boxed, all forms properly secured in their correct position and made tight, all reinforcement, anchors, and embedded items secured in their proper places. Concrete which may be on the forms or reinforcement, and which is set and dry, shall be cleaned off, and the forms and steel washed off before proceeding. Remove all foreign matter from forms and excavations.
2. Water shall be removed from place of deposit before concrete is placed unless otherwise permitted by the Owner. Any flow of water into an excavation shall be diverted through proper side drains into a sump or shall be removed by other approved methods which will avoid washing away the freshly deposited concrete.
3. Soil on which concrete will be poured shall be thoroughly wetted (except in freezing weather).
4. Anchors and Embedded Items
   a. Anchors, bolts, sleeves, inserts, wood blocking, and any other items to be embedded in concrete shall be accurately secured in position before the concrete is placed. Aluminum shall not be embedded in concrete.
5. Handling and Depositing
   a. Before any concrete is placed, the Contractor shall notify all whose work is in any way connected with or influenced by the concrete work, and give them reasonable time to complete all portions of their work that must be completed before concrete is deposited.
   b. Immediately before concrete is placed, the Contractor shall inspect all forms be be sure that they are in proper position, sufficiently rigid, thoroughly clean, properly oiled and free from foreign materials, and that all reinforcement is in proper position.
   c. Concreting, once started, shall be carried on as a continuous operation until the section of approved size and shape is completed.
   d. Concrete shall be conveyed as rapidly as practicable from the mixer to the place of final deposit by methods which prevent the separation or loss of ingredients. It shall be deposited, as nearly as practicable, in its final position to avoid rehandling or flowing.
   e. Concrete shall not be dropped freely where reinforcement will cause segregation, nor shall it be dropped freely more than six (6) feet. Concrete shall be deposited to maintain a plastic surface approximately horizontal.
   f. Concrete that has partially hardened shall not be deposited in the work.
6. Pumping
   a. Concrete may be placed by pumping if first approved in writing by the Owner for the location proposed.
   b. Equipment for pumping shall be of such size and design as to ensure a practically continuous flow of concrete at the delivery end without separation of materials.
   c. The concrete mix shall be designed to the same requirements as herein before specified and may be richer in lubricating components in order to allow proper pumping.
   d. Concrete shall not be pumped through aluminum pipes.

e. All pumping operations must have full-time inspection by a recognized testing laboratory approved by the Owner and paid for by the Contractor. The cost of this full-time inspection shall be included in the contractor's bid proposal if the option of pumping is elected.

8. Vibrating and Compacting
   a. All concrete shall be thoroughly consolidated and compacted by suitable means during the operation of placing, and shall be thoroughly worked around reinforcement, embedded items, and into the corners of the forms. All concrete against forms shall be thoroughly spaded. Internal vibrators shall be used under experienced supervision, and shall be kept out of contact with reinforcement and wood forms. Vibrators shall not be used in a manner that forces mortar between individual form members.
   b. Vibrators shall be flexible electric type or approved compressed air type, adequately powered and capable of transmitting to the concrete not less than seven thousand (7,000) impulses per minute. Vibration shall be sufficiently intense to cause the concrete to flow or settle readily into place without separation of the ingredients. A sufficient number of vibrators shall be employed so that complete compaction is secured throughout the entire volume of each layer of concrete. At least one (1) vibrator shall be kept in readiness as a spare for emergency use. Vibrators shall be such that the concrete becomes uniformly plastic with their use.
   c. Vibration shall be close to the forms but shall not be continued at one spot to the extent that large areas of grout are formed or the heavier aggregates are caused to settle. Care shall be taken to not disturb concrete which has its initial set.
   d. Where conditions make compacting difficult, or where the reinforcement is congested, batches of mortar containing the same proportions of cement to sand as used in the concrete shall first be deposited in the forms, to a depth of at least on inch.
   e. The responsibility for providing fully filled out, smooth, clean, and properly aligned surfaces free from objectionable pockets shall rest entirely with the Contractor.

G. Protection and Curing

1. Protect concrete from injurious action of the elements and defacement of any nature during construction operations.
2. Keep concrete in a thoroughly moist condition from the time it is placed until it has cured, for at least (7) days.
3. Carefully protect exposed concrete corners from damage.

H. Defective Work

1. The following concrete work shall be considered defective and may be ordered by the Owner to be removed and replaced at Contractor's expense:
   a. Incorrectly formed.
   b. Not plumb or level.
   c. Not specified strength.
   d. Containing rock pockets, voids, honeycomb, or cold joints.
   e. Containing wood or foreign matter.
   f. Otherwise not in accordance with the intent of the Drawings and Specifications.

PART 4 – MEASUREMENT & PAYMENT

4.1 METHOD OF MEASUREMENT AND PAYMENT

A. Measurement and Payment for METAL FASTENINGS shall be included in the Measurement

and Payment for TIMBER. See Division 06 Section, HEAVY TIMBER CONSTRUCTION.

END OF SECTION

SECTION 03 30 00: CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SUMMARY

A. The work of this Section consists of providing all equipment and materials and do all work necessary to complete the cast-in-place concrete work, as indicated in the Contract Documents and as specified.

B. Provide all equipment and materials, and do all work necessary to complete the cast-in-place concrete work which includes, but is not necessarily limited to the following:

1. Cast-in-place concrete as used in the following:
   a. Concrete walkways and sidewalks
   b. Concrete curb ramps
   c. Concrete foundations and footings
   d. Concrete pads for site furnishings
   e. Furnishing and installing inserts for steel member connections, and similar items in conjunction with concrete work.
   f. Installation of items furnished by other sections (such as pins/dowels, waterstops, anchors, sleeves, bolts, and plates), and required to be cast into concrete.
   g. Make provisions in forms for proper location and installation of pipe sleeves, keys, chases, electrical boxes, bolts, anchors, inserts, and similar items, as required by other trades. Notify appropriate trades when items noted are ready for installation.
   h. Unless specifically excluded, furnishing and installation of any other items of cast-in-place concrete work indicated on Contract Documents, specified, or obviously needed to make work of this Section complete.
2. Forms
3. Forms ties
4. Reinforcing steel and mesh
5. Grout for setting anchor pins
6. Cutting and patching
7. Stainless steel anchor pins
8. Control joints
9. Expansion joints

1.3 REFERENCES

A. Except as noted, work shall conform to the latest edition of the following codes specifications and standards:

1. AASHTO: American Association of State Highway and Transportation Officials
   M153
   M182
   M194
2. ASTM: American Society for Testing and Materials

A82	Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
A108	Standard Specification for Steel Bars, Carbon, cold-Finished, Standard Quality
A185	Standard Specification for Steel Welded Wire Fabric, Plain, For Concrete Reinforcement
A276	Standard Specification for Stainless Steel Bars and Shapes

A496	Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement
A497	Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement
A510	Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel
A615/A615M	Standard Specification for Deformed and Plain Billet-Steel bars for Concrete Reinforcement
C31/C31M	Standard Practice for Making and Curing Concrete Test Specimens in the Field
C33	Standard Specification for Concrete Aggregates
C39/C39M	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
C40	Standard Test Method for Organic Impurities in Fine Aggregates for Concrete
C42/C42M	Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
C94/C94M	Standard Specification for Ready-Mixed Concrete
C109/C109M	Standard Test method for Compressive Strength of Hydraulic Cement Mortars
C143/C143M	Standard Test Method for Slump of Hydraulic Cement Concrete
C150	Standard Specification for Portland Cement
C171	Standard Specification for Sheet Materials for Curing Concrete
C172	Standard Practice for Sampling Freshly Mixed Concrete
C173	Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
C231	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
C260	Standard Specification for Air-Entraining Admixtures for Concrete
C330	Standard Specification for Lightweight Aggregates for Structural Concrete
C348	Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars
C494/C494M	Standard Specification for Chemical Admixtures for Concrete
C496	Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens
C567	Standard Test Method for Density Structural Lightweight Concrete
C618	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
C827	Standard Test Method for Change in height at Early Ages of Cylindrical Specimens from Cementitious Mixtures
C1064/C1064M	Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete
D1572	Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
E154	Standard Test Methods for Water Vapor Retarders Used in Contact with Earth under Concrete Slabs, on Walls, or as Ground Cover
E488	Standard Test Method for Strength of Anchors in Concrete and masonry Elements

3. ACI: American Concrete Institute:

ACI 301	Structural Concrete for Buildings
ACI 302	Guide for concrete Floor and Slab Construction
ACI 304	Recommended Practice for Measuring, Mixing, Transporting & Placing Concrete
ACI 305R	Hot Weather Concreting
ACI 306R	Cold Weather Concreting
ACI 306.1	Standard Specifications for Cold Weather Concreting
ACI 308	Standard Practice for Curing Concrete
ACI 315	Manual of Standard Practice for Detailing Reinforced Concrete Structures
ACI 318/318R	Building Code Requirements for Reinforced Concrete

ACI 347R Guide to Formwork for Concrete
SP-66(94)

4. CRSI: Concrete Reinforcing Steel Institute:
   Reinforced Concrete - A Manual of Standard Practice, latest edition
   Recommended Practice for Placing Reinforcing Bars, latest edition
5. FHWA: Federal Highway Administration
   Program Report No. FHWAJRD86/193
6. Commonwealth of Massachusetts Department of Transportation (MADOT):
   Specifications Standard Specifications for Highways and Bridges

1.4 RELATED SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 02 Section: SITE PREPARATION & DEMOLITION
2. Division 07 Section: PAVEMENT JOINT SEALANTS
3. Division 31 Section: EARTH MOVING
4. Division 32 Section: REINFORCED CONCRETE PAVING
5. Division 32 Section: SITE IMPROVEMENTS

1.5 SUBMITTALS

A. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, curing compounds, rebar mechanical splicers, expansion bolts, and other items if requested by the Landscape Architect. Contractor shall review all Contract Documents for all items that are required to be embedded in concrete and shall make necessary provisions as required so that reinforcing steel will not interfere with the placement of such embedded items.

B. Shop drawings for reinforcement detailing, fabricating, bending, and placing of all concrete reinforcement. Comply with ACI 315 showing bar schedules, stirrup spacing, bent bar diagrams, and arrangement of concrete reinforcement. Show reinforcing in elevation for beams and walls, show reinforcing in plan for slabs and toppings, show all reinforcing splices and labs, show dowels with concrete element to be cast first, and show details where interference of reinforcing may occur.

C. Name and address of Testing Laboratory for approval by Landscape Architect.

D. Submit two copies of laboratory test reports for concrete materials and mix designs tests as specified.

E. Corrective Work: submit shop drawings showing details of any proposed corrective work, prior to performing corrective work.

F. Concrete Curing and Protection: Submit to Landscape Architect detailed methods proposed for curing and protecting concrete in normal, cold, and hot conditions.

G. Mill Test Certification: Submit to Landscape Architect, prior to delivery of reinforcing steel or concrete to the job site, certified mill test reports of reinforcing steel and cement, (including names and locations of mills and shops, and analyses of chemical and physical properties), properly correlated to concrete to be used in this Project. This submittal is for information and file record.

H. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

I. The Contractor shall be responsible for furnishing and installing materials called for in Contract Documents, even though these materials may have been omitted from approved shop drawings.

J. Field quality control test and inspection reports.

1.6 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. Contractor shall select and the Owner shall approve a qualified independent testing agency to perform on-site observation and testing during the construction operations. Independent testing agency shall

be paid directly by the Contractor and reimbursed by the Owner upon submission of receipts for testing and observation services. Owner will not reimburse Contractor for testing services or field observation when test results indicate that materials do not meet the requirements of this Section.

1. Concrete shall be tested and reported for each batch.

B. Unless otherwise specified, work and materials for construction of the reinforced Portland cement concrete paving shall conform to ACI 316R, and applicable portions of the following:

1. MassDOT Specifications Section 476 Cement Concrete Pavement

C. Sampling and testing for quality control during concrete placement shall include the following, as directed by the Landscape Architect.

1. Sampling Fresh Concrete: ASTM C172, except modified for slump to comply with ASTM C94.
   a. Slump: ASTM C143; one test at point of discharge for each concrete truck load and one test for each set of compressive strength test specimens.
   b. Air Content: ASTM Cl73. volumetric method for light weight or normal weight concrete: ASTM C231, pressure method for normal weight concrete; one for each set of compressive strength specimens.
   c. Concrete Temperature: ASTM C1064; one test hourly when air temperature is 40 degrees Fahrenheit and below, when 80 degrees Fahrenheit and above, and one test for each set of compressive-strength specimens.
   d. Compression Test Specimen: ASTM C31: one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
   e. Compressive Strength Tests ASTM C39; one set for each day's pour exceeding 5 cu. yd. plus additional sets for each 50 cubic yards more than the first 25 cubic yards of each concrete class placed in any one day, one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five (5) randomly selected batches or from each batch if fewer than five are used.

3. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete

4. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 pounds per square inch (3.5 MPa).

C. Testing: All personnel and laboratories testing concrete shall be licensed by the Commonwealth of Massachusetts.

D. Forms and Reinforcing: The Contractor shall verify that forms and reinforcing steel have been installed in accordance with the specified requirements.

E. Test results shall be reported in writing to the Landscape Architect, Structural Engineer, and ready-mix producer within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.

F. Non-destructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

G. Additional Tests: The testing agency shall make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by the Landscape Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed

H. In the event the compressive strength of the cylinders, when tested, is below the specified minimum, the Owner may require test cores of the hardened structure to be taken by the Testing Laboratory in accordance with ASTM C42. If such test indicates that the core specimen is below the required strength, the concrete in question shall be removed and replaced without cost to the Owner. Any other work damaged as a result of this concrete removal shall be replaced with new materials to the satisfaction of the Owner at no additional cost to the Owner. The cost of coring will be deducted from the contract amount. Where core cylinders have been taken by the Testing Laboratory and the concrete proves to be satisfactory, core holes shall be filled in a manner satisfactory to the Owner at no additional cost to the Owner.

I. The Contractor shall coordinate the date and location of tests with the Owner before any concrete work is started.

J. The testing laboratory's presence does not include supervision or direction of the actual work by the Contractor, his employees, or agents. Neither the presence of the testing laboratory, any inspection wherever conducted, nor any observations and testing performed by the testing laboratory shall excuse the Contractor from defects discovered in his work, nor relieve the Contractor of his responsibility to furnish materials and workmanship in accordance with Contract requirements, nor shall inspector's acceptance of material or workmanship prevent later rejection of same by the Landscape Architect if defects are discovered.

1.7 PRODUCT DELIVERY, STORAGE & HANDLING

A. Reinforcing steel shall be transported to the site, stored, and covered in a manner which will ensure that no damage shall occur to it from moisture, dirt, grease, or any other cause that might impair bond to concrete. Store reinforcement steel on wood skids to protect it from weather, oil, earth, and damage from trucking or other construction operations. A sufficient supply of approved reinforcing steel shall be stored on the site at all times to ensure that there will be no delay of the work. Reinforcement shall be free from loose mill scale, rust, form oil, concrete splatter, and other extraneous coating at the time it is embedded in the concrete.

B. Cement and aggregates shall be stored in such a manner as to prevent deterioration or intrusion of foreign matter. Any materials which have deteriorated, or which have been damaged, shall not be used for concrete.

C. Identification of steel shall be maintained after bundles are broken.

1.8 EXAMINATION OF SITE AND DOCUMENTS

A. The Contractor shall carefully examine the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of lack of full knowledge of existing conditions as indicated in the Contract Documents, or obvious from observations from the site.

B. Examine Contract Documents, surveys, measurements, and dimensions during the bid period. Any discrepancies, errors or omissions shall be brought to the attention of the Landscape Architect prior to submission of a bid.

1.9 USE OF SITE

A. The Contractor shall conduct his operations so as to interfere as little as possible with the use ordinarily made of roads, driveways, sidewalks or other facilities near enough to the work to be affected thereby.

1.10 PERMITS AND CODES

A. Comply with the local, state and federal rules, regulations, laws and ordinances, and of all other authorities having jurisdiction. All labor, materials, equipment, and services necessary to make the work comply with such requirements shall be provided without additional cost to the Owner.

1.11 RECORD DOCUMENTS

A. Accurately record actual locations of embedded utilities and components which are concealed from view.

B. Field quality control and inspection reports.

1.12 QUALITY ASSURANCE

A. Pre-installation Conference: Conduct conference at Project site to comply with requirements of the Contract and the following:

1. At least 30 days prior to submitting design mixes, conduct a meeting to review detailed requirements for preparing concrete design mixes and to determine procedures for satisfactory concrete operations. Review requirements for submittals, status of coordinating work, and availability of materials. Establish preliminary work progress schedule for procedures for materials inspection, testing and certifications. Require representatives of each entity directly concerned with cast-in-place concrete to attend conference, including, but not limited to, the following:
   a. Contractor's superintendent
   b. Agency responsible for concrete design mixes
   c. Agency responsible for field quality control
   d. Ready-mix concrete producer
   e. Concrete subcontractor
   f. Primary admixture manufacturer

B. Perform work in accordance with ACI 301.

C. Conform to ACI 305R when concreting during hot weather. Conform to ACR 360R when concreting during cold weather.

D. Detailing and construction of formwork, shoring and bracing shall be sufficient to maintain required alignments and surfaces. All work shall conform to ACI 318 and ACI 301, the Massachusetts State Building Code, and accepted construction practice.

E. Reinforcing steel detailing and installation shall be in accordance with CRSI - Manual of Standard Practice, ACI SP-66, and ACI 318.

F. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field-Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
   2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician – Grade II.

G. Concrete Testing Service: The Owner will engage a qualified independent testing agency to perform material evaluation tests and to verify concrete mixtures as described in section 3.07. Materials and workmanship shall be subjected to inspection and testing in mill, shop and/or field by Designer and/or Testing Agency. Such inspection and testing shall not relieve Contractor of his responsibility to provide his own inspection, testing, and quality control as necessary to furnish materials and workmanship in accordance with requirements of this section.

1. During progress of work, provide free and safe access to work at all times to Landscape Architect and Testing Agency so as to make possible proper inspection of work.
2. Notify Architect and Testing Agency prior to start of any phase of concrete work so as to afford them reasonable opportunity to inspect work. Such notification shall be made at least 24 hours in advance for concrete placements and at least 36 hours in advance for other inspections.

PART 2 – PRODUCTS

2.1 CONCRETE MATERIALS

A. Portland Cement shall be ASTM C150, Type I or II, free from water-soluble salts or alkalies which will cause efflorescence on exposed surfaces. Only one brand of cement shall be used on the project.

B. Fly ash shall conform to the requirements of ASTM C618, Type C. Fly ash shall not exceed 25 percent of cement content by weight.

C. Aggregates:

1. Fine Aggregates for Concrete: Shall be natural sand consisting of clean, hard, durable, uncoated particles, conforming to ASTM C33. Organic content shall be determined according to ASTM C33. Organic content shall be determined according to ASTM C40, and supernatant liquid above test sample shall show color no darker than reference standard color solution prepared at the same time. Allow no frozen or partially frozen aggregate in the mix.

2. Coarse Aggregate for Concrete: Use crushed stone or gravel from approved source conforming to ASTM C33. Maximum size aggregate to be 0.75 inch.

D. Lightweight Fine and Coarse Aggregates: Rotary kiln expanded shale and conforming to ASTM C330 and as specified in this Section. Aggregate sizes shall include fine aggregate designated as “sand size”, and coarse aggregate designated as graded three-quarters of an inch size.

E. Admixtures:

1. Calcium chloride, triocynanates, and admixtures containing more than 0.05 percent chloride ions are not permitted.
2. Air-entraining Agent shall conform to ASTM C260 for Air-entraining Admixtures for Concrete. Air-entraining agent must be by the same manufacturer as water-reducing agent.
3. Water Reducing Agent shall conform to ASTM C494 Type A for Chemical Admixtures for Concrete. Water-reducing agent must be by the same manufacturer as air-entraining agent.
4. High-range water reducing admixture (Super Plasticizer) shall conform to ASTM C494, type For Type G.
5. Water-reducing set retarders shall conform to ASTM C494 Type D and may be used when ambient temperatures exceed 80 degrees Fahrenheit. Do not use without specific approval of the Landscape Architect.
6. Accelerator admixture shall be a non-chloride and non-corrosive accelerator conforming to ASTM C494 Type C and may be used when temperatures are below 50 degrees Fahrenheit. Do not use without specific approval of the Landscape Architect.
7. Corrosion inhibitor admixture shall be a calcium nitrite-based inhibitor complying with AASHTO M194 type C, such as W.R. Grace DCI Corrosion Inhibitor” or approved equal, applied at the rate of 4.0 gallons per cubic yard of concrete

F. Water from approved source shall be potable, clean, and free of oils, salt, alkali, organic matter and other deleterious materials detrimental to concrete.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars shall be new, deformed billet steel bars, conforming to ASTM A615, Grade 60 deformed.

B. Welded wire fabric shall conform to the requirements of ASTM A185.

C. Reinforcing Mesh shall be new deformed wire fabric conforming to ASTM A496 and A 497

D. Stainless steel pins and stainless steel rods shall conform to ASTM A276, and shall be sized as noted on the Contract Documents.

E. Reinforcement accessories, consisting of spacers, chairs, ties, and similar items shall be provided as required for spacing, assembling, and supporting reinforcement in place. All accessories shall be dielectric coated steel or approved plastic accessories, conforming to the applicable requirements of the CRSI Standards specified in this Section.

2. At all other reinforcement: For slabs on grade, use supports with sand plates or horizontal runners where base material will not support chair legs. Tie wire shall be annealed wire of sufficient strength for intended purpose but not less than 18 gauge. Supports touching interior formed surfaces exposed to view shall be CRSI Class 1, plastic protected, or CRSI Class 2, stainless steel.

F. Tie wire for reinforcement shall be 16 gauge or heavier dielectric coated steel or approved plastic accessories, conforming to the applicable requirements of ASTM A82.

2.3 FORMWORK, COATINGS & ACCESSORIES

A Formwork:

1. Forms for Exposed Finish Concrete: Unless otherwise shown or specified, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood faced or other acceptable panel type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practical sizes to minimize number of joints and to conform to joint locations shown on the Contract Documents. Where plywood is used, use plywood complying with U. S. Product Standard PS-1 “B-B (Concrete form) Plywood,” Class 1, Exterior Grade or better, mill-oiled, and edge-sealed, with each piece bearing legible inspection trademark. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflections.
2. Forms for Unexposed Finish Concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal, or other acceptable materials. Provide lumber dressed on at lease two edges and one side for tight fit.
3. Chamfer Strips: Use one-half of an inch, 45-degree strips, nailed 6 inches on center, and installed in inside corners of all forms, unless otherwise directed by the Landscape Architect or shown on the Contract Drawings.

B. Form Coatings shall be non-grain raising and non-staining type that will not leave residual matter on surface of concrete or adversely affect proper bonding of subsequent application of other material applied to concrete surface. Agent shall be chemically active, shall minimize surface voids, leave no residual on concrete, produce a smooth, architectural concrete surface, and shall be specifically formulated for application to the forms used by the Contractor. Coating containing mineral oil or the non-drying ingredients will not be permitted. Provide form release agent with a maximum of 350 mg/l volatile organic compounds (VOCs).

C. Form Ties and Spreaders: Standard metal form clamp assemble and plastic cone, factory-fabricated, adjustable-length, removable or snap-off metal, of type acting as spreaders and leaving no metal within one inch of concrete face. Designed to prevent form deflection and to prevent spalling of concrete upon removal. Inner tie rod shall be left in concrete when forms are removed. No wire ties or wood spreaders will be permitted. Use 1/2 of an inch x 1 inch plastic cones for sinkages.

2.4 RELATED MATERIALS

A. Bonding Agent system shall be an epoxy resin/Portland cement adhesive bonding agent for steel and concrete meeting ASTM C881 Bond Strength Requirements.

1. Component “A” shall be an epoxy resin/water emulsion containing suitable viscosity control agents. It shall not contain butyl glycidyl ether.
2. Component “B” shall be primarily a water solution of a polyamine.
3. Component C” shall be a blend of selected Portland cements and sands.
4. The material shall not contain asbestos.
5. Properties of the mixed epoxy resin/Portland cement adhesive
   a. Pot Life: 75-105 minutes
   b. Contact Time: 24 hours
   c. Color: dark gray
6. Properties of the cured epoxy resin/Portland cement adhesive.
   a. Compressive Strength (ASTM C109)
      i. 1 day: 810 psi minimum
      ii. 7 day: 6,000 psi minimum
      iii. 28 day: 8,000 psi minimum
   b. Splitting Tensile Strength (ASTM C496)
      i. 28 days: 540 psi minimum.
   c. Flexural Strength (ASTM C348)
      i. 1100 psi minimum
   d. Bond Strength (ASTM C882 modified) at 14 days
      i. 0 hrs. open time: 1,900 psi minimum
      ii. 24 hrs. open time: 1,500 psi minimum
7. The epoxy resin/Portland cement adhesive shall not produce a vapor barrier.
8. Material must be proven to prevent corrosion of reinforcing steel when tested under the procedures as set forth by the Federal Highway Administration Program Report No. FHWAJRD86/193. Proof shall be in the form of an independent testing laboratory corrosion report showing prevention of corrosion of the reinforcing steel.

B. Joint Filler: Where used with caulking or sealants, it shall be non-extruding, self-expanding filler strips conforming to AASHTO-M153, Type II, as manufactured by Celotex Corporation, W.R. Meadows, Inc., W.R. Grace and Company, or, approved equal.

C. Grout shall be a non-staining, non-shrink cement grout conforming to ASTM C-827 and Army Corps of Engineers Specification CRD-C-621. Grout shall contain no metals. Grout shall be one of the following or an approved equal:

1. Five Star Grout
   U.S. Grout Corporation
   401 Stillson Road
   Fairfield, CT 06430

2. Sika Grout 212
   Sika Corporation
   201 Polito Avenue
   Lyndhurst, NJ 07071

3. Harris Construction Grout
   A.H. Harris & Sons Inc.
   10 West Mill Street
   Medfield, MA 02052

D. Provide vapor barrier over prepared base material beneath slabs on ground. Use only materials that are resistant to decay when tested in accordance with ASTM E154. Use polyethylene sheet not less than 6 mils thick or approved equivalent. Cover vapor barrier with 3 inches of sand to prevent shrinkage cracks in slab.

E. Concrete Curing Membranes conforming to ASTM C171:

1. Polyethylene film
2. Polyethylene-coated burlap
3. Waterproof paper

F. Absorptive cover shall be burlap cloth made from jute or kenat, weighing approximately 9 ounces per square yard complying with AASHTO M182, Class 2.

G. Expansion bolts shall be hot-dipped galvanized bolts conforming to Federal Spec. FF-S-325, Group II, Type 4, Class 1. Allowable pullout and shear values shall be based on ASTM E488 spacings. Use one of the following or approved equal:

1. “Molly Parabolt”, USM Corporation
2. “Kwikbolt”, Hilti Incorporated
3. “Red head Wedge Anchor”, ITT Philips Drill Division.

H. Concrete wash out bag shall be used such as an EnviroSac or approved equal.

I. Base material shall be as specified, provided, installed, and paid for under Division 31 Section, EARTH MOVING, of this Specification.

2.5 CONCRETE MIXES

A. Cast-in-place concrete shall conform to the requirements and applicable provisions of Section M4 of the MassDOT Standard Specification. Minimum 28-day compressive strength shall be 4,000 pounds per square inch (30 MPa). Slump of concrete shall be 4 inches.

1. Maximum allowable net water content is the total water in the mix at the time of mixing, including free water on aggregate.
2. Consider any fly ash as part of the cement content for purposes of establishing cement factor and w/c ratio. Limit use of fly ash to not exceed 25 percent of cement content by weight.
3. Use maximum water-cement equal to 0.45 for concrete subject to freezing and thawing, repeated surface wetting or deicers.

B. Normal weight concrete shall have an air-dry weight not exceeding 150 pounds per cubic foot.

C. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

1. Slabs, including concrete topping slabs, ramps, and sloped surfaces: Not more than 3 inches.
2. Concrete containing high-range water-reducing admixtures (superplasticizer): Not more than 8 inches after adding admixture to site-verified 2- to 3-inch slump concrete.
3. Lightweight concrete: Not more than 5 inches.
4. Other concrete: Not more than 4 inches.

D. Air-entraining and water-reducing agents shall be used in all concrete in strict accordance with the manufacturer's printed instructions. Total air-entrained in freshly mixed concrete shall be 5 percent plus or minus 1.0 percent of volume of concrete.

E. The proportions of aggregate to cement for any concrete shall be such as to produce a mixture which will work readily into the corners and angles of the forms and around reinforcement with the method of placing employed not the work, but without permitting the materials to segregate or excess free water to collect on the surface.

F. Pre-mix admixtures in solution form and dispense as recommended by the manufacturer. Include the water in the solution in the design water content of the mixtures.

G. Maximum water-soluble chloride ion (C1-) in concrete: 0.10 percent by weight of cement.

2.6 ADMIXTURES

A. Use water-reducing admixture or high-range water-reducing admixture (super plasticizer) in concrete, as required by site conditions and approved by the Landscape Architect, for placement and workability.

B. Use accelerating admixture in concrete slabs placed at ambient temperatures below 50 degrees Fahrenheit.

C. Use corrosion inhibitor admixture in concrete that will be exposed to a corrosive environment, including waterproofing base slab, topping, and wearing slabs subject to vehicular traffic.

D. Use high-range water-reducing admixture in pumped concrete, and concrete with water-cement ratios below 0.45.

E. Use air-entraining admixture in concrete exposes to exterior environment and in accordance with manufacturer's written instructions. Interior protected concrete may be air entrained for improved workability. See ACI 301 Table 3.4.1 for required air content except that maximum for all sizes of aggregate shall be 6 percent in exterior environments. Tolerance at point of placement shall be plus or minus one percent.

F. Use admixtures for water reduction and set accelerating or retarding in strict compliance with manufacturer's directions.

2.7 CONCRETE MIXING AND DELIVERY

A. Ready-Mixed Concrete: use ready-mixed concrete produced by plant acceptable to the Landscape Architect. Hand or site mixing shall not be done. Batch constituents, including admixtures, at central plant. Admixtures shall be premixed in solution form and dispensed as recommended by manufacturer. Comply with requirements of ASTM C94, and as specified.

1. When air temperature is between 85 degrees Fahrenheit and 90 degree Fahrenheit, reduce mixing and delivery time from 90 minutes to 75 minutes, and when air temperature is above 90 degrees Fahrenheit, reduce mixing and delivery time to 60 minutes.

2. For normal weight concrete, water may be added at the site only to makeup water withheld at the plant. Batching plant shall document at the driver's delivery ticket any water withheld at the plant. When water has not been withheld and slump is too low for proper handling of concrete, use high-range water reducing admixture to bring slump within specified range.

B. Transport ready-mixed concrete to the site in watertight agitator or mixer trucks loaded not in excess of rated capacities. Discharge at site within one and one-half hours after cement was first introduced into mix. Do not use concrete with a temperature greater than 85 degrees Fahrenheit (30 degrees Centigrade). Central mixed concrete shall be plant-mixed a minimum of five minutes. Agitation shall begin immediately after premixed concrete is placed in truck and shall continue without interruption until discharged. Transit-mixed concrete shall be mixed at mixing speed for at least ten minutes immediately after charging truck followed by agitation without interruption until discharged.

C. Do not re-temper (mixing with or without additional cement, aggregates, or water) concrete that has partially hardened.

2.8 MISCELLANEOUS

A. Retaining wall to have processed gravel for drainage, non-woven filter fabric and PVC drainpipe as specified on the Contract Drawings, as installed and paid for under Division 31 Section, EARTH MOVING.

B. Bond breaker shall be asphalt felt conforming to ASTM D 226, Type I or 6 mil polyethylene sheeting.

PART 3 – EXECUTION

3.1 FORMS

A. General: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Forms shall be so braced and tied together that the movement of men, equipment, materials, or placing and vibrating the concrete will not throw them out of line or position. Securely brace and shore forms, making them sufficiently tight, to prevent the leakage of concrete. Construct formwork so concrete members and

structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances and surface irregularities complying with the following A.C.I. 347 limits

1. Provide Class A tolerances for concrete surfaces exposed to view.
2. Provide Class B tolerances for all formed concrete surfaces.

B. Construct forms to sizes, shapes, lines and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.

C. 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. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal.

D. Provide temporary openings for clean-outs and inspections where interior area of formwork is inaccessible before and during concrete placement. Securely brace temporary openings and set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.

E. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

F. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

G. Openings for Items Passing through Concrete: Contractor shall establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other sections. Contractor shall be held responsible for proper coordination of all work of this nature in order that there will be no unnecessary cutting and patching of concrete. Any cutting and repairing to concrete required as a result of failure to provide for such openings shall be paid for by the Contractor at no additional expense to the Owner.

H. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

3.2 PLACING REINFORCEMENT

A. General: Place reinforcing steel in accordance with the Contract Documents and approved Shop Drawings. Comply with CRSI’s Recommended Practice for Placing Reinforcing Bars, for details and methods of reinforcement placement and supports.

1. Install reinforcement accurately and secured against movement, particularly under the weight of workmen, the placement of concrete and vibration work.
2. Reinforcing Steel Supports: Bars shall be supported on approved plastic or dielectric-coated metal chairs or spacers, accurately placed and securely fastened to forms or steel reinforcement in place. Additional bars shall be supplied, whether specifically shown on the Contract Documents or not, where necessary to securely fasten reinforcement in place. Support legs of accessories in forms without embedding in form surface. Spacing of chairs and accessories shall conform to CRSI's "Recommended Practice for Placing Bar Support". Hooping and stirrups shall be accurately spaced and wired to the reinforcement. No wood will be permitted inside forms. Lifting of welded wire fabric into proper position while concrete is being poured rather than supporting fabric on chairs will not be permitted.
3. Placing and Tying: All reinforcement shall be set in place, spaced, and rigidly and securely tied or wired with tie wire at all splices and at all crossing points and intersections in the positions shown, or as directed. Re-bending of bars on the job to accommodate the job to accommodate

existing conditions will not be permitted without the written approval of the Owner. Point ends of wire ties away from forms.

4. Spacing: Minimum center to center distance between parallel bars shall be in accordance with the details on the Contract Documents, or, where not shown, the clear spacing shall be 2 times the bar diameter but in no case less than 1-1/2 inches or less than 1.5 times the maximum size aggregate.
5. Splices shall be in accordance with the following:
   a. Maximum 50 percent of steel spliced occurring within lap length.
   b. Splice lengths: #6 bars and smaller - 30 bar diameter
6. Protective Concrete covering
   a. Except where shown otherwise on Contract Documents, the minimum concrete coverage for steel reinforcement shall conform with the applicable revisions of the "Codes and Standards" previously specified in this Section. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
7. Dowels and Sleeves
   a. Install expansion dowels and sleeves perpendicular to and across expansion joints in concrete at 24 inches on center minimum, or as shown on the Contract Documents. Core drill existing concrete where required and grout non-sleeved end of dowel in place. After grout has set, bend dowel and sleeve as required to level before pouring new concrete.

B. When required or permitted, mechanical connections shall be installed per manufacturer’s recommendations. After installation of mechanical connections on epoxy-coated reinforcing bars, coating damage shall be repaired in accordance with the requirements of this Section for repair of coating damage due to handling, shipment and placing. All parts of mechanical connections used on coated bars, including steel splice sleeves, bolts, and nuts shall be coated with the same material used for repair of rebar coating damage.

C. Do not bend, tack weld, or cut reinforcement in field in any manner other than as shown on Contract Documents unless specific approval for each case is given by Landscape Architect.

D. Continue reinforcement through construction joints unless otherwise indicated on Contract Documents.

E. Splice reinforcement only in accordance with requirements of Contract Documents or as otherwise specifically approved by Landscape Architect. Do not splice reinforcement at points of maximum stress unless shown on the Contract Documents.

F. Clean reinforcement of earth, ice, and other materials that reduce or destroy bond with concrete; also, clean uncoated reinforcement of loose rust and mill scale. Paint reinforcement expected to be exposed to weather for a considerable length of time with a heavy coat of cement grout. Protect stored materials so as not to bend or distort bars in any way. Bars that become damaged will be rejected.

G. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by the Landscape Architect.

H. Install welded wire fabric in lengths as long as practicable lap adjoining pieces by 12 inches and as indicated and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

I. Before concrete is cast, check all reinforcement after it is placed to ensure that reinforcement conforms to Contract Documents and approved Shop Drawings. Such checking shall be done only by qualified experienced personnel. In addition, notify the Landscape Architect at least 36 hours prior to concrete placement so a visit may be made to observe completed reinforcement and formwork before concrete placement.

3.3 JOINTS

A. Construction Joints

1. Construction joints shall be placed a maximum of 40 feet apart. The Contractor shall prepare a placing plan for location of construction joints and submit it to the Landscape Architect for approval. Locate and install construction joints so they do not impair strength or appearance of the structure. Where a joint is to be made, the surface of the concrete shall be sandblasted or thoroughly picked, thoroughly cleaned, and all laitance removed. In addition to the foregoing, joints shall be thoroughly wetted, but not saturated, and slushed with a coat of grout immediately before the placing of new concrete. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise. Forms shall be re-tightened before placing of concrete is continued. There shall be an interval of at least 48 hours between adjacent pours.

B. Expansion Joints

1. Expansion joints in walls or wall caps shall include joint sealant and installed as indicated on Contract Documents. Expansion joints shall be placed a maximum of 30 feet on center in walls and wall caps. Expansion joints shall be one half of an inch wide. Follow manufacturer's recommendations for filler and sealant.

3.4 INSTALLING EMBEDDED ITEMS

A General: Set and build into formwork anchorage devices, sleeves, and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.

B. Conform to requirements of ACI 318, paragraph 6.3, Conduits and Pipes Embedded in Concrete”.

C. Install anchor bolts for column base plates in accordance with AISC Code of Standard Practice, Paragraph 7.5 and the following: Use setting plate templates. Maintain elevations and plan locations of bolt groups within one-quarter of an inch of the locations shown on the Contract Documents. Place individual bolts in a bolt group within one-eighth of an inch of center-to-center dimensions shown on the Contract Documents.

D. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

E. Complete cooperation shall be extended suppliers of embedded items in their installation. Secure information for embedded items from other trades as required. All embedded items shall be securely anchored in correct location and alignment prior to placing concrete.

3.5 PREPARING FORM SURFACES

A General: Coat contact surfaces for forms with an approved form-coating compound before placing reinforcement.

B Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer’s instructions.

1. Coat steel forms with a non-staining, rust-preventative material. Rust-stained steel formwork is not acceptable.
2. Do not coat steel deck in composite steel deck and concrete slabs.

3.6 CONCRETE PLACEMENT

A. Inspection 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.

B. General: Comply with ACI 304, Guide for Measuring, Mixing, Transporting, and Placing Concrete”, and as specified.

C. If concrete pumping is proposed, refer to “Submittals” paragraph in this Section for requirements. Concrete may be placed into the pump at the maximum but not more than the specified slump.

D. Remove water and foreign matter from forms and excavations and, except in the freezing weather or as otherwise directed, thoroughly soak wood forms just prior to placing concrete. Place no concrete on frozen substrate and provide adequate protection against frost action during freezing weather.

E. To secure bond at construction joints, thoroughly clean concrete surfaces with water jet or compressed air. Just before new concrete is deposited, saturate joint surface with water for not less than 2 hours, leaving surface without free or glistening water.

F. Do not place concrete having slump outside of allowable slump range. The loss of slump between pump and discharge end of pipeline shall not exceed 2 inches.

G. Transport concrete from mixer to place of final deposit as rapidly as practical by methods which prevent separation of ingredients and displacement of reinforcement, and which avoid re-handling. Deposit no partially hardened concrete. When concrete is conveyed by chutes, equipment shall be of such size and U-shaped design as to insure continuous flow in chute. Do not use flat (coal) chutes, use metal or metal-lined chutes with different portions having approximately the same slope. Slope shall not be less than 25 degrees nor more than 45 degrees from horizontal. Use a baffle or spout at the discharge end of the chute to prevent segregation. If discharge end of chute is more than 5 feet above surface of concrete in forms, use spout with its lower end at surface of deposit. When operation is intermittent, discharge chute into hopper. Do not allow concrete to flow horizontally over distances exceeding 5 feet.

H. Place concrete in such manner as to prevent segregation and accumulations of hardened concrete on forms or reinforcement above mass of concrete being placed. To achieve this end, use suitable hoppers, spouts with restricted outlets and tremies as required.

I. During and immediately after depositing, compact concrete in accordance with ACI 309 by means of internal type mechanical vibrators or other tools to produce required quality of finish. Vibration shall be done by experienced operators under close supervision and shall be performed only enough to produce homogeneity and optimum consolidation without permitting segregation of constituents or ‘pumping’ of air. Vibrators used for normal weight concrete shall operate at speed of not less than 7,000 RPM and be of suitable capacity. Do not use vibrators to move concrete. Keep at least one vibrator on hand for every 10 cubic yards of concrete placed per hour, plus one spare. Vibrators shall be operable and on site prior to starting placement.

J. Place vertical lifts to not exceed 18 inches. Vibrate through successive lifts to avoid pour lines. Vibrate first lift thoroughly until top of lift glistens to avoid stone pockets, honeycomb, and segregation.

K. Deposit concrete continuously, and in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause formation of seams and planes of weakness within section. If section cannot be placed continuously between planned construction joints, as specified, introduce a joint and additional reinforcement so as to preserve structural continuity. Notify Landscape Architect in any such case.

L. Cold joints, particularly in exposed concrete, including ‘honeycomb”, are unacceptable. If they occur, Landscape Architect may require that entire section in which such defect occurs be removed and replaced with new materials at Contractor’s expense

M. When placing exposed concrete walls or beams, strike corners of forms rapidly and repeatedly from outside along full height while depositing concrete and vibrating.

N. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.

1. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.

2. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
3. Maintain reinforcing in proper position on chairs during concrete placement.

O. Clean chutes, hoppers, spouts, adjacent work, etc. before and after each run; discharge water and debris outside form.

P. Temperature of the concrete mix should be between 50 degrees Fahrenheit and 85 degrees Fahrenheit and it should not vary more than approximately 10 degrees Fahrenheit from the temperature of the concrete against which it is placed.

Q. Cold-weather Placement: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

R. When air temperature has fallen to or is expected to fall below 40 degrees Fahrenheit, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 degrees Fahrenheit and not more than 80 degrees Fahrenheit at point of placement.

1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
2. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.
3. Concrete and formwork must be kept at a temperature of not less than 50 degrees Fahrenheit for not less than 96 hours after placing.

S. Hot-weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 85 degrees Fahrenheit. Mixing water may be chilled or chipped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor’s option.
2. No concrete shall be deposited when the air temperature is greater than 90 degrees Fahrenheit.
3. Cover reinforcing steel with water-soaked burlap if it becomes too hot so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
4. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas
5. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to the Landscape Architect.

T. No water shall be add to the mix on site.

3.7 FINISHING FORMED SURFACES

A. Concrete Finish Schedule

1. Exposed Horizontal Surfaces
   a. Exposed horizontal concrete surfaces subject to pedestrian foot traffic shall receive a non-slip broom finish after troweling.
2. Exposed Vertical Surfaces
   a. Exposed vertical surfaces shall have a smooth-formed finish.
3. Hidden Vertical Surfaces
   a. Hidden vertical surfaces shall be rough-formed.

B. Definitions

1. Non-slip Broom Finish: Apply a non-slip broom finish to all slabs subject to vehicular traffic, loading dock platforms, exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

a. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route Coordinate required final finish with the Landscape Architect before application.

2. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, damp-proofing, veneer plaster, painting, or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed. Clean and dampen tie holes and fill solid with patching material immediately after form removal.
3. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 0.25 inch (6 mm) in height rubbed down or chipped off. Clean and dampen tie-holes and fill solid with patching material immediately after form removal

3.8 MISCELLANEOUS CONCRETE ITEMS

A. Ready-mix or transit-mixed concrete shall be transported to the site in watertight agitator or mixer trucks loaded not in excess of rated capacities for the respective conditions as stated on the nameplate. Discharge at the site shall be within 1-1/2 hours after cement was first introduced into the mix. Central mixed concrete shall be plant-mixed a minimum of 1-1/2 minutes per batch and then shall be truck-mixed or agitated a minimum of 8 minutes. Agitation shall begin immediately after the pre-mixed concrete is placed in the truck and shall continue without interruption until discharge. Transit-mixed concrete shall be mixed at mixing speed for at least 10 minutes immediately after charging the truck, followed by agitation without interruption until discharged.

.

B. Concrete trucks will not be allowed to wash out into the park or city drainage system. A concrete wash out bag shall be used such as an EnviroSac or approved equal.

C. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work.

D. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Contract Documents. Set anchor bolts for machines and equipment to template at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.9 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Where corrosion inhibitor admixture has been used, provide continuous water-fog spray or mist or evaporation retardant to prevent plastic shrinkage cracks during initial setting time. In hot, dry and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

B Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing Weather permitting, keep continuously moist for not less than 7 days

C. Curing Methods: Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified.

D. Provide moisture curing by the following methods:
1. Keep concrete surface continuously wet by covering with water.
2. Use continuous water-fog spray

3. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4-inch lap over adjacent absorptive covers.

E Provide moisture-retaining cover curing as follows:

1. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

F Apply curing compound on slabs, concrete toppings, equipment pads and curbs as follows:

1. Apply curing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
2. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.

G. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

H. Curing Unformed Surfaces: Cure unformed surfaces, including tops of beams, and other flat surfaces, by applying the appropriate curing method.

3.10 SHORES AND SUPPORTS

A. General: Comply with ACI 347 for shoring, and as specified

B. Remove shores and re-shore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to support work without excessive stress or deflection.

3.11 REMOVING FORMS

A. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 degrees Fahrenheit for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained

B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than 14 days or until concrete has attained at least 75 percent of its specified 28-day minimum compressive strength. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

C. Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

D. All forms and miscellaneous appurtenances shall be removed from concrete prior to the closeout of the work.

3.12 REUSING FORMS

A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed concrete surfaces. Apply new form-coating compound as specified for new formwork

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure Joint to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to the Landscape Architect.

3.13 CONCRETE SURFACE REPAIRS

A. Intent of this Specification is to require forms, mixtures of concrete, and workmanship to be of the very best quality so that final, stripped concrete surfaces will require no patching, except for plugging of tie holes.

B. Clean and dampen tie holes and fill solid with patching mortar immediately after form removal.

C. Patching Defective Areas: Patch and repair defective areas, as specified, only after examination and approval by the Landscape Architect. Repair and patch as soon as possible after removing forms, in compliance with ACI 301 Chapter 9 and as specified in this Section.

D. Mix dry-pack mortar, consisting of one-part Portland cement to 0.5-parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.

1 Cut out honeycombs, rock pockets, voids over 1/4 of an inch in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch. Make edges of cuts perpendicular to the concrete surface. If honeycomb exists around reinforcement, chip to provide clear space at least 3/4 of an inch wide all around steel to ensure proper bond thereto. Thoroughly clean, dampen with water, and brush-coat the area to be patched with epoxy adhesive. Place patching mortar before epoxy adhesive has dried. Repairs thicker than 1-1/2 inches shall be built-up on successive days, each layer of 1½ inches being applied as described in ACI 301 Chapter 9.
2. Remove and replace patches that become crazed, cracked, or sound hollow upon tapping, at Contractor’s expense.

E. Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of the Landscape Architect. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar

1. Repair concealed formed surfaces containing defects that affect the concrete’s durability. If defects cannot be repaired, remove and replace the concrete.

F. Repairing Unformed Surfaces (except concrete pavements): Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope

1. Repair finished unformed surfaces containing defects that affect the concrete’s durability. Surface defects include crazing and cracks in excess of 0.01 of an inch wide or that penetrate to the reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycombs, rock pockets, and other objectionable conditions.
2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
3. Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used subject to the approval of the Landscape Architect
4. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4 of an inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. 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.

G Repair isolated random cracks and single holes 1 inch or less 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. Place dry-pack before bonding agent has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched areas continuously moist for at least 72 hours.

H. Perform structural repairs with prior approval of the Landscape Architect for method and procedure, using specified epoxy adhesive and mortar.

I. Repair methods not specified above may be used, subject to acceptance of the Landscape Architect.

3.14 ACCEPTANCE STANDARDS

A. The following concrete work shall be considered defective and may be ordered by the Owner to be removed and replaced at Contractor's expense:

1. Incorrectly formed.
2. Not plumb or level.
3. Not specified strength.
4. Containing rock pockets, voids, honeycomb, or cold joints.
5. Containing wood or foreign matter.
6. Surface texture does not conform to the requirements of the Contract Documents.
7. Forms and miscellaneous appurtenances not removed.
8. Otherwise not in accordance with the intent of the Contract Documents.

END OF SECTION

SECTION 05 05 13: FACTORY-APPLIED COATINGS FOR METAL – Add Alternate

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SECTION INCLUDES

A. This Section specifies factory-applied metal coatings including the following:

1. Hot-dip galvanizing and factory- applied high performance Polyamide Epoxy Powder Primer and a High Performance Fluoropolymer Powder Urethane coating for iron and steel fabrications:
   a. Ornamental steel picket fence - Add Alternate #3

1.3 RELATED WORK UNDER OTHER SECTIONS

A. Examine Contract Documents for requirements that affect Work of this Section. Other Specification Sections that directly relate to Work of this Section include, but are not limited to:

1. Division 03 Section: CAST-IN-PLACE CONCRETE
2. Division 05 Section: SITE METAL FURNISHINGS – Add Alternate
3. Division 32 Section: REINFORCED CONCRETE PAVING
4. Division 32 Section: SITE IMPROVEMENTS

1.4 REFERENCES

A. The following standards shall apply to the work of this Section.

1. American Society for Testing and Materials (ASTM):

A90/A90M	Standard Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc Alloy Coatings
A123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A153/A153M	Standard Specification for Zinc Coating (Hot-dip) on Iron and Steel Hardware
A307	Standard Specification for Carbon Steel Bolts, Studs and Threaded Rod 60,000 PSI Tensile Strength
A385	Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)
A 500/A500M	Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
A780	Standard Practice for Repair of Damaged and Uncoated Areas of hot-Dip Galvanized Coatings
A900/A900M	Standard Test Method for Lamination Factor of Amorphous Magnetic Strips
A1011/A1011M	Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Allow, High Strength Low-Alloy with Improved Formability and Ultra-High Strength
B6	Standard Specification for Zinc
B117	Standard Practice for Operating Salt Spray (Fog) Apparatus
D522	Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings
D523	Standard Test Method for Specular Gloss
D2244	Standard Practice for Calculation of Color Tolerances and Color Differences form Instrumentally Measured Color Coordinates
D2794	Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid

Deformation (Impact)
D3359 Standard Test Methods for Rating Adhesion by Tape Test
D3363 Standard Test Method Film Hardness by Pencil Test
D4214 Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films
D4585 Standard Practice for Testing Water Resistance of Coatings Using Controlled Condensation
D4798 Standard Practice for Accelerated Weathering Text Conditions and Procedures for Bituminous Materials (Xenon-Arc Method)
F1083 Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures

2. Society for Protective Coatings (SSPC):
QP 3 Qualification Procedure: Paint Shops
PA 2 Paint Application: Determining Compliance to Required DFT
SP 1 Surface Preparation: Solvent Cleaning
SP 7 Surface Preparation: Brush-off Blast Cleaning
SP 8 Surface Preparation: Pickling
3. Federal Standard 595B: U.S. Government Federal Standard Paint Colors
4. American Welding Society (AWS):
D1.1 Structural Welding Code

5. Massachusetts Department of Transportation (MassDOT)
Specifications Standard Specifications for Highways and Bridges

1.5 SUBMITTALS

A. Product Literature: Submit galvanizer's product literature for coatings specified in this Section indicating type of product and performance criteria.

B. Submit manufacturer's product data and certification for the following:

1. Primer and paint products

C. Verification Samples: Submit two (2) 3-inch x 6-inch samples of factory-applied coatings and colors proposed for use for approval prior to coating application.

D. Certificate of Compliance for Items Coated by Galvanizer: If requested, submit notarized Certificate of Compliance with application for payment for galvanizing, signed by the galvanizer, indicating compliance with requirements of specifications. Include scope of services provided, and quantity and itemized description of items processed.

E. Certificate of Compliance for Shop Drawing Review by Galvanizer: If requested, submit galvanizer's certification that shop drawings for metal fabrications to receive metal coatings have been reviewed and that fabrications are acceptable to galvanizer for proper application of galvanizing and metal coatings. All drawings should be signed by the galvanizer to indicate acceptance of design for galvanizing.

F. Certificate of Compliance of Item Identification by Galvanizer: The galvanizer shall mark all lots of material with a clearly visible tag indicating the name of the galvanizer, the type and weight of the coating, and the applicable ASTM Specification Numbers. If requested, submit certification of compliance that items have been tagged.

G. Galvanizer/applicator shall supply a certificate of compliance that all coatings have been performed in accordance with SSPC Qualification Procedure Standard QP 3: Qualification of Paint Shops.

1.6 QUALITY ASSURANCE

A. Galvanizer's Qualifications: Engage the services of a qualified galvanizer who has demonstrated a minimum of ten years of experience in the successful application of galvanized coatings specified in this specification in the facility where the work is to be performed and who will apply the coatings

within the same facility. For surface preparation and shop painting, current SSPC QP-3 certification is required.

B. Coating Applicator's Qualifications: Galvanizing and factory-applied coatings shall be performed by a company with a minimum of ten years of experience in the successful application of hot-dip galvanizing utilizing the dry kettle process.

C. Pre-Construction Conference for Metal Fabrications to Receive Factory-Applied Metal Coatings: Contractor shall schedule a meeting to be attended by Contractor, Architect, fabricator, and galvanizer. Agenda shall include the following: Project schedule, scope of services, coordination between fabricator and galvanizer, finish of surfaces, application of coatings, color selections, submittals, and approvals.

D. Coordination between Fabricator and Galvanizer: Prior to fabrication and final submittal of shop drawings to Architect, direct fabricators to submit shop drawings to the galvanizer for all metal fabrications to receive factory-applied metal coatings. Direct galvanizer to review fabricator's shop drawings for suitability of materials for galvanizing and coatings and coordinate any required modifications to fabrications required to be performed by the fabricator.

E. Rugosity: Factory-applied metal coatings shall exhibit a rugosity (smoothness) not greater than 4 rug (16-20 microns of variation) when measured by a profilometer over a 1 inch straight line on the surface of architectural and structural elements that are less than 24 pounds per running foot. Profilometer shall be capable of operating in 1 micron increments. Surface blasting prior to application of factory-applied post galvanizing wet coatings will produce a high rugosity and not be acceptable.

F. Galvanizing shall be performed by a company with a minimum of ten years' experience in the successful application of hot-dip galvanizing utilizing the dry kettle process.

1.7 GUARANTEE

A. The Contractor shall furnish and deliver standard written manufacturer's guarantee in Owner's name covering all materials and workmanship under this Section, SITE METAL FURNISHINGS.

1. The warranties shall be as follows:
   a. Galvanization: 20-year warranty against rust
   b. Powder-coating: 10-year warranty on the finishes

PART 2 – PRODUCTS

2.1 COATING APPLICATOR

A. Coating Applicator: For the purpose of establishing a standard of quality and performance, provide factory-applied metal coatings by Duncan Galvanizing, 69 Norman Street, Everett, MA, (617) 389-8440, www.duncangalvanizing.com; or, approved equal.

2.2 FINISH SCHEDULE

A. All steel items fabricated under the Division 05 Section, SITE METAL FURNISHINGS, and all hardware shall be color finished in accordance with the following finish schedule of this Section, FACTORY-APPLIED COATINGS FOR METAL, and specified and performed under this Section, FACTORY-APPLIED COATINGS FOR METAL. Color finishing shall be paid for under this Section.

B. Finish Schedule:

ITEM	GALVANIZING	PRIMER	TOPCOAT
Ornamental steel picket fence – Add Alternate #5	YES	YES	Mid-tone blue (RAL 5015)

2.3 GALVANIZING – GENERAL

A. All site improvements, hardware, attachments, or other specified steel elements to be galvanized shall conform to the following specifications.

B. Prior to galvanizing, all specified metal items shall be cleaned (pickled) in accordance with SSPC-SP 8: Paint Shops. Cleaning shall remove all rust, scale, and coating surface must be clean, dry, undamaged, and free of all loose rust, dirt, grease, or other contaminants including salt deposits. Specified metal items calling for galvanizing shall be hot-dipped galvanized after fabrication and chromated after galvanizing by dipping in a 0.15 percent chromic acid solution. Galvanizing bath shall contain 0.05 – 0.09 percent nickel. Galvanize all ferrous fasteners, clips, sleeves, anchors, and accessories in contact with galvanized items.

C. Galvanizing shall comply with ASTM A123M, A153/A153M, A385 as applicable.

D. All galvanized materials shall be inspected for compliance with these specifications and marked with a stamp indicating the name of the galvanizer, the ASTM Specification, and the weight of the zinc coating in ounces per square foot.

E. Items to be galvanized shall be galvanized after fabrication. Where size of assembly is too large for complete unit galvanizing, these assemblies shall be galvanized prior to fabrication, in as large sections as practical and then only with the written approval of the Architect.

F. Touch-Up and Repair: For damaged and field welded zinc-coated surfaces, clean welds, bolted connections, and abraded areas.

G. Following galvanizing, each item shall receive surface grinding to remove lumps, sags, or spikes resultant from the galvanizing process. The finished surface following grinding shall be hand smooth and without irregularities. Take care not to damage the galvanized surface coating.

2.4 HOT-DIP GALVANIZING & HIGH PERFORMANCE SUPER-DURABLE COATING

A. Hot-Dip Galvanizing: For steel exposed to the elements, weather, or corrosive environments and other steel indicated to be galvanized, provide coating for iron and steel fabrications applied by the hot-dip process.

1. Basis-of-Design: Duragalv by Duncan Galvanizing
2. Comply with ASTM A123 for fabricated products and ASTM A153 for hardware.
3. Provide thickness of galvanizing specified in referenced standards.
4. Galvanizing bath shall contain special high grade zinc and other earthly materials.
5. Fill vent holes after galvanizing, if applicable, and grind smooth.
6. All exposed galvanizing shall be blasted per SSPC SP16 to achieve a 1-3 mile profile. Inaccessable areas shall be abraded per SSPC SP2 or SP3 to achieve a 1-3 mil profile.
7. Galvanizing shall exhibit a rugosity (smoothness) of less than 25 microns when measured by a profilometer. Profilometer shall be capable of operating in 1 micron increments. This pertains to those elements that are less than 24 pounds per running foot.

B. Primer over Galvanized Steel: Provide factory-applied polyamide thermosetting epoxy prime coat over hot-dipped galvanized steel.

1. Basis-of-Design: Primergalv® Thermoset by Duncan Galvanizing, of Everett, Massachusetts
2. Primer shall be a polyamide epoxy powder primer with 0 VOC.
3. Apply primer within 12 hours after galvanizing or blasting at the same galvanizer's plant in a controlled environment meeting applicable environmental conditions and as recommended by the primer coating manufacturer. Cure schedule shall be as recommended by the manufacturer.
4. Polyamide epoxy powder primer shall be applied at 1.8-3 mils DFT and certified OTC/VOC compliant and conform to EPA and local requirements.
5. Polyamide epoxy powder primer shall meet or exceed the following performance criteria as stipulated by the coatings manufacturer:
   a. Cure Schedule: 10 min. at 400°F

b. Specific Gravity: 1.58 +/- .05
c. Coverage at 1.0 Mil 121.7 sq. ft./ lb.
d. 60° Gloss: 55-65 (ASTM D-523)
e. Adhesion: 5B (ASTM D-3359)
f. Flexibility: Pass 1/8 " Mandrel Bend (ASTM D-522)
g. Pencil Hardness: 2H-3H (ASTM D-3363)
h. Impact Resistance: 80 in-lbs direct (ASTM D-2794) 80 in-lb reverse
i. Typical Environmental Properties:On Bonderite 1000 Panels
   1) Salt Fog 1000 hours (ASTM B-117)
   2) Salt Fog (top-coated)* 5000+ hours (ASTM B-117)
   3) Humidity 1000 hours PASSED

C. High-Performance Fluoropolymer Powder Topcoat: Provide coating matching approved samples. Factory-applied metal coatings shall be applied in a facility acceptable to the coating manufacturer. Full cure of the coatings shall be verified by the coating manufacturer's recommended test methods.

1. Coatings must meet or exceed the criteria for the following categories as stipulated by the coating manufacturer. All testing must be on lab prepared panels.
   a. Adhesion: ASTM D 3359, no loss.
      1) Hardness: ASTM D 3363 (pencil), H min.
      2) Falling Sand ASTM D 968 40L/mil.
      3) Salt Fog Resistance: ASTM B 117, passes 4000 hrs.
      4) Humidity: ASTM D 2247, 4000 hours, few #8 blisters.
      5) Impact Resistance (3mm): ASTM D 2794, no loss.
      6) Color Retention: ASTM D 2244, 10 year less than or equal to 5 delta E.
      7) Chalk Resistance: ASTM D 4214, #8 rating.
      8) Gloss Retention: ASTM D 523, greater than or equal to 50 percent retention.
      9) Erosion Resistance: ASTM B 244, less than 10 percent film loss.
      10) Compliance: AAMA 2605.

D. Warranty: Provide galvanizer's standard warranty that materials will be free from 10 percent or more visible rust for 20 years.
1. Warranty for the finish gloss and color shall be 10 years in accordance with the following performance specifications.
   a. Fade**:** Loss of gloss shall not exceed 35 units of gloss which shall be measured in accordance with ASTM D 523-89 with 60 degree geometry.
   b. Color Shift**:** Shall not exceed 15 Delta E CIE LAB units for whites and light colors. Dark colors shall not exceed 25 Delta E CIE Lab units as measured by ASTM D 2244. (Yellows, Oranges and Reds are excluded.)

PART 3 – EXECUTION

3.1 APPLICATION OF FACTORY-APPLIED METAL COATINGS

A. Galvanizing Application: Galvanize materials in accordance with specified standards and this specification. Galvanizing shall provide an acceptable substrate for applied coatings. The dry kettle process shall be used to eliminate any flux inclusions on the surface of the galvanized material.

B. Prior to galvanizing, the steel shall be immersed in a pre-flux solution (zinc ammonium chloride). The pre flux tank must be 12 to 14 Baumé and contain less than 0.4 percent iron. The wet kettle process shall be prohibited.

B. To provide the galvanized surface required, the following procedures shall be implemented:

1. A monitoring recorder shall be utilized and inspected regularly to observe any variances in the galvanizing bath temperature.
2. The pickling tanks shall contain hydrochloric acid with an iron content less than 8 percent and

zinc content less than 3 percent. Titrations shall be taken weekly at a minimum.

3. All chemicals and zinc shall be tested at least once a week to determine compliance with ASTM standards. All testing shall be done using atomic absorption spectrometry or x-ray fluorescence (XRF) equipment at a lab in the galvanizing plant.

D. Finish coatings shall be applied under the following conditions.

1. Minimum air temperature shall be 65 degrees Fahrenheit. Surface temperature of steel shall be 60 degrees to 95 degrees Fahrenheit and, in any event, be 5 degrees Fahrenheit higher than the dew point. Humidity shall be 85 percent maximum.
2. The use of iron or steel shot and sand and aluminum oxide grit as a blast medium, and power wire brushes are not permitted.
3. Surface of substrate shall be dry and free from dust, dirt, oil, grease or other contaminants. Coating and cure facility shall be maintained free of airborne dust and dirt until coatings are completely cured.

3.2 INSTALLATION

A. Installation: Comply with fabricator's and galvanizer's requirements for installation of materials and fabrications, including use of nylon slings or padded cables for handling factory-coated materials.

B. Touch-Up and Repair: For damaged and field-welded metal coated surfaces, clean welds, bolted connections, and abraded areas.

1. For galvanized surfaces, apply organic zinc repair paint complying with requirements of ASTM A 780, modified to 95 percent zinc in dry film. Galvanizing repair paint shall have 95 percent zinc by weight, ZiRP by Duncan Galvanizing. Thickness of applied galvanizing repair paint shall be not less than coating thickness required by ASTM A 123 or A 153 as applicable. Touch-up of galvanized surfaces with silver paint, brite paint, or aluminum paints is not acceptable.
2 For factory-applied finish coatings, field-touch-up shall be performed by factory approved personnel for warranties to apply. Touch-up shall be such that repair is not visible from a distance of 6 feet. If non factory-approved technicians are used for field touch-up, no warranties shall exist.
3 A touch-up repair kit or touchup instructions shall be provided to the Owner for each type of factory-applied finish.

3.3 ACCEPTANCE

A. Fence layout shall conform to the requirements of the Contract Documents. Straight runs of fencing shall be straight and true without visible deviation. Curved sections of fencing shall have a smooth, continuous arc without kinks or broken backs.

A. Rails shall form a continuous smooth line parallel with the grade unless otherwise described on the Contract Documents.

C. All posts shall be plumb and cut to the same height above grade.

D. Fencing will be rejected by the Landscape Architect for the following reasons:

1. Welders were not qualified under or did not perform work in accordance with AWS "Standard Qualification Procedure".
2. Fabricated items show metal pieces that were not accurately saw cut and were not fitted together. Gaps, spaces, voids, breaks, and crooks in arris lines, humps, bumps, sags, and saddles are present.
3. Sections are not well formed and do not meet the shapes and sizes indicated on the Contract Documents.
4. Horizontal or vertical curves do not meet the shapes and profiles shown on the Contract Documents. Curves that have broken backs, sags, saddles, tangents, or kinks shall be rejected.

5. Exposed surfaces do not have a smooth finish and show surface differentiation and variation. Edges show nicks, grind marks or machine marks.
6. Castings do not have sharp corners and edges and are not clean, smooth, and true to pattern.
7. Welds are not continuous extending for the entire length of the joints.
8. Welds are not ground smooth.
9. The presence of flux deposits.
10. Welds are not watertight.
11. Connections are not full seam welded, not ground flush and smooth.
12. Threaded connections are not drawn up tightly. Threads have not been deformed to prevent loosening.
13. Coating has runs, sags, hairs, defective brushing, and clogging of lines and angles.

END OF SECTION

SECTION 05 05 23: METAL FASTENINGS – Add Alternate

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. The work of this Section includes all labor, materials, and equipment necessary to complete the work of this Section including but not limited to the following:

1. Galvanized machine bolts and threaded rods, nuts, and washers; galvanized lag screws and washers; galvanized flat bar; galvanized angles, galvanized nails, and spikes; stainless steel screws (316) and all other hardware not specified elsewhere.

1.2 RELATED WORK

A. Related work specified elsewhere:

1. Division 03 Section – REINFORCED CONCRETE FOOTINGS – Add Alternate
2. Division 05 Section – METAL FABRICATIONS – Add Alternate
3. Division 06 Section – WOOD TREATMENT – Add Alternate
4. Division 06 Section – HEAVY TIMBER CONSTRUCTION – Add Alternate

1.3 QUALITY ASSURANCE

A. Except as noted elsewhere, work shall conform to the following codes and standards:

1. American Society for Testing and Materials (ASTM).
2. American Welding Society (AWS).
3. American Institute of Steel Construction (AISC).

1.4 SUBMITTALS

A. Shop drawings for all shop fabricated items shall be submitted to the Engineer for approval before beginning fabrication.

B. Certificate of compliance with applicable ASTM specifications for all galvanized items shall be submitted to the Engineer with all materials delivered to the fabricator or site.

1.5 PRODUCT DELIVERY, STORAGE & HANDLING

A. All parts provided under this specification shall be delivered, stored, and handled so that they are not lost or damaged before installation in the work.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Structural steel shall conform to ASTM A36 Specification.

B. Machine bolts, threaded rods, and lag screws shall conform to ASTM A-307 for Mild Steel Bolts unless otherwise noted.

C. All steel items under this section shall be galvanized. Galvanizing shall be by the hot dip method according to ASTM Specifications A-123 and A-153.

D. Welding rods shall conform to AWS E70XX grade. Sizes shall be as indicated on the drawings.

PART 3 – EXECUTION

3.1 FABRICATION

A. Fabrication shall conform to AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

B. Workmanship shall be equal to standard commercial practice.

C. All materials shall be clean and straight. Each assembly shall be accurately fabricated to the lines and dimensions called for and shall be free from undue twists, bends, warping, distortion and other irregularities.

D. Assemblies shall be fabricated to within + or - 1/16" of their theoretical dimensions.

3.2 INSTALLATION

A. Installation shall conform to AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

B. Parts covered by this specification shall be installed in the work as shown on the drawings.

C. No cutting or burning of steel shall be done to install fasteners without approval of the Engineer.

D. Damaged hot dipped galvanized coating or coating damaged by welding shall be cleaned and coated with a cold galvanizing compound according to the manufacturer's instructions.

3.3 DEFECTIVE WORK

A. The following shall be grounds for rejection and replaced at no additional cost to the Owner:

1. Any damaged parts.
2. Any parts improperly installed in the work.
3. Any items found not to have the proper coating.
4. Otherwise not according to Contract Documents.

PART 4 – MEASUREMENT AND PAYMENT

4.1 METHOD OF MEASUREMENT AND PAYMENT

A. Measurement and Payment for METAL FASTENINGS shall be included in the Measurement and Payment for TIMBER. See Division 06 Section, HEAVY TIMBER CONSTRUCTION.

END OF SECTION

SECTION 05 50 00: METAL FABRICATIONS – Add Alternate

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. All of the Contract Documents, including the conditions and general requirements of the Contract, Division 00 and applicable parts of Division 01, apply to the work under this Section.

B. The Contractor shall carefully examine all the Contract Documents for requirements that affect the work of this Section. The exact scope of this Section cannot be determined without a thorough review of all specification sections and other Contract Documents.

1.2 DESCRIPTION

A. Provide all labor, materials, equipment, and supervision necessary to complete work specified in this Section.

1.3 SCOPE OF WORK

A. Scope of work includes, but is not necessarily limited to, manufacturing or shop fabricating metal elements including:

1. Pile cap steel brackets
2. Stringer connection angles.

1.4 RELATED WORK

A. Related work specified elsewhere:

1. Division 03 Section – REINFORCED CONCRETE FOOTINGS – Add Alternate
2. Division 05 Section – METAL FASTENINGS – Add Alternate
3. Division 06 Section – WOOD TREATMENT – Add Alternate
4. Division 06 Section – HEAVY TIMBER CONSTRUCTION – Add Alternate

1.5 QUALITY ASSURANCE

A. Except as noted, work shall conform to the following codes and standards:

1. American Society for Testing and Materials (ASTM), latest edition.
2. American Institute of Steel Construction (AISC) Specification for the Design, Fabrication and Erection of Structural Steel for Buildings, latest editions.
3. American Welding Society (AWS).

1.6 SUBMITTALS

A. Shop drawings

1. Submit for approval prior to fabrication all information necessary for the fabrication of the component parts. Indicate size and weight of members, type and location of shop and field connections, the type, size and extent of all welds, and welding sequences. Use American Welding Society welding symbols. Approval of shop drawings will be for size and arrangement of principal and auxiliary members and strength of connections. Any errors in dimensions shown on shop drawing shall be the responsibility of the Contractor.

B. The Contractor shall use only certified welders and the shielded arc process for all welding performed in connection with the work of this Section. Each welder shall be certified for the particular work, prior to commencing the work, which must be accomplished.

C. Completed welds will be subject to inspection and approval of an independent testing agency. Faulty welds shall be cut out and replaced at no cost to the Owner.

D. Upon completion of this portion of the work, and as a condition of its acceptance, the Contractor shall deliver to the Engineer a letter signed by an official of the miscellaneous metal fabricating firm or firms certifying that all fabricated metal has been fabricated in complete accordance with this Section of these specifications.

1.7 PRODUCT HANDLING

A. All materials shall be delivered, stored and handled so that they are not damaged.

PART 2 – MATERIALS

2.1 STRUCTURAL STEEL

A. Structural steel, including rolled shapes and plates, shall conform to the following unless noted otherwise:

1. ASTM A36 (F_y = 36 KSI) for, angles, plates, channels and bars

2.2 WELD ELECTRODES

A. Weld rod shall conform to AWS E70XX grade.

PART 3 – EXECUTION

3.1 FABRICATION

A. Fabricate products in a fully-equipped facility capable of producing high grade of metal fabrication work. All work shall be straight and true, free from warppage and other defects. Joints, covers, copes and miters shall be accurately and neatly cut, machined, filed and fitted.

B. Carry out bolting and welding in accordance with latest approved methods, with due consideration for strength and appearance of finished product. All welding shall be done by certified welders.

C. All steel will be free from imperfections, dirt, loose scale, paint, oil or other foreign substances.

D. All welds shall be made watertight.

E. All material shall be fabricated to within + or - 1/16 inch of their theoretical dimensions as shown on the drawings.

F. Holes for bolts shall be located as shown on the drawings and shall be drilled or burnt 1/16" in diameter larger than the galvanized bolt or fastener.

G. All fabrication under this section shall be galvanized. Galvanizing shall be by the hot dip method according to ASTM Specifications A-123 and A-153

3.2 INSTALLATION

A. Store materials on skids, not on ground, in such a fashion as to prevent bending, twisting or similar damage. Do not dump steel off truck.

B. Clean installed work from weld spatter, dirt and other foreign materials. Protect installed work as required from damage by subsequent building operations.

3.3 DEFECTIVE WORK

A. Any parts damaged or improperly fabricated shall be removed and replaced or corrected as directed by the Engineer and at no additional cost to the Owner.

PART 4 – MEASUREMENT AND PAYMENT

4.1 METHOD OF MEASUREMENT

A. Measurement for METAL FABRICATIONS shall be made by the Contract Unit Price of Lump Sum and include the items indicated under the Payment Item portion of this Section.

4.2 METHOD OF PAYMENT

A. Payment for METAL FABRICATIONS shall be at the Contract Unit Price Lump Sum and shall constitute full compensation for all labor, equipment, transportation, materials, temporary supports, survey, supervision, submittals and, shop drawings required for the supply and installation of new steel pile cap brackets, all hardware required, and any other incidentals necessary for the satisfactory supply and installation of all work in accordance with the Contract Documents. Payments for work under this item will not be made until specific work has been installed. Partial payments will be allowed.

4.3 PAYMENT ITEMS

ITEM	DESCRIPTION	UNIT
05 50 00-1	METAL FABRICATIONS	Lump Sum

END OF SECTION

SECTION 05 60 00: SITE METAL FURNISHINGS – Add Alternate

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SUMMARY

A. The work of this Section consists of providing all shop drawings, labor, equipment, materials, incidental work, and construction methods necessary to furnish and install all site metal fabrications and related items as indicated on the Contract Documents, as specified in this Section, and includes, but is not limited to, the following:

1. Galvanized and powder-coated ornamental steel picket fence – Add Alternate #3

1.3 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 03 section: CAST-IN-PLACE CONCRETE
2. Division 05 Section: FACTORY-APPLIED COATINGS FOR METALS
3. Division 32 Section: REINFORCED CONCRETE PAVING
4. Division 32 Section: SITE IMPROVEMENTS
5. Division 32 Section: DECORATIVE METAL FENCES & GATES

1.4 REFERENCES

A. The following standards shall apply to the work of this Section:

1. Massachusetts Department of Transportation (MassDOT): Specifications Standard Specifications for Highways and Bridges
2. ASTM: American Society for Testing and Materials

A 36/36M	Carbon Structural Steel
A 53/53M	Pipe, Steel, Black and Hot-dipped, Zinc-coated
A 108	Steel Bars, Carbon cold Finished, Standard Quantity
A 123/123M	Zinc (Hot-dip galvanized) Coatings on Iron and Steel Products
A 153/153M	Zinc Coating (Hot-dip) on Iron and Steel Hardware
A 193/193M	Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service
A 276	Stainless Steel Bars and Shapes.
A 307	Carbon Steel Bolts and Studs, 60000 PSI Tensile Strength
A 312/312M	Seamless and Welded Austenitic Stainless Steel Pipes
A 385	Standard Practice for Providing High-Quality Zinc Coatings (Hot- Dip)
A 500	Cold-formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
A 536	Standard Specification for Ductile Iron Castings
A 510	Wire rods and coarse Round Wire, Carbon Steel

3. AISI: American Iron and Steel Institute

AISI 304	Stainless Steel Alloy Designation
AISI 316	Stainless Steel Alloy Designation
AISI M1020	Merchant Quality Steel
AISI BS 1449, Part 4	Standard Mill Surface Finished

4. AWS: American Welding Society
   D1.1 Structural Welding Code: Steel

1.5 SUBMITTALS

A. At least 30 days prior to intended use; the Contractor shall provide the following samples and submittals to the Architect for review. Contractor shall not order materials until the Architect's review of samples, certifications or test results has been obtained. Delivered materials shall closely match the approved samples. Approval of samples shall not constitute final acceptance. The Architect reserves the right to reject, on or after delivery, and material which does not meet these Specifications.

B. All submittals included herein shall follow specifications established under provisions of Division 01 Section, SUBMITTAL PROCEDURES

1. Manufacturer's Literature: Submit for approval manufacturer's material descriptions for the following:
   a. Epoxy body putty for filling vent holes after galvanizing and before painting operation
   b. Zinc-rich primer to be used for coating bare steel surfaces left exposed at the end of the galvanizing process.
2. Constructed Sample: Fabricate and submit samples of all items fabricated under this Section, showing workmanship for welds, joints, hardware, and color finishing. Samples shall be fabricated per approved Shop Drawings or approved product literature catalogue sheets. These samples may not be part of the finished work. Upon approval samples shall be the standard of quality for all site metal items fabricated under this Section.
3. Shop Drawings: Submit complete shop drawings of all miscellaneous metals work required under this Section, SITE METAL FURNISHINGS for Architect’s approval. Include plans, sections and details as required to show all materials, layout, dimensions, jointing and connections for all items required.
4. Shop drawings required are as follows:
   a. Powder-coated ornamental steel picket fence – Add Alternate #3
5. Shop drawings for site metal items requiring accurate dimensional relationships to newly built or as-built construction, shall be prepared following a review and confirmation of existing conditions to remain. Provide same for existing or as-built measurements and conditions for areas scheduled to receive miscellaneous metal items by the installer.
   a. Coordinate the location of all galvanizing vent holes with the galvanizer. Show locations of all vent holes on the Shop Drawings for approval by the Architect.

C. A notarized statement of compliance with specifications shall be furnished to the Architect by the galvanizer with the initial shipment of galvanized metal items. The notarized statement shall indicate that the galvanized metal items comply with the ASTM Standard and that the dry kettle method with zinc-nickel alloy was used. Stamp a representative number of pieces of galvanized metal work. The notarized statement shall declare the day each piece was galvanized. The stamp shall indicate the ASTM Standard and the coating weight.

D. The Contractor shall submit in writing the names and addresses where all galvanizing, surface preparation, priming, intermediate coat application and finish coat application are to be performed. The Architect reserves the right to visit each shop facility to inspect the surface condition of all specified miscellaneous metal items prior to shipment and delivery to the next place of work.

1.6 QUALITY STANDARDS

A. The current issue of Standard Code of Arc and Gas Welding in Building Construction shall apply to this Section, SITE METAL FURNISHINGS, as though written out in full. Welding shall be in accordance with the Structural Welding Code of the American Welding Society.

B. Where structural joints are made by welding, the details of all joints, techniques of welding employed, the appearance and quality of welds made, and the methods used to correct defective work shall conform to requirements of the AISC and AWS codes.

C. Welds shall be made only by welders who have previously been qualified by tests as

prescribed in AWS "Standard Qualification Procedure" for the type of work required.

D. All dissimilar metals shall be insulated to prevent bimetallic interaction.

E. Workmanship and finish shall be equal to the best practice of modern shops for each item of work. Metal fabrication shall be accomplished using the highest standards of workmanship. All work shall be executed by experienced metal workers, shall conform to the requirements of the Contract Documents, and meet the following requirements.

1. Individual metal pieces shall be saw cut and carefully fitted together.
2. Sections shall be well formed to shape and size with sharp lines and angles; curved work shall be sprung evenly to curves.
3. Exposed surfaces shall have a smooth finish and sharp, well defined lines and arrises.
4. Grind all edges of bars and plates completely free from nicks and machine marks, prior to galvanizing or shop priming.
5. All surfaces and connections of metal items shall be without visible grinding marks, surface differentiation or variation.
6. All fabricated metal items shall be fine sanded throughout to produce a high standard of surface smoothness.
7. Square and rectangular steel tubing shall have sharp 90 degree corners and edges. Metal furnishings with rounded corners and edges arriving to the Project site or having been installed on the Project site will be rejected, removed, and discarded. Replacement of all metal furnishings so rejected shall be entirely at the Contractor's expense.
8. Welding shall be continuous and shall extend for the entire length of the joints except where specifically indicated on the Contract Documents. All exposed welds shall be ground smooth.
9. Weld with uncoated wire to prevent flux deposits. If coated wire is used, all flux residue shall be thoroughly removed and bare white metal exposed, prior to galvanization, if applicable. Where overlapping surfaces are welded, seal off contact area by welding all edges around contact area.
10. All welds shall be watertight.
11. All shop connections shall be full seam welded and ground flush and smooth. Field connections bolted unless otherwise permitted as indicated in this Section, SITE METAL FURNISHINGS. Draw up all threaded connections tightly, after buttering same with pipe joint compound, to exclude water. Deform threads to prevent loosening for all exposed connections subject to vandalism.

F. Where the work of this Section, SITE METAL FURNISHINGS, must be attached to other materials or where it must be assembled and installed in the field, Contractor shall cut, drill, punch and ream, countersink and tap, or otherwise provide the required holes in the shop, unless such connections are to be welded. The sizes and locations of all such holes shall be shown on the Shop drawings.

G. Metalwork to be built in with concrete or masonry shall be of the form required for anchorage or shall be provided with suitable anchors or expansion shields.

H. All materials and workmanship under this Section, SITE METAL FURNISHINGS, shall be subject to inspection in the mill, shop, or field by the Architect, or by qualified inspectors retained by the Owner. Inspection shall be without expense to the Contractor. However, such inspection, wherever conducted, shall not relieve Contractor of his responsibility to furnish materials and workmanship in accordance with Contract requirements.

1.7 DELIVERY, STORAGE & HANDLING

A. Deliver and store work as specified under this Section, SITE METAL FURNISHINGS, in a manner to prevent damage to surface finishes of metal items, wracking or stress of components, and to prevent mechanical damage or damage by the elements. All stored materials and items shall be protected from weather, careless handling, and vandalism.

B. Items which become rusted or damaged because of non-compliance with these conditions will be rejected and shall be replaced without additional cost to the Owner.

C. Deliver work to the site in sufficient time to avoid delay in job progress and at such times as to permit proper coordination of the various parts. The Contractor shall be responsible for scheduling the

delivery of all items so as to minimize on-site storage time prior to installation.

D. Deliver bolts and other small items required for erection of work under this Section, SITE METAL FURNISHINGS, bundled with their respective items.

1.8 COORDINATION

A. The work of this Section, SITE METAL FURNISHINGS, shall be completely coordinated with the work of other Sections. Verify dimensions and work of other trades which adjoin materials of this Section, SITE METAL FURNISHINGS, before installing items specified.

B. Obtain all necessary templates and patterns required from other trades for proper execution of work of this Section, SITE METAL FURNISHINGS. Furnish to other trades items to be built into work of other Sections. Supervise installation of such built-in work.

1.9 GUARANTEE

A. The Contractor shall furnish and deliver standard written manufacturer's guarantee in Owner's name covering all materials and workmanship under this Section, SITE METAL FURNISHINGS.

B. Contractor shall pay for repairs of any damage to any part of the project caused by defects in the work of the miscellaneous metal fabricators and for any repair to the materials or equipment caused by replacement. All repairs are to be done to the satisfaction of the Architect.

PART 2 – PRODUCTS

2.1 MATERIAL REQUIREMENTS

A. Provide only new materials, free from defects impairing strength, durability, or appearance and of the quality specified.

B. Standard products meeting the detailed requirements specified in this Section, SITE METAL FURNISHINGS, will be considered for approval by the Architect.

C. Furnish all supplemental parts necessary to complete each item whether or not such parts are shown or specified. Furnish all fastenings for securing the work required in this Section, SITE METAL FURNISHINGS, to the work of other trades. Furnish, deliver, and pay for the costs of furnishing and delivery under the work of this Section, SITE METAL FURNISHINGS. Installation of all fastening devises on the job site shall be paid for under the work of other Sections.

D. Provide fastenings of the same material, color, and finish as the metal to which applied unless otherwise indicated.

2.2 METALS – GENERAL

A. Steel for galvanization shall be fashioned from hot-rolled mild carbon steel and shall be in conformance with the following:

1. ASTM A36/A36M requirements for flat bar stock.
2. AISI M1020 requirements for steel round bar stock.
3. Steel tubing shall be in accordance with ASTM A500 Grade B requirements. Steel sections for tubing shall be one-quarter inch wall thickness.
4. All steel sections shall be fillet welded and ground smooth prior to galvanizing to the sizes and dimensions as shown on Drawings.

B. All hardware shall conform to ASTM A307 requirements.

C. All steel shall be galvanized and/or powder-coated in accordance with the requirements of this Division 05 Section, FACTORY-APPLIED COATINGS FOR METAL, after fabrication.

2.3 GALVANIZED & POWDER-COATED ORNAMENTAL STEEL PICKET FENCE – ADD ALTERNATE #3

A. Steel for fabrication shall be in conformance with ASTM A36/A36M or AISI M1020 requirements for flat bar stock and solid squares, and ASTM A500 Grade B requirements for steel tubing. Steel sections for tubing shall be one-quarter inch wall thickness. All steel sections shall be fillet welded and ground smooth prior to galvanizing, and priming and shop painting, to the sizes and dimensions as shown on Contract Documents.

B. Materials:

1. Vertical main tube: alternating 3/4-inch square straight bars and 3/4-inch square curved bars spaced at 4 inches max.
2. Horizontal top and bottom rail: 1/2-inch by 2-inch flat rail at top and bottom
3. Post: 2-1/2-inch square steel post with flat cap

C. Panel height shall be 48 inches high. Panel width shall be 96 inches.

2.4 GROUT

A. Grout as required for anchoring shall be a pourable, quick setting, non-metallic and non- shrinking hydraulic cement grout equal to the following:

1. Five Star Grout
   U.S. Grout Corporation
   425 Stillson Road Fairfield, CT 06430
   (800) 243-2206
2. Sika Grout 212
   Sika Corporation
   Lyndhurst, NJ 07071
   (201) 933-8800
3. Harris Construction Grout
   AH Harris & Sons
   10 West Mill St. Medfield, MA 02052
   (508) 359-7321

2.5 SELF-LEVELING POLYURETHANE SEALANT

A. Provide two or more part, self-leveling, polyurethane based elastomeric sealant, complying with ASTM C 920, Type 1 Class A, having Shore A hardness of not less than 30 when tested according to ASTM C 920, cured modulus of elasticity at 100 percent elongation of not more than 150 psi, when tested according to ASTM D 412, and tear resistance of not less than 50 pounds per inch when tested according to ASTM D 624.

B. Where joint surfaces contain bituminous materials, provide modified sealants that are compatible with bituminous materials encountered.

C. Provide one of the following products that meet or exceed specified requirements:
1. Pecora Urexpan NR-200.
2. Mameco Vulkem 245 or 255.
3. Sika 2C, SL.
4. Sonneborn Sonolastic PvJtSt.
5. Tremco THC 900.

D. Extent: Provide self-leveling polyurethane sealant for horizontal joints at stairways, at intersection of reinforced concrete pavement and site improvement items, and to seal all miscellaneous joints or holes shown on the Contract Documents.

PART 3 – EXECUTION

3.1 METAL FABRICATION – GENERAL

A. Take all measurements required at the work site. Check measurements compare dimensions and other data with various trades installing adjoining work to assure proper coordination.

B. Fabricate fences, rails, posts, and similar items such that when installed posts and pickets are plumb and rails follow grade

C. Do all shop drilling, shop fitting, shop cutting, shop welding, and bolting required to erect, install, and fit metal work to adjoining work. Conform to AISI Code for Steel or Stainless Steel as applicable. Furnish all screws, bolts, anchors, etc., required to attach metal work securely to adjoining work.

D. Welding shall be continuous except where tack welding is specifically permitted. Tack welding will not be permitted on exposed surfaces. All exposed welds shall be ground smooth.

E. Do not enlarge unfair holes by burning and forcing but correct by reaming.

F. Install all supports and anchors for metal work except those to be cast into concrete or built into masonry as indicated.

A. Furnish all required metal inserts, anchor slots, anchors, anchor bolts, fastenings, etc., for attachment of work of all trades to cast-in-place concrete and unit masonry, except where otherwise specified or obviously included under other Sections of the Specifications.

I. Weld with uncoated wire to prevent flux deposits. If coated wire is used, all flux residue shall be thoroughly removed and bare white metal exposed. Where overlapping surfaces are welded, seal off contact area by welding all edges around contact area.

3.2 INSTALLATION

A. All metal items fabricated under this Section, SITE METAL FURNISHINGS, shall be transported to the construction site and installed in accordance with the requirements of this Section, SITE METAL FURNISHINGS. Cost of transportation of all metal items fabricated under this Section shall be paid for under this Section.

B. Install fabricated site metal in conformance to the Contract Documents and approved Shop Drawings. Set all posts and pickets plumb. Rails shall follow grade.

C. Core-drill all holes in concrete and site masonry in precise locations established in the field with fabricated site metal furnishings on hand.

D. Set posts in cored holes with non-shrink grout, recessed 0.75 inches to receive sealant. All care shall be taken to prevent cracks, chips, or scratches to the accepting materials surface during the core drilling process.

3.3 SEALANTS

A. Strictly comply with manufacturers' instructions and recommendations, except where more restrictive requirements are specified in this Section.

B. Clean cored holes immediately before installation of sealants using high pressure air. Remove substances which could interfere with bond.

C. Unless otherwise indicated, use of sealants shall conform to ASTM C 1193.

D. Tape or mask adjoining surfaces to prevent spillage and migration problems.

E. Force sealant into void between posts and inside of cored holes to provide uniform, dense, continuous ribbons free from gaps and air pockets.

F. Install and tool sealants around posts to shed water.

G. Provide sealants to depths indicated, or if not indicated, follow manufacturer's recommendations.

H. Cure sealants in strict compliance with manufacturers' instructions and recommendations to obtain highest quality surface and maximum adhesion. Make every effort to minimize accelerated aging effects and increase in modulus of elasticity.

I. Remove smears from adjacent surfaces immediately, as the work progresses. Exercise particular care to prevent smearing or staining of surrounding surfaces which will be exposed in the finished work, and repair any damage done to same as result of this work without additional cost to Owner.

J. Clean adjacent surfaces using materials and methods recommended by sealant manufacturer. Where required, high pressure washing or the use of chemical cleaners shall be employed to clean adjacent surfaces.

K. Remove and replace work that cannot be successfully cleaned or work that is damaged or deteriorated.

L. Provide temporary protection to ensure sealant work is not damaged following acceptance of sealant work. Protection may include covering of joints subject to damage during remainder of construction period. Remove protection immediately before final acceptance.

3.4 ACCEPTANCE STANDARDS

A. In accordance with the requirements for Quality Standards noted in this Section and for installation as follows, site metal furnishings will be accepted only if they meet the following requirements:

1. Posts and pickets are set plumb. Rails follow grade.
2. Fences and rails are set at a constant height, meeting the requirements of the Contract Documents, and all applicable codes.
3. Fence and rail alignments are straight and true in locations shown on the contract documents.
4. Paint coatings are free of bare spots, nicks, scratches, and any surface degradation.
5. Surfaces of site metal furnishings are free of stains, cementitious coatings, and grouts.
6. Sealant set flush with surrounding receiving surface and sheds water.

END OF SECTION

SECTION 06 05 73: WOOD TREATMENT – Add Alternate

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. The work of this Section includes all labor, materials, and equipment necessary to complete the work of this Section including but not limited to the following:

1. The treatment of southern pine timber members with a wood preservative.
2. The field application of all treated timber subject to field cutting and drilling.

1.2 RELATED WORK

A. Related work specified elsewhere:

1. Division 03 Section – REINFORCED CONCRETE FOOTINGS – Add Alternate
2. Division 05 Section – METAL FASTENINGS – Add Alternate
3. Division 05 Section – METAL FABRICATIONS– Add Alternate
4. Division 06 Section – HEAVY TIMBER CONSTRUCTION – Add Alternate

1.3 QUALITY ASSURANCE

A. Except as noted all work shall conform to the latest editions of the following codes, specifications and standards.

1. American Society for Testing and Materials (ASTM) D-25.
2. American Wood Preservatives Association (AWPA).

PART 2 – PRODUCTS

2.1 MATERIALS

A. All Southern Yellow Pine columns, pile cap and stringer members shall be treated with chromated copper arsenate (CCA) in accordance with AWPA Standard P5 and C2. Column and pile cap timber shall be treated to a retention of 1.5 pounds per cubic foot, and stringer timber shall be treated to a retention of 1.0 pounds per cubic foot.

PART 3 – EXECUTION

3.1 Prior to treatment all dimension lumber shall be kiln-dried. Conditioning by heating is not permitted.

3.2 Sealing compound for treatment of field cuts and drilled holes shall be two (2) coats of copper naphthenate meeting AWPA standard P8.

PART 4 – MEASUREMENT AND PAYMENT

4.1 METHOD OF MEASUREMENT AND PAYMENT

A. Measurement and Payment for WOOD TREATMENT shall be included in the Measurement and Payment for TIMBER. See Specification Section 06 13 00 – HEAVY TIMBER CONSTRUCTION.

END OF SECTION

SECTION 06 13 00: HEAVY TIMBER CONSTRUCTION – Add Alternate

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 DESCRIPTION

A. Provide all labor, materials, equipment and supervision necessary to complete the work specified in this Section.

B. Scope of work includes, but is not limited to the following:

1. Pile caps
2. Stringers
3. Columns
4. Decking (Ipe)

C. Related work specified elsewhere:

1. Division 03 Section – REINFORCED CONCRETE FOOTINGS – Add Alternate
2. Division 05 Section, METAL FASTENINGS: Fasteners, anchor bolts, and bolts – Add Alternate
3. Division 05 Section – METAL FABRICATIONS – Add Alternate
4. Division 06 Section – WOOD TREATMENT – Add Alternate

1.3 QUALITY ASSURANCE

A. Except as noted all work shall conform to the latest editions of the following codes, specifications, and standards:

1. Southern Pine Inspection Bureau (SPIB)
2. West Coat Lumber Inspection Bureau (WCLIB)
3. Western Wood Products Association (WWPA)
4. National Forest Products Association (NFPA)
5. American Society for Testing and Materials (ASTM)
6. Commonwealth of Massachusetts State Building Code (CMSBC)
7. American Institute of Timber Construction (AITC)

1.4 SUBMITTALS

A. AWPA quality stamp on all treated timber.

B. AWPA quality certification of all timber species.

C. Certification of timber species.

D. Material list with treatment, sizes, and quantities

1.5 PRODUCT DELIVERY, STORAGE & HANDLING

A. All timber shall be stored in stacks such that there is an air space beneath the material and situated to prevent the timber from being exposed to standing water.

B. The material shall be stored on site in an area which will be designated by the Owner.

C. Timber shall be handled in an approved manner such that the material will not be damaged.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stringer, column, and pile cap timber to be used shall be No. 1 dense Southern Pine as graded by SPIB and with design values per NFPA National Design Specification or the equivalent for Douglas Fir as graded by WCLIB and WWPA.

B. All timber shall be new and supplied with nominal dressed dimensions unless otherwise noted.

C. Deck timber shall be Ipe.

PART 3 – EXECUTION

3.1 PREPARATION

A. Prior to installation all demolition affecting the new work shall be completed.

3.2 INSTALLATION

A. Coat ends of field cut members as specified under WOOD TREATMENT, SECTION 06 05 73.

B. Ends of Ipe decking shall be coated per supplier recommendation to prevent checking and cracking.

C. Joints are to be square, tight, and well-fastened with all members assembled in accordance with the Contract Drawings.

D. Holes for bolts shall be drilled the same size as the bolt before galvanizing. Holes shall be swabbed with 2 coats of sealing compound as specified herein before installing the bolts.

E. Bolts shall be tightened to provide a solid connection. No more than one dock washer shall be installed under the bolt head or nut. Bolt threads shall project no more than one bolt diameter beyond the nut.

F. All timber shall be cut and fit in such a manner as to have full bearing over the entire contact surface.

PART 4 – MEASUREMENT AND PAYMENT

4.1 METHOD OF MEASUREMENT

A. Measurement for TIMBER shall be made by the Contract Unit Price of Lump Sum and include the items indicated under the Payment Item portion of this Section.

4.2 METHOD OF PAYMENT

A. Payment for TIMBER shall be at the Contract Unit Price Lump Sum and shall constitute full compensation for all labor, equipment, transportation, materials, temporary supports, survey, supervision, submittals and, shop drawings required for the supply and installation of new timber decking, pile caps, stringers, bracing, curbs, blocks, ledger, handrails and all hardware required, and any other incidentals necessary for the satisfactory supply and installation of all timber in accordance with the Contract Documents.
Payments for work under this item will not be made until specific work has been installed. Partial payments will be allowed.

4.3 PAYMENT ITEMS

ITEM	DESCRIPTION	UNIT
06 13 00-1	TIMBER	Lump Sum

END OF SECTION

SECTION 07 92 00: JOINT SEALANTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 REFERENCES

A. The following standards shall apply to the work of this Section.

1. American Society for Testing and Materials (ASTM):

C 920	Specifications for Elastomeric Joint Sealants
C 1193	Guide for Use of Joint Sealants
D 412	Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension
D 624	Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers

1.3 RELATED SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 03 Section – CAST-IN-PLACE CONCRETE
2. Division 32 Section – REINFORCED CONCRETE PAVING

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's printed product data, specifications, standard details, installation instructions, use limitations and recommendations for each sealant material used. Provide certifications that sealant materials comply with specified requirements.

B. Initial Selection Samples: Submit samples manufacturer's color charts showing complete range of colors, textures, and finishes available for each material used.

C. Verification Samples: Show full color ranges and finish variations expected. Provide sealant samples having minimum size of four inches long.

D. Test Reports: Provide certified reports for all specified tests.

1.5 COMPATIBILITY

A. Provide sealant and sealant joint backing materials suitable for the use intended and compatible with the materials with which they will be in contact. Compatibility of sealant and accessories shall be verified by the sealant manufacturer.

1.6 QUALITY ASSURANCE

A. Source: For each sealant material type required for the work of this section, provide primary materials that are the product of one manufacturer. Provide secondary or accessory materials that are acceptable to the manufacturers of the primary materials.

B. Installer: A firm with a minimum of 5 years' experience in type of work required by this Section.

C. Mock-Ups: Prior to commencing the primary work of this Section, provide mock-ups at locations acceptable to Landscape Architect. Obtain Landscape Architect's acceptance of visual qualities.

Protect and maintain accepted mock-ups throughout the remainder of the work of this section to serve as criteria for acceptance of the work.

1.7 PROJECT CONDITIONS

A. Weather: Perform work of this Section only when existing or forecasted weather conditions are within the limits established by manufacturers of the materials and products used.

B. Substrates: Proceed with work only when substrate construction and penetration work is complete.

1.8 PRODUCT DELIVERY, STORAGE & HANDLING

A. Materials under this Section shall be delivered to, and stored at, the job site in unbroken factory sealed containers with labels intact.

1.9 WARRANTY

A. Furnish joint sealant manufacturer's written single-source performance warranty that joint sealant work will be free of defects related to workmanship or material deficiency for 5 years from date of Substantial Completion of the Project.

PART 2 – PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Before installation check each sealant for compatibility with adjacent materials and surfaces and with indicated exposures. Select sealers that are recommended by manufacturer for each application indicated. Where exposed to pedestrian or vehicular traffic, provide sealants that are non-tracking and are strong enough to withstand the traffic without damage.

B. Provide colors as selected by Landscape Architect from manufacturer's standard and special colors. Where specifically requested, provide custom color matches.

2.2 SELF-LEVELING POLYURETHANE SEALANT

A. Provide two or more part, self-leveling, polyurethane based elastomeric sealant, complying with ASTM C 920, Type 1 Class A, having Shore A hardness of not less than 30 when tested according to ASTM C 920, cured modulus of elasticity at 100 percent elongation of not more than 150 psi, when tested according to ASTM D 412, and tear resistance of not less than 50 pounds per inch when tested according to ASTM D 624.

B. Where joint surfaces contain bituminous materials, provide modified sealants which are compatible with bituminous materials encountered.

C. Provide one of the following products that meet or exceed specified requirements:

1. Pecora Urexpan NR-200.
2. Mameco Vulkem 245 or 255.
3. Sika 2C, SL.
4. Sonneborn Sonolastic PvJtSt.
5. Tremco THC 900.

D. Extent: Provide self-leveling polyurethane sealant for paving joints.

2.3 MISCELLANEOUS MATERIALS

A. Primer: Provide primer recommended by sealant manufacturer for surfaces to be adhered to.

B. Bond Breaker Tape: Provide polyethylene or other plastic tape recommended by sealant manufacturer to prevent three-sided adhesion.

C. Backer Rod: Provide compressible rod of durable non-absorptive material recommended by sealant manufacturer for compatibility with sealant. Provide products of one of the following manufacturers:

1. Backer Rod Manufacturing and Supply Co.
2. Dow Chemical Co.
3. W. R. Meadows, Inc.
4. Williams Products, Inc.
5. Woodmont Products, Inc.

D. Joint backing for general use at joints in horizontal surfaces shall consist of two rows of butyl rubber or neoprene foam rod in contact with one another, and each compressed to approximately 2/3 original width when in place.

E. Provide miscellaneous materials of type that will not bleed through sealant, discolor surface, or produce other deleterious effects. Select size to provide compression to approximately 2/3 original width when in place. Provide backing material profile concave to the rear of the sealant and equipped with a bond-breaking film.

PART 3 – EXECUTION

3.1 INSPECTION

A. The Installer shall examine substrates and conditions under which this work is to be performed and notify Contractor, in writing, of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions are corrected. Beginning of sealant work means Installer's acceptance of joint surfaces and conditions.

3.2 PREPARATION

A. Strictly comply with manufacturers' instructions and recommendations, except where more restrictive requirements are specified in this Section.

B. Clean joint surfaces immediately before installation of sealants, primers, tapes and fillers. Remove substances which could interfere with bond. Etch or roughen joint surfaces to improve bond. Surfaces which have been given protective coatings and those that contain oil or grease shall be thoroughly cleaned with xylol or MEK solvent, with due precautions taken to minimize hazards.

C. Unless otherwise indicated, use of sealants shall conform to ASTM C 1193.

D. Tape or mask adjoining surfaces to prevent spillage and migration problems.

E. Prime surfaces as recommended by sealant manufacturer.

3.3 INSTALLATION

A. Provide backer rods for joint sealants except where specifically recommended against by sealant manufacturers.

B. Prevent three-sided adhesion by use of bond breaker tapes or backer rods.

C. Force sealant into joints to provide uniform, dense, continuous ribbons free from gaps and air pockets. Completely wet both joint surfaces equally on opposite sides.

D. Except in hot weather, make sealant surface slightly concave. Install sealants so that compressed sealants do not protrude from joints. Dry tool sealants to form a smooth dense surface. At horizontal joints form a slight cove to prevent trapping water.

E. Provide sealants to depths indicated, or if not indicated, follow manufacturer's recommendations.

3.4 EXTENT OF SEALANT WORK

A. General Extent: Seal all joints in concrete pavement, between concrete pavement and site walls and between concrete pavement and other site features. Provide elastomeric sealant installation with backer rod in all pavement expansion joints.

B. Exterior Sealing: Without limitation, the work of this Section includes sealing concrete to concrete joints in new and existing concrete pavements.

3.5 CURING

A. Cure sealants in strict compliance with manufacturers' instructions and recommendations to obtain highest quality surface and maximum adhesion. Make every effort to minimize accelerated aging effects and increase in modulus of elasticity.

3.6 CLEANING & PROTECTION

A. Remove smears from adjacent surfaces immediately, as the work progresses. Exercise particular care to prevent smearing or staining of surrounding surfaces which will be exposed in the finished work, and repair any damage done to same as result of this work without additional cost to Owner.

B. Clean adjacent surfaces using materials and methods recommended by sealant manufacturer. Where required, high pressure washing, or the use of chemical cleaners shall be employed to clean adjacent surfaces.

C. Remove and replace work that cannot be successfully cleaned or work that is damaged or deteriorated.

D. Provide temporary protection to ensure sealant work is not damaged following acceptance of sealant work. Protection may include covering of joints subject to damage during remainder of construction period. Remove protection immediately before final acceptance.

END OF SECTION

SECTION 10 18 00: INFORMATIONAL SIGNAGE

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SUMMARY

A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to perform all planting work and related items as indicated on the Contract Documents and as specified in this Section and includes, but is not limited to, the following:

1. Exterior Custom High Pressure Laminate (CHPL) graphics for wayfinding signs.
2. The contractor shall provide five (5) wayfinding signs, as shown on the Contract Drawings.
3. Landscape Architect shall provide Contractor with graphics.

1.3 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 03 Section – CAST-IN-PLACE CONCRETE
2. Division 32 Section – SITE IMPROVEMENTS

1.4 QUALITY ASSURANCE

A. Manufacturer: Obtain all products in this section from a single Manufacturer.

B. Installer: Installation shall be performed by installer specialized and experienced in work similar to that required for this project.

1.5 SUBMITTALS

A. Product Data: Submit Manufacturer’s product data for specified products. Include material details for each sign specified.

B. Graphic approval samples: Submit 9 in x 15 in laminate sample of section of typical project panel for approval of image quality and color fidelity.

C. Closeout submittals: Submit maintenance data for installed products, including precautions against harmful cleaning materials and methods.

D. Submit warranty documents specified herein.

1.6 DELIVERY, STORAGE & HANDLING

A. Comply with Manufacturer's ordering instructions and lead-time requirements to avoid construction delays.

B. Shipping of products shall be within one week of approval of production art.

C. Deliver products in Manufacturer's original, unopened, undamaged containers with identification labels intact.

D. Store products protected from weather, temperature, and other harmful conditions as recommended by Manufacturer.

E. Handle products in accordance with Manufacturer's instructions.

1.7 WARRANTY

A. Manufacturer's Warranty: Submit Manufacturer's standard warranty document executed by authorized company official.

B. Warranty Period: Ten years from product ship date.

PART 2 – PRODUCTS

2.1 EXTERIOR CUSTOM HIGH PRESSURE LAMINATE (CHPL) GRAPHICS

A. Acceptable Manufacturers:

1. Fossil Industries, Inc. of Deer Park, New York, www.fossilgraphics.com
2. iZone Imaging of Temple, Texas, www.izoneimaging.com
3. Approved equal: Contractor must submit substitution manufacturer information in accordance with the General Conditions. Manufacturers shall provide a minimum of four customer references.

B. Acceptable Product: Exterior Custom High Pressure Laminate (CHPL)

C. Display Laminate Requirements:

1. Thickness: 0.090 inch – by signage component
2. Provide UV inhibiting top layer and compatible spray coating.
3. Mechanical mounting to display frame shall be with appropriate tamperproof stainless steel fasteners.
4. Graphics:
   a. Graphics shall be subsurface and consolidated into the phenolic board by temperatures exceeding 275° F heat and pressure of 1200 PSI per Manufacturer’s standard method.
   b. Lettering and Graphics: Provide sizes, colors, and type styles indicated on drawings and in schedules. Provide computer generated lettering, accurately reproducing letterform and executed in a clean, precise manner.
   c. Acceptable Materials: Use only non-rusting, non-degrading, compatible materials to fabricate sign and graphics. Steel and wood components are not acceptable.

E. Fabrication – General

1. General: Comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
2. Visual inspection of each panel shall reveal no visible cuts, hairline cracks or surface defects. All edges shall be smooth and cut within 1/32” of size required for installation.
3. Allow for thermal movement resulting from a maximum ambient temperature change (range) of 100 deg F (38 deg C).
4. Mill joints between multiple panels to a tight, hairline fit.
5. Preassemble signs in the shop to the greatest extent possible to minimize field assembly. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in a location not exposed to view after final assembly.
6. Conceal fasteners if possible; otherwise, locate fasteners to appear inconspicuous.

7. Form panels to required size and shape. Comply with requirements indicated for design, dimensions, finish, color, and details of construction.
8. Coordinate dimensions and attachment methods to produce message panels with closely fitting joints. Align edges and surfaces with one another in the relationship indicated.
9. Increase material thickness or reinforce with concealed stiffeners or backing materials as required to produce surfaces without distortion, buckles, warp, or other surface deformations.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions: Verify installation conditions previously established under other sections are acceptable for product installation in accordance with Manufacturer's instructions.

B. Scheduling of installation by Owner or its representative implies that substrate and conditions are prepared and ready for product installation. Proceeding with installation implies installer’s acceptance of substrate and conditions.

3.2 INSTALLATION

A. Install product in accordance with Manufacturer’s instructions.

B. Install product in locations indicated using mounting methods recommended by sign Manufacturer and free from distortion, warp, or defect adversely affecting appearance.

C. Install product level, plumb, and at heights indicated.

3.3 CLEANING, PROTECTION, AND REPAIR

A. Replace components where repairs were made but are still visible to the unaided eye from a distance of 3 feet.

B. Remove temporary coverings and protection to adjacent work areas. Clean installed products in accordance with Manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project in accordance with provisions in Division 01.

3.4 SIGN SCHEDULE AND DRAWINGS

A. Schedule: Refer to schedule and Drawings for sizes, locations, and layout of panel types, text, and graphics.

END OF SECTION

SECTION 11 68 00: PLAY EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SUMMARY

A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to furnish and install designated play equipment and related items as indicated on the Contract Documents, as specified in this Section, and includes, but is not limited to, the following:

1. Play Structure #1
2. Play Structure #2
3. Play structure #3
4. Play structure #4
5. *Robinia* (black locust) posts & edging
6. Children's table
7. Swings
8. Wooden sailboat
9. Embankment slide
10. Rubber half spheres
11. Sand & water play: Stainless steel sand play table with water rill, water seesaw, and
12. Pavement playground markings

1.3 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 03 Section – CAST IN-PLACE CONCRETE
2. Division 32 Section – ASPHALT PAVING
3. Division 32 Section – SITE IMPROVEMENTS
4. Division 32 Section – REINFORCED CONCRETE PAVING
5. Division 32 Section – RESILIENT RUBBER SAFETY SURFACING
6. Division 32 Section – PROTECTIVE PLAYGROUNDS SURFACING

1.4 REFERENCES

A. The following standards shall apply to the work of this Section:

1. ASTM: American Society for Testing and Materials
2. CPSC: U.S. Consumer Product Safety Commission
   Public Playground Safety Handbook
3. CMR: 521 Massachusetts Architectural Access Board

1.5 SUBMITTALS

A. Shop Drawings:

1. Play Equipment: all components

2. Plan View at 1” = 10’ scale showing all use zones
3. Mounting Heights for slides and accessible components
4. Pavement playground markings: Indicate markings, colors, and dimensions to adjacent work

B. Manufacturer's Literature: Submit copies of each of manufacturer's material descriptions and installation instructions for the following:

1. Play Equipment, for all components: Plan view showing use zones, three dimensional illustrations showing all elements, and color mock-up
2. Fall zone for each piece of equipment according to manufacturer and CPSC
3. Pavement playground markings
4. Rubber half spheres (manufacturer’s literature on materials, hardware, and anchorage)

C. Samples:

1. Colors for all play equipment: Equipment colors are identified for bidding purposes. Final color selection shall be made as part of the play equipment submittal process.
2. Colors for pavement playground markings
3. Material samples for pavement playground markings
4. Rubber half spheres: color sample

1.6 PRECONSTRUCTION CONFERENCE

A. Prior to installation, Contractor shall schedule a preconstruction conference with the Owner, Landscape Architect, Play Equipment Manufacturer’s Representative, and the Play Equipment Installer to discuss delivery, schedule, layout, and installation.

PART 2 – PRODUCTS

2.1 PLAY EQUIPMENT – GENERAL

A. Play equipment shall be manufactured by one of the following:

1. Kompan, Inc. of Tacoma, Washington
2. Landscape Structures, Inc. of Delano, Minnesota
3. An approved equal

B. Warranty

1. Manufacturer shall offer a minimum of the following warranties on the materials and components of its system:
   a. 15 Year warranty on all plastic components and coatings
   b. 5 Year warranty on cables, chains, swing seats and rocking components
   c. 100 Year warranty on all posts, fasteners, beams, and caps against structural failure due to corrosion/natural deterioration or manufacturing defects.

2.2 PLAY EQUIPMENT – MATERIALS

A. Play Structure #1: The basis of design for Play structure #1 is Robinia Cocowave Rope Swing, product #NRO915 from Kompan.

B. Play Structure #2: The basis of design for Play structure #2 is Robinia Wobble Bridge, product #NRO810 from Kompan.

C. Play structure #3: The basis of design for Play structure #3 is Robinia Parkour 2, product #NRO852 from Kompan.

D. Play structure #4: The basis of design for Play structure #4 is Wizard Hideaway, product #NRO409-0032 from Kompan.

E. Children's table: The basis of design is Robinia Kids table with 4 sitting poles, product #NRO212 from Kompan.

F. Swings: The basis of design for swings shall include the following from Kompan:

1. Swing frame for 6 seats, product #NO926
2. Group swing: Birds Nest Swing, product #NRO911
3. Bank of 2 swings (5 to 12 year old)
4. Bank of 2 swings (2 to 5 year old)

G. Wooden boat: The basis of design is Robinia Forest Lake Boat, product #NRO514 from Kompan.

H. Embankment slide: The basis of design is Embankment Slide, product #COR71100 from Kompan.

I. Sand and water play:

1. Sand play table with water rill: The basis of design is "Water channel with splash table", product #NRO508 by Kompan comprised of Robinia wood.
2. Water seesaw: The basis of design is "Water Seesaw", product #NRO504 by Kompan comprised of Robinia wood.
3. Water channel: The basis of design is "Water Channel", product #NRO505 by Kompan comprised of Robinia wood. Contractor shall provide three.
4. Quantities to be as shown on Contract Drawings.

2.3 RUBBER HALF SPHERES

A. Basis of Design: The basis of design for the rubber half spheres is the Euroflex half ball as distributed by Goric and manufactured by Kraiburg Relastec.

B. Product requirements and materials:
   a. Granulated recycled rubber (90%) topped with EPDM rubber granulate.
   b. MDI polyurethane binding agent (10%)
   c. Surface: smooth with open pores.
   d. Fire resistance: E (DIN EN 13501-1 2002)
   e. Cold fracture resistance: 24h/ -40 degrees C, no fracture
   f. Cold crack resistance: 5h/ -30 degrees C, no cracks
   g. Weight 22.5 lbs., 66 lbs, 183 lbs. See plan for size.
   h. Steel anchor: 1.63" x 29.5"
   i. Tolerances: +/- 0.8%
   j. Conditionally resistant to acids and bases.
   k. UV resistant
   l. Color to be blue (RAL 5012, RAL 5015 and/or RAL 5010); to be determined by submitted samples.

2.4 *ROBINIA* POSTS & EDGING

A. Posts and edging shall be *Robinia pseudoacacia* (black locust) round timbers with bark removed. Timbers to be free of branches and all edges shall be eased.

B. Minimum diameter of timbers after stripping shall be 6 inches. Timbers may be used in full length or cut to meet minimum diameter.

C. Stakes shall for edging shall be #4 rebar by 36" long and shall be covered with black locust dowel plug.

2.5 PAVEMENT PLAYGROUND MARKINGS

A. Basis of Design: The basis of design for the pavement playground markings is DecoMark as manufactured by Ennis-Flint Thomasville, North Carolina, or approved equal.

1. Pavement playground markings include painted markings applied to asphalt pavement as shown o n Contract Documents.
2. Pavement playground markings shall be thermoplastic markings which are durable, skid resistant, retroreflective thermoplastic pavement marking material.
3. The material shall be capable of being affixed to bituminous pavements by the use of the normal heat of a propane torch, or an infrared heater, or a blue-flame radiant heater. The use of a compactor or similar equipment shall not be necessary.
4. Installed pavement playground markings shall be ADA accessible after installation.
5. Must be composed of an ester modified rosin resistant to degradation by motor fuels, lubricants et c. in conjunction with aggregates, pigments, binders, abrasives, and glass beads which have been fa ctory produced as a finished product and meets the requirements of the current edition of the Manual o n Uniform Traffic Control Devices for Streets and Highways. The thermoplastic material conforms to A ASHTO designation M249.

B. Contractor shall provide pavement playground markings in the quantity shown on the Contract Docu ments.

1. Colors shall be mix of 3 different color options.
2. Size shall be graphic shown on Contract Drawings. Landscape Architect to provide vector graph ic.
3. Quantity shall be as shown on Contract Documents.

C. Pavement playground markings shall have a 5 year warranty.

2.6 CONCRETE

A. Concrete footings shall be 4,000 pounds per square inch (30MPa) cast-in-place concrete. Concrete pads shall be 3,000 pounds per square inch (20MPa) cast-in-place concrete.

B. Cast-in-place concrete for pads and footings shall be as specified and paid for under the work of Division 03 Section, CAST-IN-PLACE CONCRETE of this Specification.

PART 3 – EXECUTION

3.1 EARTHWORK

A. All excavation, filling, compacting, and grading of backfill materials, including base and subbase materials, ordinary borrow, drainage fill and structural associated with and used in the installation of the items of this Section, shall be as specified under the Division 31 Section, EARTHWORK.

3.2 CONCRETE

A. Concrete footing placement, protection and formwork shall be as specified under the MassDOT Standard Specifications Section 901.

B. Concrete footing placement, protection and formwork shall be as specified by play equipment manufacturer's recommendations.

3.3 PLAY EQUIPMENT – GENERAL

A. Installation instructions and aids

1. To guide installation, each structure shall be accompanied by bills of materials, written instructions, an erection plan view drawing, and a footing plan location drawing to be furnished prior to or with the delivery of the play structure. All components shall be shipped unitized, protectively wrapped, banded for mechanical handling and ready for assembly.

B. Play equipment shall be erected by a certified playground installer.

C. The play equipment manufacturer shall certify on the shop drawings that the play equipment is compliant with the current ADA regulations.

D. Manufacturer's instructions for installation shall be followed.

E. Age appropriate signage for each structure (2 to 5 and 5 to 12) shall be provided by the manufacturer and installed at the Contractor's expense as located in the field by the Landscape Architect.

3.4 RUBBER HALF SPHERES

A. Products to be protected and stored above ground until ready for installation.

B. Each rubber half sphere receives steel mounting anchor to concrete footing. Steel anchors are to be glued into the half sphere with polyurethane glue – Ottocoll M 500 (red) or Ottocioll P83 (grey).

C. Half spheres to be installed per manufacturers recommendations.

D. Half spheres cannot be field repaired without first contacting manufacturer.

3.5 *ROBINIA* POSTS & EDGING

A. *Robinia* posts and edging may be adjusted from the Contract Drawings by Landscape Architect.

B. Secure edging with support stakes, minimum two (2) stakes each log, or 5 feet on center maximum. Stakes shall be set 24 inches minimum into undisturbed soils or to refusal.

3.6 PAVEMENT PLAYGROUND MARKINGS

A. Examination:

1. Verify that pavement is dry ad in suitable condition to begin pavement markings according to manufacturer's written instructions.
2. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

B. Do not apply pavement markings until layout, colors, and placement have been verified by Landscape Architect.

C. Protect pavement markings from damage and wear during remainder of construction period.

D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction. Surface must be free of dirt, dust, chemicals, oily substances, and loose aggregate.

E. Layout shall be determined by Landscape Architect in field prior to installation.

END OF SECTION

SECTION 26 00 00: ELECTRICAL

1 GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT, CONDITIONS OF THE CONTRACT, and all Sections within DIVISION 1 - GENERAL REQUIREMENTS, are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials, and equipment necessary to complete the work of this Section, including, but not limited to, the following:

1. Complete connections to existing cabinet/panels/controls.
2. All branch power circuits to all lighting fixtures and as required for all special systems components.
3. Complete grounding system as required by Article 250 of the National Electrical Code.
4. Complete raceway system with conduits, conduit fittings, outlet boxes, wire ways, and all incidental items as required for a complete installation.
5. Vendor services, testing and training.
6. All devices and products under this section are to meet the voltage requirements available on site. It the Electrical Contractor's responsibility to ensure this.

B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:

1. SECTION GENERAL CONDITIONS OF THE CONTRACT.
   a. Cutting, patching and drilling, except installation of pipe supports and fastenings.
2. EARTHWORK.
   a. All excavation and backfill.
3. CAST-IN-PLACE CONCRETE.
   a. All concrete work.

C. Extent: The work required under this Section, without limiting the generality thereof, includes the furnishing of all labor and materials required to supply and distribute proper power, including all conduit and controls, to all electrical fixtures, accessories, devices, motors, motor controllers, etc., and the special systems called for under all Sections of the Specifications, and all other materials, equipment, and labor necessary, whether or not such items are specifically indicated on the Drawings or in the Specifications to complete the electrical work, in all respects ready for continuous and trouble free operation.

D. Intent: It is the intent of the Contract Documents to include all work and materials necessary for erecting complete, ready for continuous use, all electrical and special systems shown on the accompanying Drawings, or as hereinafter described. These Drawings shall be taken in a sense as diagrammatic; branch circuit runs, electrical equipment, etc. and methods of running them are shown, but it is not intended to show every fitting, wire, or device, nor every structural difficulty that will be encountered during the installation of the work.

1.3 QUALITY ASSURANCE

A. Execution:

1. The Electrical Subcontractor shall refer to all the Drawings for a full comprehension of the work to be done and for conditions affecting the location and placement of his equipment and materials. These Drawings are intended to be supplementary to the Specifications and any work indicated, mentioned, or implied in either is to be considered as specified by both. Should the character of the work herein contemplated or any matter pertaining thereto be not sufficiently explained in the Specifications or Drawings, the Electrical Subcontractor may apply to the Architect-Engineer for further information and shall conform to such when given, as it may be consistent with the original intent. The Architect-Engineer reserves the right to make

any reasonable changes in location prior to installation at no expense to the Owner. All lines are diagrammatic and exact locations are subject to the approval of the Architect-Engineer.

2. Before submitting his bid, the Electrical Subcontractor shall visit the site with the Drawings and Specifications and shall become thoroughly familiar with all conditions affecting his work since the Electrical Subcontractor will be held responsible for any assumption he may make in regard thereto.

3. The Electrical Subcontractor shall, at all times, have a foreman or superintendent on the project authorized to make decisions and receive instructions as if the Electrical Subcontractor himself were present. The Electrical Subcontractor shall employ only competent and experienced workmen at a regular schedule in harmony with the other tradesmen on the job. The Electrical Subcontractor shall also exercise care and supervision of his employees in regard to proper and expeditious layout of his work.

4. When items in the contract drawings and specifications are in conflict, then the more stringent of the two shall take precedence.

B. Products:

1. All materials used in this Section shall be new, full weight, and first class in every respect, without defects, and designed to function properly in that portion of the work for which they are intended and with the same brand of manufacturers for each class of material or equipment.

2. Equality of material or equipment other than those named or described in this Section will be determined in accordance with the provisions of the Contract and as specified further herein.

C. All work installed under these Drawings and Specifications must be installed in strict accordance with the requirements of all local and other departments having jurisdiction, the utility companies, and with the requirements of the Underwriters' Laboratories, Inc., National Bureau of Fire Underwriters, International Building Code, National Electrical Code 2011 (USA), EIA/TIA Building Telecommunication Wiring Standard, and/or similar codes applied hereto.

1.4 CODES AND STANDARDS

A. Workmanship, material and equipment shall be in accordance with Specifications and Drawings and in some instances the requirements exceed those required by codes and standards. Where not exceeded, the codes and standards shall be considered as absolute minimum requirements. Where conflicts occur between codes the most stringent shall apply.

B. All materials, appliances, equipment and devices provided under this contract must meet the requirements of Underwriters Laboratories (UL) Standards.

C. Refer to NEC, for definitions of terms used in the Drawings, Specifications, etc. These definitions, in conjunction with local authorities interpretation, convention and common usage, will apply.

D. International Building Code.

E. International Fire Code

F. Massachusetts Building Code

1.5 REFERENCE ABBREVIATIONS

A. References are made in the various Electrical Sections to technical societies, codes, specifications, trade organizations, and regulatory authorities in accordance with the following abbreviations:

1. ADA - Americans with Disabilities Act (1992).

2. FM - Factory Mutual

3. IEEE - Institute of Electrical and Electronics Engineers.

4. IPCEA - Insulated Power Cable Engineers Association.

5. NEC - National Electrical Code (NFPA Pamphlet No. 70).

6. NEMA - National Electrical Manufacturer's Association.

7. NETA - International Electrical Testing Association, Inc.

8. NFPA - National Fire Protection Association.

9. UL - Underwriters Laboratories, Inc.

1.6 SHOP DRAWINGS AND DATA TO BE SUBMITTED

A. Within 30 days of award of the Contract, the Electrical Subcontractor shall submit, for approval, six (6) copies of a complete list of manufacturer's shop drawings, detail prints and data.

B. Reference catalog cuts and brochures of products to proper paragraph in Specifications. Furnish numerical index by Specifications paragraph number listing product name, catalog number and reference to page number of submittal brochure.

C. Cross reference individual catalog numbers of substitute products to numbers of specified materials.

D. Requests for permission to use substitute or alternate products shall be accompanied with evidence to prove that the product:

1. Conforms to the standard of performance and quality specified.
2. Will physically fit in the space allocated, with sufficient access and maintenance space.
3. Will not entail changes in details and construction of related work whether mechanical, electrical, or general in nature.
4. Involves no additional costs to the Owner or extended construction time.

E. Requests for permission to use substitute or alternate products shall be immediately brought to the Landscape Architect’s attention. In the event that the use of these products may be determined to result in a material or labor savings to the Contractor, then the amount of these savings as a credit to the Owner will be required to assist in determination of acceptability of the product. Provide drawings, specifications, samples, performance data and other information as may be required to assist in determination of acceptability of the product.

F. Equipment Items

1. Submit manufacturer's certified data relative to equipment required for the installation of the electrical systems.
2. Submit adequate engineering data on each piece of equipment to allow a careful check of compliance with the technical requirements of the Contract Documents. Clearly indicate on submitted data the manufacturer's name, piece number, equipment capacity, and other applicable technical data.
3. Data and drawings for Electrical Systems:
    a. Wiring Devices
    b. Raceways and Fittings
    c. Underground Conduit
    d. Wires and Cables
    e. Handholes
4. Do not release for shipment, deliver, or install any equipment or material without the prior approval of the Architect-Engineer.

1.7 OPERATING AND MAINTENANCE MANUALS

A. Bind in loose-leaf binders with the words, "Operating and Maintenance Manual" and the Project identification imprinted on the cover. Prepare three complete sets of records for the Owner, with table of contents, index, and tabbed section dividers.

B. During the construction period, accumulate the following for inclusion in the Operating and Maintenance Manuals:

1. Copies of warranties and guarantees on each piece of equipment installed.
2. Fixture brochures.
3. Wiring and control diagrams.

4. Approved Shop Drawings.
5. Operating instructions for:
    a. Electrical Systems
6. Recommended maintenance procedures.
7. Lists of major items of equipment with name, address, and telephone number of each local representative.

C. Submit the manuals for approval at approximately 75 percent job completion.

D. Each manual shall consist of:

1. Complete description of each item of equipment and apparatus furnished and installed including ratings, capacities, and characteristics.
2. Fully detailed parts list, including all numbered parts of each item of equipment and apparatus furnished and installed.
3. Manufacturer's printed instructions describing operation, servicing, maintenance and repair of each item of equipment and apparatus.
4. Typewritten record of all tests made of materials, equipment, and systems. All such records shall state the date tests were conducted, the names of all persons making and witnessing the tests, and citing any unusual conditions relevant to the tests.

1.8 DELIVERY, STORAGE, AND HANDLING

A. The Electrical Subcontractor shall provide for the delivery of all his materials and fixtures to the site when required so as to carry on his work efficiently and to avoid delaying his work and that of other trades.

B. The Electrical Subcontractor shall, at all times, fully protect his work and materials from injury or loss by others. Any injury or loss, which may occur, shall be made good without expense to the Owner. The Electrical Subcontractor shall be responsible for the proper protection of all his materials until the Owner accepts the work.

1.9 GUARANTEE/WARRANTY

A. The Electrical Subcontractor shall and hereby does warrant that all work executed and all equipment furnished under this Section shall be free from defects of workmanship and materials for a period of one year from date of final acceptance of this work. The Electrical Subcontractor further agrees that he will, at his own expense, repair and replace all such defective work and all other work damaged thereby which becomes defective during the term of the Guarantee/Warranty.

1.10 RECORD DRAWINGS

A. Accumulate Record Drawings during the construction of the project. Keep one (1) set of Contract Drawings at the job site at all times, and mark changes, rerouting or modifications which occur, clearly on the Drawings with dimensions.

B. At completion of the job, obtain electronic drawings from the Architect and transfer the notations indicating changes to them. Reproducible drawings shall be submitted for review prior to final payment. Submit a complete set of reproducible drawings together with AutoCAD 2006 electronic drawings prior to final payment.

1.11 TEMPORARY LIGHT AND POWER

A. This Contractor shall furnish, install, maintain and remove at completion of work necessary temporary electrical distribution wiring.

B. Panel boards, switches, receptacles, poles, transformer, metering and accessories required for temporary light and power installation shall be provided.

C. Outlets shall be located at convenient points so that extension cords of not over fifty (50) feet will reach work requiring temporary light and power.

D. The General Contractor and Subcontractors, individually, shall furnish cords, sockets, motors and accessories for their work.

E. Temporary wiring, service equipment and accessories thereto installed, shall be removed at the expense of this Contractor after they have served their purpose.

F. The General Contractor is required to pay the cost of electricity consumed by himself and by his Subcontractors. This Contractor shall pay for replacement of lamps broken and/or removed from the premises during the construction period and until date of substantial completion as determined by Architect.

G. Temporary work shall be furnished and installed in conformance with OSHA, local codes and ordinances.

H. The Electrical Contractor shall supply power for the General Contractor's and Clerk of the Work's trailers.

2 PRODUCTS

2.1 GENERAL PROVISIONS FOR ELECTRICAL WORK

A. SUMMARY

1. The Specifications for accompanying drawings are intended to secure the provision of all material and labor necessary for complete electrical installation tested and ready for service, and as called for herein and as indicated on the drawings. Each system shall be complete and shall include all the necessary appurtenances and minor auxiliaries required to make it functional and complete in every respect.
2. All materials shall be new and shall conform to the standard of the Underwriters Laboratories, Inc. Materials shall be fabricated in accordance with the specifications and approved rules and regulations of NEMA and shall be UL listed and labeled. Materials and apparatus for like services shall be by the same manufacturer.
3. Provide a complete electrical system as described herein and / or as shown on the drawings.

B. CODES AND PERMITS

1. The requirements of the National Electrical Code, the rules and regulations of state and municipal authorities having jurisdiction, the construction requirements of NEMA, NFPA, ANSI, OSHA and BOCA shall be observed and shall govern all materials furnished and installation methods applied.
2. The Contractor of electrical work shall at his expense, obtain all necessary permits and certificates, pay all fees and charges connected with his work in compliance with the codes, applicable laws and municipal regulations, and shall deliver these to the Owner/Engineer before final acceptance of his work.

C. SITE VISIT

1. Bidders, before submitting proposals, shall visit and carefully examine the site affected by this work to familiarize themselves with existing conditions and with the difficulties that may attend the execution of this work. Bidders shall also consider the eventuality of having to perform certain tasks on premium time, outside of normal working hours. Submission of a proposal with appropriate references to potential scheduling concerns will be construed as evidence that such an examination has been made and proper consideration given. Later claims for more labor, equipment or materials, required because of difficulties encountered, will not be recognized.
2. The Contractor for the electrical work shall also examine the general construction and mechanical/plumbing plans and specifications, insofar as labor and materials and type of construction, etc., may affect the electrical examination has been made. No later claims for extra work resulting from failure to do so will be recognized.

D. CUTTING AND PATCHING

1. Where required by drawings, the Electrical Contractor shall repair or replace paved areas disturbed by the installation of underground conduits and / or cables. Patched or re-paved areas shall be completed using appropriate and suitable materials and methods to effect a permanent repair.

E. CLEANING AND ADJUSTMENTS

1. Scratched or damaged painting shall be touched up with appropriate materials and methods as necessary to return the painting to a new condition and appearance.

F. ACCEPTANCE

1. Seven (7) days prior to date of requested Final Inspection, Contractor shall:
    a. After the completion of the work, the electrical contractor shall test and demonstrate to the satisfaction and approval of the Owner, Engineer or their representatives all systems in perfect working order, using instruments or by actual operation of the system.
    b. Furnish engineer required maintenance manual, parts list, operating instructions, wiring diagrams, and electric control diagram.

G. RACEWAYS AND CONDUCTORS

1. Electrical metallic tubing shall be thin wall steel pipe, minimum size 1/2”, and may be used in dry locations. Fitting shall consist of compression or set screw type of connectors.
2. Underground rigid nonmetallic conduit shall be NEMA TC2, Schedule 40 PVC with NEMA TC3 fittings.
3. Conductors shall be 600 V Type RHHW, XHHW color coded, minimum size #12 AWG.
4. All raceways shall be concealed.
5. All conductors shall be copper.
6. Branch circuits more than 100 feet long shall be #10 AWG for the entire length, up to the first outlet or junction box.

H. GROUNDING

1. Equipment ground shall consist of grounding all metallic non-current carrying components of electrical system (conduit system, cabinets, frames of motors, panelboards, etc.). Metallic raceways shall effectively and permanently maintain continuity of ground between equipment. Grounding source for equipment ground shall be the same as for the service ground. Equipment grounding conductors shall be run in all raceways.
2. All poles shall be grounded with a ground rod (min 5’ in length).

I. EXECUTION OF WORK

1. Install all materials and equipment in a neat and workmanlike manner and provide for the following:
    a. All work shall be installed so as to be readily accessible for operation, maintenance and repair. Minor deviations from the plans may be made to accomplish this, subject to the approval of the Engineer.
    b. The area of work shall be kept free of litter and debris. Contractor shall clean up the work area at the end of each working day. All scrap material and other waste shall be removed from the site by the contractor.
    c. Electrical contractor shall coordinate the electrical work with other trades, including civil (to coordinate underground work). Electrical contractor shall secure shop drawing from other contractors and verify exact electrical characteristics of equipment to be wired. This is done before electrical contractor rough-in for subject equipment. If discrepancies are noted between the electrical contract drawings and the other contractor shop drawings, electrical contractor is to notify Engineer at once. Failure by the electrical contractor to perform this duty will not relieve him of the responsibility to correct wiring deficiencies at his expense.
    d. Drawings are diagrammatic, small scale and indicate the general arrangement of systems and work included. Electrical Contractor shall apply for detailed information regarding the location of all equipment before rough-in as the final location may differ from that shown on drawings. Outlets, etc., improperly placed because of failure to obtain this information shall be relocated and installed without additional expense. Certain raceways, bends, fittings, boxes, system components, appurtenances and related specialties are not shown, but shall be provided. Do not scale drawings.
    e. All electrical work required for identical items shown on the drawings shall be provided although each specific identical item may not be shown.
    f. All circuits shall be clearly identified at panelboards with printed circuit schedules. All other electrical equipment shall be labeled with white engraved with black lettering laminated nameplates.

2.2 ELECTRICAL GENERAL REQUIREMENTS

A. SCOPE OF WORK

1. Coordinate all work in this Section with related trades.
2. Furnish all materials, equipment, supplies, transportation and labor, and perform all operations necessary in the installation of all electrical work, complete and in operating condition.
3. Examine the drawings and specifications and determine work to be performed by the electrical and other trades. Provide the type and quantity of electrical materials and equipment necessary to complete this work and place all systems in proper operation, tested and ready for use.
4. Work Included: In general, the electrical work shall consist of, but not be limited to, the following:
    a. Incidental items not indicated on the drawings nor mentioned in the specifications that belong to the work described or are required to provide a complete system as though called out here in every detail.
    b. Acquire all permits and pay all fees as may be necessary to perform the specified work.
5. The requirements of authorities shall be the minimum acceptable requirements for the work and nothing described in these specifications or indicated on the drawings shall be construed to permit work not conforming to the most stringent of the applicable codes and regulations.
6. When drawings or specifications call for materials or construction of better quality or larger size than required by codes, laws, rules and regulations, the drawings and specifications shall take precedence.
7. Should any changes to the work indicated on the drawings or described in the specifications be necessary in order to comply with the above requirements, notify the Architect immediately and cease work on all parts of the Contract which are affected until approval for any required modifications to the construction has been obtained from the Architect.

B. WORK RESPONSIBILITIES

1. Examine the site and all electrical, architectural and other drawings and accept such conditions and make allowance for them in preparing the bid. No extra charges will be considered for costs resulting from failure to comply with the above.
2. The drawings indicate diagrammatically the desired locations or arrangements of conduit runs, outlets, equipment, etc. and are to be followed as closely as possible. Proper judgment must be exercised in executing the work so as to secure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference with existing conditions. The contractor is responsible for the correct placing of his work and the proper location and connection of his work in relation to the work of other trades.
3. In the event changes in the indicated locations or arrangements are necessary due to developed conditions in the construction or rearrangement of furnishings or equipment, such changes shall be made without extra costs, providing the change is ordered before the conduit runs, etc. and the work directly connected to same is installed and no extra materials are required.
4. All scaled and figured dimensions are approximate of typical equipment of the class indicated. Before proceeding with any work, carefully check and verify all dimensions, sizes, etc. with the drawings to see that the equipment will fit into the spaces provided without violation of applicable codes.
5. Should any changes to the work indicated on the drawings or described in the specifications be necessary in order to comply with the above requirements, notify the Architect immediately and cease work on all parts of the Contract which are affected until approval for any required modifications to the construction has been obtained from the Architect.
6. Perform all work competent and skilled personnel.
7. All work shall be of the highest quality consistent with the best practices of the trade.
8. Replace of repair, without additional compensation, any work which, in the opinion of the Architect, does not comply with these requirements.

9. The Electrical Contractor shall be responsible for the safety and good condition of all materials and equipment until final acceptance by the Owner; for providing adequate and proper storage facilities during the progress of the work; for replacing all damaged and defective work before applying for final acceptance; for erecting and maintaining suitable barriers, protective devices, light and warning signs for the protection of the public and employees; and for all loss, damage or injury to persons or property resulting from any neglect of these responsibilities.
10. The Contractor shall be responsible for all faults and deficiencies in his work during the guarantee period and shall repair, at no cost to the Owner, all such deficiencies that occur immediately upon notification by the Owner. All damage to other work there from, which may occur during the construction and guarantee period, shall be repaired at once, at no cost to the Owner.

C. INTERPRETATION
1. All requests for interpretation of plans and specifications must be made by the Contractor through the Architect. Any such requests made by equipment manufacturer or suppliers will be referred to the Contractor.

D. SELECTION OF MATERIALS AND EQUIPMENT
1. Specified materials and equipment shall be selected within the operating ranges indicated for efficiency, capacities, noise levels, and projected life. In the absence of specific criteria, conservative commercial practice, in the opinion of the Architect, will apply.
2. Items of a similar application shall be of the same manufacturer.
3. The label of listing by Underwriters Laboratories, Inc. shall appear on all materials and equipment for which standards have been established by that agency.
4. Where local or other authorities have jurisdiction, have established label or approval requirements, furnish all materials and equipment with either the required labels affixed, or the necessary written approval.
5. The equipment plans are designed around standard products of one or more of the manufacturer's listed as being acceptable for the product involved. Where one or more manufacturer is listed as being acceptable for a product, each manufacturer listed for that product shall be considered as "equal" and acceptable.
6. All materials to be free of asbestos and urea formaldehyde.

2.3 BASIC ELECTRICAL MATERIALS AND METHODS

A. SUMMARY
1. This Section includes the following:
a. Raceways
b. Supporting devices for electrical components
c. Electrical identification
d. Electricity-metering components
e. Concrete equipment bases
f. Cutting and patching for electrical construction
g. Touchup painting

B. DEFINITIONS
1. EMT: Electrical metallic tubing
2. IMC: Intermediate metal conduit
3. RNC: Rigid non-metallic conduit

C. COORDINATION
1. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the work.
2. Coordinate electrical service connections to components furnished by utility companies.
a. Coordinate installation and connection of exterior underground and overhead utilities and services, including provisions for electricity metering components.

b. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.

3. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

D. RACEWAYS

1. EMT: ANSI C80.3, zinc-coated steel, with set-screw or compression fittings.
2. FMC: Zinc-coated steel
3. IMC: ANSI C80.6, zinc-coated steel, with threaded fittings
4. LFMC: Zinc-coated steel with sunlight resistant and mineral-oil-resistant plastic jacket
5. RNC: NEMA TC2, Schedule 40 PVC, with NEMA TC3 fittings
6. Raceway Fittings: Specifically designed for the raceway type with which used.

E. CONDUCTORS

1. Conductors, No. 10 AWG and Smaller: Solid or stranded copper.
2. Conductors, Larger Than No. AWG: Stranded copper.
3. Insulation: Thermoplastic, rated at 75 deg C minimum.
4. Wire Connectors and Splices: Units of size, ampacity rating, material, type, and class suitable for service indicated.
5. Use only RHHW wire for power.

F. SUPPORTING DEVICES

1. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.
2. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.
3. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
4. Cable Supports for Vertical Conduit: Factory fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable iron casting with hot-dip galvanized finish.
5. Toggle Bolts: All steel springhead type.
6. Power Driven Threaded Studs: Heat treated steel.

G. EQUIPMENT FOR UTILITY COMPANY'S ELECTRICITY METERING

1. Meter Sockets: Comply with requirements of electrical power utility company.

H. TOUCHUP PAINT

1. For Equipment: Equipment manufacturer’s paint selected to match installed equipment finish.
2. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

2.4 ACCEPTABLE MANUFACTURERS

A. Manufacturer's names and catalog numbers are scheduled or specified for the purpose of establishing standard of design, quality, appearance, performance and serviceability, and not to limit competition. Scheduled products (as may be modified by detailed specifications) are those selected as the basis for system design with respect to physical size and space arrangements, required capacity and performance characteristics, and the product quality intended.

B. The Drawings indicate scheduled products physically arranged in the spaces, based on catalog data of specific manufacturers.

C. Listed "Acceptable Manufacturers" are those considered capable of manufacturing products conforming to detailed specifications, and as such, are invited to compete on an equal basis provided the offering is comparable in every respect to scheduled or specified products and actually conforms to the detailed specifications and schedule requirements. Listing herein as "acceptable manufacturers" does not imply "accepted", "approved", "prior approval", or any other such connotation. All product offerings must be submitted for approval after Contract award.

D. Vendors are invited to submit material or equipment bids to bidding contractors on any comparable equivalent product, whether or not the manufacturer of such product is listed herein as an "acceptable manufacturer". Such product bids should clearly indicate offerings that are not listed as "acceptable manufacturers". In the event a bidding contractor, after satisfying himself that such unlisted product is in fact "equal" to the specified product with respect to design, quality, performance and arrangement (space requirements), and the Contractor desires to furnish that product on the Project, he may request the name of the manufacturer be added to the list of acceptable manufacturers as an 'Alternate'.

E. At a bidder's request, an unnamed manufacturer's equipment will be considered to determine additional "acceptable manufacturers" if a request is made in writing no later than six (6) days prior to the bid opening. If such requests are found acceptable, an addendum will be written listing additional acceptable manufacturers. Consideration will be given only to requests of bonafide bidders (contractors), not to those received from vendors.

F. Manufacturers of materials and equipment shall be as specified, scheduled, or as listed in each respective product Specification Article.

2.5 WATERPROOFING

A. Seal penetrations with sealant to prevent moisture leakage. Apply sealing material (caulking) in accordance with manufacturer's published instructions.

B. Product Research and Chemical Co. "Poly-Sulphide Sealant" PRC-5000.

2.6 WIRE AND CABLE

A. General:

1. Wire and cable for feeder and branch circuits shall conform to the requirements of the current edition of the National Electrical Code, and shall meet applicable ASTM specifications. Conductors shall be soft drawn, annealed, 98 percent conductivity copper. Wire and cable shall be new, shall have size, type of insulation, voltage rating and manufacturer's name permanently marked on the outer covering at regular intervals. Conductors No. 8 AWG and smaller shall be color-coded #6 and larger to be marked with phasing tape. Colors for each phase and neutral shall be consistent throughout the system.

B. 600 volt insulation:

1. Provide conductors with insulation rated for 600 volts unless specified or indicated otherwise. System design is based on the following U.S. products:

2. NEC Type RHHW, XHHW.

C. Acceptable Manufacturers: for Wire and Cable: Essex, Okonite, and Southwire.

D. Acceptable Manufacturers for Connectors: Appleton, Blackburn, Bridgeport, Buchanan, Burndy, Ideal, Killark, 3M, O.Z., Penn Union, Thomas & Betts.

2.7 RACEWAYS

A. Metallic conduit and ANSI C80.4 fittings shall be incorporated into the Electrical Work in accordance with the applicable articles of the National Electrical Code.

B. GRC - Galvanized rigid conduit, threaded and coupled steel, ANSI C80.1, UL-6, protected by an overall zinc coating to the inside and outside surfaces of the metal. Coating may be applied by the hot-dip metalizing or sherardizing process.

C. IMC - Intermediate metal conduit, threaded and coupled steel, manufactured in accordance with UL 1242, hot-dip galvanized, installed in accordance with UL general information card DYBY and NEC Article 345, with threaded joints.

D. EMT - Electrical metallic tubing, 'thin wall" zinc coated steel, enameled interior, ANSI C80.3, UL-797, assembled using concrete tight and rain tight cast gland-ring compression threaded insulated throat type fittings for sizes 1-1/4' and smaller. Sizes 1-1/2" and larger can be setscrew type with insulated throat.

E. ENT – Electrical non-metallic tubing.

F. PVC - Polyvinyl chloride Schedule 40, NEMA TC2, UL 651, with solvent welded joints.

G. SMR - Surface Metal Raceway - An assembly consisting of base and cover sections, fittings and boxes, constructed of corrosion resistant coated steel with an interior finish to avoid abrasion of electrical conductors, conforming to UL No. 5-1977 and F.S. W-C-582.

H. Acceptable Manufacturers - Walker & Wire mold.

I. Application:

1. Provide electrical metallic tubing (EMT) within enclosures, except as specified otherwise.

2. EMT connectors - Provide gland ring compression threaded fittings for 1/2" thru 1-1/4". Sizes 1-1/2" and larger shall be setscrew type.

3. Rigid steel conduit (GRC) shall be used in the following locations (except where indicated otherwise):

a. At or below grade.

b. In locations where electrical metallic tubing is not permitted and other raceway is not required.

c. In or beneath slabs on grade.

d. Hazardous areas as defined by NEC.

e. Where exposed to physical damage, excessive moisture, rain, etc.

4. PVC may be used:

a. In or beneath grade.

5. Conduit and fittings shall be UL listed for the application and location of their intended uses.

2.8 HANGERS AND SUPPORTS

A. All free standing equipment shall be braced and anchored to the floor. Secure equipment using stainless steel anchor bolts in accordance with the manufacturer’s instructions..

B. Panel boards, disconnects, starters, cabinets, pull and junction boxes, etc. Provide channel supports and miscellaneous steel angles to rigidly support equipment from the structure where required by special conditions and where vertical and/or horizontal support is required other than that provided in the structure.

2.9 GROUNDING AND BONDING

A. Rods: Ten (10) feet long, 3/4-inch diameter copper weld rods or as indicated on the drawings.

B. Conductor: Sized no smaller than the following:

1. The size noted on the drawings or otherwise scheduled.

2. The size of the phase conductors in the feeder or branch circuit.

3. The sizes required by Article 250 of the National Electrical Code.

C. Compression Grounding Connectors: Provide Hyground compression system as manufactured by Burndy. Each connector shall have the die index number embossed on application.

D. Grounding connectors shall meet the test requirements of IEEE Standard 837-2002 and shall be exothermic type.

E. All ground conductors shall be copper, and unless specifically noted otherwise, shall be provided with Type RHHW, 600-volt insulation.

F. All ground electrode conductors shall be bare copper, sized in accordance with Article 250 of the National Electric Code.

2.10 WIREWAYS, PULL AND JUNCTION BOXES

A. Provide wire way, junction and pull boxes indicated and at locations required by the National Electrical Code, and at those locations required to facilitate the pulling of wire, fabricated in accordance with NEMA and National Electrical Code requirements with respect to material, gages, dimensions and methods of fastening. Wire way, junction and pull boxes shall bear the UL label

and shall be listed for the application and location of their intended use. Units shall be finished in standard gray enamel, sides and backs spot welded in position, and removable screw cover.

B. Construct wire way and accessories in accordance with UL 870, with hinged, removable, sealable covers, arranged for lay-in conductor installation. Connectors shall be slip-in arrangement with captive mounting screws. Arrange hangers in a "J" configuration to allow conductor lay-in from one side.

C. Interior boxes shall be stamped or fabricated galvanized steel.

D. Exterior boxes not totally protected from exposure to driving rain or from excessive moisture shall be PVC or hot-dip galvanized cast iron, complete with threaded hubs, bolted weatherproof covers, and rubber or neoprene gaskets.

E. Grade level exterior boxes shall be PVC or cast iron with solid covers secured with rubber gaskets and bronze cap screws. Conduit connections shall be drilled and tapped for threaded

F. Construct exterior concrete boxes as detailed with solid cast iron covers secured with rubber gaskets and bronze cap screws.

G. Conduits entering boxes shall be through tight-fitting bored or punched holes, or threaded hubs, and shall be secured firmly.

H. Covers in finished areas shall have prime coat.

I. The volume of the boxes shall be in accordance with the NEC requirements, but shall be no smaller than four (4) inches square in any case.

J. Boxes shall be accessible at job completion. Boxes with covers in finished areas shall be in those physical locations approved by the Architect.

K. Acceptable Manufacturers: Carlon, Circle AW, Hoffman, and Neenah.

2.11 OUTLET BOXES AND ACCESSORIES

A. Exterior boxes: Hot-dip galvanized cast iron, complete with threaded hubs, bolted weatherproof covers, and rubber or neoprene gaskets.

B. Concrete boxes: Outlet boxes in concrete slabs shall be two-piece concrete boxes not less than 4-inch nominal size with a minimum depth of 2-1/2-inches. If used for lighting fixtures, outlet boxes shall be equipped with fixture stud.

C. Waterproof boxes: Conduit boxes of cast or metal threaded hub type with suitable gasket covers shall be used where waterproof boxes are required.

D. Acceptable Manufacturers: Appleton, Adult, Bell, Bowers, Crouse Hinds, Killark, O.A Gedney, Raco, Red Dot, and Steel City.

3 EXECUTION

3.1 GENERAL PROVISIONS FOR ELECTRICAL WORK

A. EXECUTION OF WORK

1. Install all materials and equipment in a neat and workmanlike manner and provide for the following:
   a. All work shall be installed so as to be readily accessible for operation, maintenance and repair. Minor deviations from the plans may be made to accomplish this, subject to the approval of the Engineer.
   b. The area of work shall be kept free of litter and debris. Contractor shall clean up the work area at the end of each working day. All scrap material and other waste shall be removed from the site by the contractor.
   c. Circuit Directory: Type directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing.
   d. Any spared circuits to be disconnected, and wiring to be removed. Circuit breakers to remain and will be re-labeled accordingly.
   e. Provide ground continuity to main electrical ground bus.
2. Field Quality Control: Perform acceptance tests as follows:

a. Make continuity tests of each circuit.

b. Procedures: perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.

c. On completion of work, the wiring system shall be entirely free from grounds, short circuits, opens, overloads and improper voltages, and thorough tests shall be made. Furnish all labor, material and instruments.

3.2 ELECTRICAL GENERAL REQUIREMENTS

A. TESTS

1. Conduct resistance to ground tests by qualified personnel to measure resistance to ground at all grounding electrodes. Make tests before slabs of affected areas are poured, in order that corrective measures, if required, may be taken. Submit to the Architect a report showing the results of these measurements. If the resistances exceed values specified elsewhere, perform all corrective measures as directed by the Architect.
2. Continuity of services - the Owner, Landscape Architect and utilities are to be notified prior to interruption.
3. Upon completion of the work and adjustment of all equipment, conduct an operating test for approval at such time as the Architect directs. Conduct the test in the presence of an authorized representative of the Architect. Demonstrate all systems and equipment to operate, in accordance with all requirements of the contract documents, and to be free from all electrical and mechanical defects.
4. All systems shall be free from short circuits and grounds, and shall show an insulation between phase conductors and ground not less than the requirements of the National Electrical Code. Test all circuits for proper neutral connections.
5. Complete all tests prior to final inspection of the project.
6. Preliminary Operations: Should the Owner require that any portion of the systems or equipment be operated prior to the final schedule dates for completion and acceptance of the work, the contractor shall consent. Such operation shall be under the direct supervision of, and at the expense of the Contractor, and shall not be construed as an acceptance of any of the work by the Owner.

B. OPERATING, INSTRUCTIONS AND SUPERINTENDENT

1. The services of an experienced superintendent shall be provided, who shall constantly be in charge of the erection of the systems in this Division, and who shall have complete knowledge of the design, operation and maintenance of all machinery, apparatus and other work installed under his supervision.
2. Upon the completion of the work, and prior to the final completion date, the Contractor shall submit to the Architect a letter signed by the Owner’s representative stating that the Owner has been instructed in the proper operation of all installed equipment.

3.3 BASIC ELECTRICAL MATERIAL & METHODS

A. APPLICATION

1. Materials and Components: Install level, plumb, and parallel and perpendicular to other systems and components, unless otherwise indicated.
2. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
3. Right of Way: Give to raceways and piping systems installed at a required slope.

B. RACEWAY APPLICATION

1. Use the following raceways for outdoor installations:
   a. Exposed: IMC
   b. Concealed: IMC
   c. Underground, Single Run: RNC
   d. Underground, Grouped: RNC

e. Boxes and Enclosures: NEMA 250, Type 3R.

f. Use the following raceways for indoor installations:

1. Exposed: EMT
2. Concealed: EMT
3. Damp or Wet Locations: IMC
4. Boxes and Enclosures: NEMA 250, Type 1, unless otherwise indicated.

C. RACEWAY AND CABLE INSTALLATION

1. Conceal raceways and cables, unless otherwise indicated, within finished walls, ceilings, and floors.
2. Use temporary raceway caps to prevent foreign matter from entering.
3. Make conduit bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.
4. Use raceway and cable fittings compatible with raceways and cables and suitable for use and location.
5. Install raceways embedded in slabs in middle third of slab thickness where practical, and leave at least 1-inch concrete cover.
   a. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
   b. Space raceways laterally to prevent voids in concrete.
   c. Install conduit larger than 1-inch trade size parallel to or at right angles to main reinforcement. Where conduit is at right angles to reinforcement, place conduit close to slab support.
   d. Transition from non-metallic tubing to Schedule 80 non-metallic conduit, rigid steel conduit, or IMC before rising above floor.
   e. Make bends in exposed parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for exposed parallel raceways.
6. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12-inches of slack at each end of the pull wire.
7. Install telephone and signal system raceways, 2-inch trade size and smaller, in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements, in addition to requirements above.

D. WIRING INSTALLATION

1. Install splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
2. Install wiring at outlets with at least 12 inches of slack conductor at each outlet.
3. Connect outlet and component connections to wiring systems and to ground. Tighten electrical connectors and terminals, according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

E. ELECTRICAL SUPPORTING DEVICE APPLICATION

1. Damp Locations and Outdoors: Hot-dip galvanized materials or non-metallic, U-channel system components.
2. Dry Locations: Steel materials.
3. Support Clamps for PVC Raceways: Click-type clamp system.
4. Selection of Supports: Comply with manufacturer's written instructions.
5. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb design load.

F. CUTTING AND PATCHING

1. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.
2. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

G. FIELD QUALITY CONTROL

1. Inspect installed components for damage and faulty work, including the following:
   a. Raceways.
   b. Supporting devices for electrical components.
   c. Electrical identification.
   d. Electricity-metering components.
   e. Concrete bases.
   f. Electrical demolition.
   g. Cutting and patching for electrical construction.
   h. Touchup painting.
2. Test Owner's electricity-metering installation for proper operation, accuracy, and usability of output data.
   a. Connect a load of known kW rating, 1.5 kW minimum, to a circuit supplied by the metered feeder.
   b. Turn off circuits supplied by the metered feeder and secure them in the "off" condition.
   c. Run the test load continuously for eight hours, minimum, or longer to obtain a measurable meter indication. Use a test load placement and setting that ensure continuous, safe operation.
   d. Check and record meter reading at end of test period and compare with actual electricity used based on test load rating, duration of test, and sample measurements of supply voltage at the test load connection. Record test results.
   e. Repair or replace malfunctioning metering equipment or correct test setup; then retest. Repeat for each meter in installation until proper operation of entire system is verified.

H. REFINISHING AND TOUCHUP PAINTING

1. Refinish and touch up paint.
   a. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
   b. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
   c. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   d. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

I. CLEANING AND PROTECTION

1. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
2. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

3.4 GROUNDING & BONDING

A. APPLICATION

1. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
2. In raceways, use insulated equipment grounding conductors.
3. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections.
4. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.
5. Underground Grounding Conductors: Use tinned-copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade or bury 12 inches above duct bank when installed as part of the duct bank.

B. EQUIPMENT GROUNDING CONDUCTORS

1. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
2. Install equipment grounding conductors in all feeders and circuits.
3. Non-metallic Raceways: Install an equipment grounding conductor in non-metallic raceways unless they are designated for telephone or data cables.

C. COUNTERPOISE

D. INSTALLATION

1. Ground Rods: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.
   a. Drive ground rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
   b. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.
2. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact or damage.
3. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.
4. Install one test well for each service at the ground rod electrically closest to the service entrance. Set top of well flush with finished grade or floor.

E. UNDERGROUND DISTRIBUTION SYSTEM GROUNDING

1. Manholes and Hand-holes: Install a driven ground rod close to wall and set rod depth so 4 inches will extend above finished grade. If necessary, install ground rod before manhole is placed and provide a No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, non-shrink grout.
2. Connections to Manhole Components: Connect exposed metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or hand-hole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper conductor. Train conductor level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

F. FIELD QUALITY CONTROL

1. Testing: Perform the following field quality-control testing:
   a. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.

b. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81.

c. Provide drawings locating each ground rod and ground rod assembly and other grounding observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

d. Equipment Rated 500 kVA and Less: 10 ohms.

e. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

G. GRADING AND PLANTING

1. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Re-establish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Maintain restored surfaces. Restore disturbed paving as indicated.

3.5 CONDUCTORS & CABLES

A. EXAMINATION

1. Examine raceways to receive wires and cables for compliance with requirements for installation tolerances and other conditions affecting performance of wires and cables. Do not proceed with installation unsatisfactory conditions have been corrected.

B. WIRE AND INSULATION APPLICATIONS

1. Service Entrance: Type RHW or THWN, in raceway.
2. Feeders: Type RHHW, in raceway.
3. Branch Circuits: Type RHHW, in raceway.

C. INSTALLATION

1. Install wires and cables as indicated, according to manufacturer's written instructions and NECA's "Standard of Installation."
2. Remove existing wires from raceway before pulling in new wires and cables.
3. Pull Conductors: Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values. Provide pull boxes and splice boxes as required.
4. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
5. Install exposed cables, parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
6. Support cables
7. Identify wires and cables

D. CONNECTIONS

1. Conductor Splices: Keep to minimum.
2. Install splices and tapes that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.
3. Use splice and tap connectors compatible with conductor material.
4. Use oxide inhibitor in each splice and tap connector for aluminum conductors.

5. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.
6. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer.
7. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

E. FIELD QUALITY CONTROL

1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.
2. Correct malfunctioning conductors and cables at Project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

3.6 IDENTIFICATION AND TAGGING

A. Identify individually:

1. Each panel-board.
2. Each switch and circuit breaker.
3. Each feeder, wire or cable of all systems.
4. Each end of nylon pull-wire in empty conduit.

B. Each wire or cable in a feeder shall be identified at its terminal points of connection and in each pull-box, junction box and panel gutter through which it passes.

C. The nomenclature used to identify panel-boards or load center shall designate the numbers assigned to them.

D. The nomenclature used to identify switches or circuit breakers shall:

1. Where they disconnect mains or services designate this fact.
2. Where they control feeders, designate the feeder number and the name of the load supplied.
3. Where they control lighting and appliance branch circuitry, designate the name of the space and the load supplied.

E. The nomenclature used to identify feeder wires and cables shall designate the feeder number.

F. Identification for panel-boards or load centers shall be by means of engraved lama-coid nameplates showing 1/4" high white lettering on a black background fastened to the outside face of the front.

G. Identification for wires and cables shall be by means of wrap around "brady" type labels.

H. Device plates for local toggle switches, toggle switch type motor starters, pilot lights and the like, whose function is not readily apparent shall be engraved with 1/8" high letters suitably describing the equipment controlled or indicated.

I. These identification letters shall be stamped into the metal of the bus bars of each phase of the main busses of each switchboard and each panel-board. The letters shall be visible from at least one "normal posture" location without having to demount any current carrying or supporting elements.

J. Provide a sign at the service entrance equipment room indicating the type and location of all on site emergency or standby power sources.

K. Identify each outlet box, junction box, and cabinet used in conjunction with empty raceway for wires of a future system by means of indelible markings on the inside denoting the system.

L. Prior to installing identifying tags and nameplates, submit their nomenclature for approval. Conform to all revisions issued by the Architect.

3.7 RACEWAYS AND BOXES

A. EXAMINATION

1. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. INSTALLATION

1. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.
2. Minimum Raceway Size: 3/4-inch trade size.
3. Conceal conduit and EMT, unless otherwise indicated, within finished walls, ceilings, and floors.
4. Install raceways level and square and at proper elevations.
5. Complete raceway installation before starting conductor installation.
6. Support raceways as specified in Division 16 Section "Basic Electrical Materials and Methods."
7. Use temporary closures to prevent foreign matter from entering raceways.
8. Use raceway fittings compatible with raceways and suitable for use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings, unless otherwise indicated.
9. Run concealed raceways, with a minimum of bends, in the shortest practical distance considering the type of construction and obstructions, unless otherwise indicated.
10. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.
    a. Run parallel or banked raceways together, on common supports where practical.
    b. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
11. Tighten set screws of threadless fittings with suitable tools.
12. Terminations: Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against the box. Where terminations are not secure with 1 locknut, use 2 locknuts: 1 inside and 1 outside the box.
13. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.
14. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200lb tensile strength. Leave at leaswt 12 inches of slack at each end of the pull wire.
15. Install raceway sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.
16. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded flush plugs flush with floor for future equipment connections.
17. PVC Externally Coated, Rigid Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.

C. PROTECTION

1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.
    a. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
    b. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

D. CLEANING
1. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

3.8 TESTS

A. Furnish all labor, material, instruments, supplies and services and bear all costs for the accomplishment of tests herein specified. Correct all defects appearing under test, repeat the tests until no defects are disclosed. Leave the equipment clean and ready for use.

B. The Electrical Contractor shall perform any test other than herein specified which may be specified by legal authorities or by agencies to whose requirements this work is to conform.

3.9 FINAL INSPECTION AND TEST

A. Prior to test, feeders and branches shall be continuous from service contact point to each outlet include: all panels, feeders and devices. Test system free from short circuits and grounds with insulation resistances not less than outlines in the National Electrical Code. Provide testing equipment necessary and conduct test in presence of the Owner's representative.

B. The final inspection and test shall include the following:
1. Testing of the impedance of the grounding system.
2. Testing of each outlet.
3. Testing of branch and feeder conductors for continuity.
4. Testing of panel boards to verify proper current balance and voltage.
5. Testing, targeting and focusing of all adjustable lighting fixtures.

3.10 EXCAVATION AND BACKFILL

A. Perform excavation and backfill required for the installation of underground conduit.

B. Cut trenches true and straight and grade bottom to afford uniform bearing of barrel on firm soil. Stack the excavation material in a suitable location. Shore trenches and excavated areas as required for safety, and for security of adjacent earth and structures.

C. Cut through walks, roads, and other structures as necessary for the installation.

D. Install underground electrical conduits in accordance with NEC.

E. Do not place backfill until the work has been inspected, tested and accepted.

F. Backfill material shall be free of cinder or rocks, and free of clods or lumps larger than 1-inch, up to 12-inches above top of pipe, and 2-inches in remainder. If the excavated material is not suitable, provide adequate material from other locations.

G. Backfill by installing clean earth in accordance with the above Specifications in layers no more than 6-inches thick, tamping (and wetting down, if necessary). Place and tamp each layer of initial backfill in 4-inch layers up to pipe centerline, and in 6-inch layers up to 12-inches above the top of pipe. Complete backfill to grade and create a substantial, well-compacted trench to 95 percent compaction by the standard Proctor test.

H. Remove surplus earth or materials remaining after backfilling from the site.

I. Repair utilities, lines, walks, and roads, and other surfaces and structures damaged by these operations to match conditions existing prior to excavation.

3.11 CONDUIT INSTALLATION

A. Complete continuous raceway shall be provided for pulling and installation of wires. All wiring shall be run in raceways unless otherwise specified.

B. In general, conduits shall be concealed in finished areas, and may be exposed in unfinished areas, run square to the construction, and continuous from outlet to outlet, connected mechanically and electrically to assure grounding. Conduits shall be cut square, reamed to full size, shouldered without butting into couplings or fittings. The threads shall be of standard length and diameter required for the size of the conduit used, and graphite bearing thread lubricant shall be used in making up the threads. Running threads will not be acceptable. Conduits shall have a smooth interior surface free of obstructions, shall be capped with conduit seals during the construction period, shall be uniformly sloped to eliminate trapped condensation, shall be thoroughly cleaned and dry before pulling any wire. Conduit installation shall clear hot pipes not less than 6-inches.

C. Conduit installed underground, in concrete or masonry:

1. Joints shall be made liquid-tight and shall engage not less than five threads.

2. Conduit in concrete shall be placed so that no portion of the conduit or couplings are exposed, and at a sufficient depth to prevent cracking or spalling. Conduit 1-inch or larger shall not be placed in walls or slabs except as specifically indicated.

3. Provide red colored concrete encasement for scheduled conduit systems installed underground.

4. Steel conduit underground, which is not concrete encased, shall be given cold applied protective tape coating, applied in accordance with manufacturer's instructions.

5. Conduits embedded in slabs except as specifically indicated or written approval is obtained shall not cross structural expansion joints. Provide conduit expansion joints in the event such crossings are permitted.

6. Place all conduit concealed in poured-in-place structure behind reinforcement bars.

D. Connections to wiring enclosures - Secure conduits to outlet boxes or wiring enclosures with double lock nuts. Where conduit boxes with threaded hubs are used, conduits shall engage at least five threads in the hubs. Provide plastic insulating bushings for rigid conduits (similar to O.Z. Type A). Provide connectors with plastic insulated throats for electrical metallic tubing termination.

E. Provide cable supports at the top of vertical runs for conductors 4 AWG and larger, and otherwise where required by NEC.

F. Minimum size conduit is 1/2-inch.

3.12 RACEWAY SYSTEMS

A. Provide grounded raceway systems with conduit, cabinets, outlet boxes, junction boxes, backboards, and miscellaneous appurtenances required for complete system. Leave empty raceway systems complete with poly 200 lb nylon pull cord or #10 gage pull wire, minimum 2 feet extra length at each end, properly tagged to indicate terminal points and length of runs (at junction boxes as well as terminations).

B. Systems shall meet requirements of, be accepted by, and be approved by the code authority, utility, equipment supplier, Owner, Contractor or subcontractor furnishing system equipment and wiring for the system involved.

C. Provide minimum 3/4-inch size empty conduit unless otherwise indicated.

D. Furnish and install empty conduit, cabinets, outlet boxes junction boxes, backboards and other miscellaneous appurtenances required for the systems specified. Conduit shall be as specified, and empty systems left complete, with 14-gage steel pull wire in each unit, ends properly tagged. Backboard shall be as specified, and cabinets shall be complete with doors and snap latches as specified for "distribution Panel boards".

E. Underground conduit intended for future use shall be identified by permanent concrete markers indicating location and intended use. Locate at each end and at each change of direction as a minimum.

3.13 CONDUCTOR INSTALLATION

A. Wire and cable No. 10 and smaller shall be factory color-coded. Provide factory color-coding for No. 8 and No. 6 wire and cable or mark conductors on each end and in all junctions or pull boxes with three-inch band of colored pressure sensitive plastic tape or by the use of brilliant waterproof lacquer properly applied. Colors for each phase and the neutral shall be consistent throughout the system.

B. When voltage to ground does not exceed 120 volts, the minimum size conductor for use in lighting and power branch circuits shall be No. 12 AWG, except that the minimum size for control circuits (switch legs) shall be No. 14 AWG. Home runs longer than 100 feet actual wire length from panel shall be no smaller than No. 10 AWG.

C. Cable terminals, taps and splices No. 6 and larger shall be made secure with UL listed solder less indenter compression barrel type connectors wherever practicable. UL listed setscrew lugs may be used on circuit breakers, motor starters, and switches not available with indenter connections. Joints in conductors No. 8 and smaller shall be made by applying a UL listed insulated, cadmium plated, live steel spring type connector in sizes up to the catalog capacity of the connector.

D. If permanently installed, do not install wires in conduit until entire system of conduit and outlet boxes is in place. Conductors shall be pulled using a UL listed wire lubricant.

E. Conductors in conduits shall be continuous and without splices except in junction boxes. Indenter compression barrel type lugs shall be used for stranded conductor terminations except UL listed bolted compression type connectors or lugs, factory furnished on such devices as circuit breakers, switch units and motor starters, may be utilized. Indenter compression type connections shall be used to make splices, taps and motor connections.

F. Insulate splices, taps, and connections such that the insulation of the joint is no less than the insulation of the wire. Insulate with manufactured lock-on splice caps or build up with rubber tape applied directly to the joint, and then cover with thermoplastic electrical tape.

G. Exercise care when installing wire in conduit so as to prevent injury to the conductor insulation. Mechanical means of pulling shall not be used unless approved. Conductors shall be pulled using UL listed lubricant.

H. Whenever wiring leaves the conduit and terminates at a terminal board, the wiring shall be formed and laced with waxed twine, or plastic wire ties.

3.14 ELECTRICAL TESTING

A. This Section applies to the testing of systems in Division 16 of the Specifications.

B. Qualifications:

1. Competent and experienced personnel, having done similar work in the past, and whose qualifications shall be subject to approval, shall perform testing of systems.

2. Submit names and qualifications of all persons proposed for testing of electrical systems and equipment.

C. Reports:

1. Provide reports and certificates required in each category of testing, adjusting and balancing, signed by both the technician performing the work and the Contractor as representing accurate, factual data, based on readings in the field.

2. Reports shall be in triplicate on 8-1/2 x 11 -inch white bond paper. Submit format for recording data for approval prior to use.

D. Equipment and Material:

1. Provide all meters, instruments, equipment and materials necessary for performance of tests.

2. Testing apparatus, not part of the permanent installation, shall remain the property of the Contractor.

3. Provide gaskets, lubricants and other expendable materials required to be replaced during the execution of the work.

E. Equipment:

1. Test and adjusted all electrical equipment to insure correct functional performance. Inspect, lubricate, test and adjust equipment and correct defects or damages before connecting the equipment to the system.

F. Wiring:

1. Test power, lighting and control wiring or bus duct for continuity, short circuits and improper grounding.
2. Test each grounding circuit separately for continuity.
3. Values of insulation resistance shall meet the standards established by the National Electrical Code.
4. If faults are detected, the point or points of such fault shall be located and the defective wiring replaced at the Contractor's expense.

G. Acceptance Tests:

1. Leave the entire electrical system installed under this Contract in proper working order. Upon completion of the installation, an acceptance test shall be run to ascertain that starters, circuit breakers, motors, relays, indicating lights, pushbuttons, alarm devices and other electrical equipment and controls are operating correctly as required for the overall operation of the facility.

H. Submit certified reports indicating full compliance with test requirements.

I. Make replacements or repairs to tested products, which are damaged as result of tests.

J. Schedule tests at a time convenient to required witnesses or persons affected by the tests.

K. Give written notification for test procedures, prior to the test.

L. Upon completion of the work, recheck electrical connections, cable to bus, cable to panels, bus to bus, throughout the job for tightness.

M. Test electrical systems grounding prior to completion of the work. Note ground resistance together with method of testing. For ground rods, note the soil condition at the time measurements were made. Ground resistance shall not exceed 25 ohms.

N. Test feeder and power circuits No. 8 AWG or larger with a "Megger” from each conductor to ground and between conductors. Record each reading. At the completion of work certify the results of the "Megger" testing.

O. After the electrical equipment and the wiring is installed, and prior to energizing for the first time any section of the electrical system, test phase-to-phase and phase-to-ground insulation on feeders and sub-feeders switchboards, and other pieces of electrical equipment to assure that they have the proper insulation and are free of grounds. Circuits rated at or below 250 volts shall be tested with a 500-volt Megger.

P. Light and test each lamp. Prove and test energy available at the load side of disconnects switches, breakers and the final point of connection to driven equipment. Make such reasonable tests required to assure a complete electrical installation in first class condition and ready for operation.

Q. Branch circuits served from lighting panel boards vary in loading. When entire load is turned on and system is operating at 100 percent demand, the initial unbalance should not exceed 10 percent. In the event greater unbalance exists, report the measured individual branch circuit loads and panel feeder loads and request instructions.

R. Furnish at the completion of the Project a final inspection certificate from the local inspecting authority.

S. Perform the following testing and certify test results-

1. Phase-to-phase and phase-to-ground resistance

a. At the supply line terminals of each item of electrical distribution system equipment.

b. At supply side of each feeder and sub-feeder.

c. At high voltage and at low terminals of each transformer.

d. At line terminals of each motor.

e. At any other point required by the Architect.

2. Ground resistance at each panel neutral bus.

3. Service voltage at switchboard at full load between phases and to ground.

T. Failures or improper operations shall be corrected. Furnish necessary test equipment and pay cost of testing, replacing and repairing.

END OF SECTION

SECTION 31 11 00: SITE CLEARING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SUMMARY

A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to prepare the site, complete, as indicated on the Contract Documents, as specified, and as follows:

1. Clearing and grubbing of existing vegetation
2. Tree protection
3. Invasive plant management

1.3 RELATED SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 01 Section – TEMPORARY BARRIERS & ENCLOSURES
2. Division 01 Section – TEMPORARY EROSION & SEDIMENT CONTROL
3. Division 02 Section – SITE PREPARATION & DEMOLITION
4. Division 32 Section – TREE PRUNING & REMOVAL
5. Division 32 Section – ASPHALT PAVING
6. Division 32 Section – REINFORCED CONCRETE PAVING
7. Division 32 Section – SITE IMPROVEMENTS
8. Division 32 Section – PLANTING SOIL
9. Division 32 Section – TURF & GRASSES

PART 2 – PRODUCTS

2.1 TREE PROTECTION FENCE

A. Tree protection fencing shall be one of the following, at the Contractor's option:

1. Galvanized chain link fencing: Posts for fencing shall be nominal 2-1/2 inches diameter, galvanized steel posts, driven a minimum of 3 feet into the ground. Posts shall be spaced 10 feet on center maximum. Fence fabric shall be 2-inch mesh, 11-gauge minimum.

2. Wire bound wood roll snow fence with 3/8 of an inch x 1-1/2-inch wide pickets, spaced approximately 2 inches apart and bound together with at least 13-gauge galvanized steel wire with brightly painted top edge. Stakes for fencing shall be steel or wood posts. Posts shall be spaced 10 feet maximum.

3. Polypropylene barricade fencing manufactured by Forestry Suppliers (formerly Ben Meadows Co.), 3589 Broad Street, Atlanta, GA. Stakes for fencing shall be 2-inch x 4-inch wood posts, driven a minimum of 3 feet into the ground. Posts shall be spaced 8 feet maximum.

4. Plastic polymer safety fence, Model BX2050 Safety Grid, manufactured by the Tensar Corporation, Morrow, GA, or approved equal. Color shall be high visibility orange. Stakes for

fencing shall be 2-inch x 4-inch wood posts, driven a minimum of 3 feet into the ground. Posts shall be spaced 8 feet on center maximum.

5. Unless otherwise indicated, height of fencing shall be 4 feet.

2.2 TREE PROTECTION – WOOD BOARD WRAPPING

A. Tree protection lumber, as designated, shall consist of 2 in. x 4 in. lumber wired together in close spacing with 16 gauge galvanized steel wire to form a protective enclosure around tree trunks.

B. Wood lath snow fencing shall be new 4 ft. high wood lath snow fencing.

PART 3 – EXECUTION

3.1 CLEARING

A. No tree or shrub clearing work (pruning or removals) shall occur prior to a site walk and meeting with the Town representatives and Landscape Architect.

B. **All work included herein shall conform to the Conservation Commission Order of Conditions; see Appendix.**

C. Trees, shrubs, stumps, brush, grasses, turf, herbaceous plants, downed timber, rubbish, organic matter, miscellaneous vegetation, or extraneous debris not indicated on the Contract Documents or designated in the field by the Landscape Architect to remain shall be cleared.

D. Clearing shall include the felling, cutting, and satisfactory disposal of all trees, stumps, and vegetative debris produced through the clearing operations.

E. Fell trees in such a way as to not injure trees to be saved. Excavation or grading within the branch spread of trees to be saved shall be performed only under the direction of the Landscape Architect unless otherwise directed.

F. Clearing includes felling of individual trees and removal of areas of other vegetation.

G. Select trees that are to be felled, only as directed by the Landscape Architect, will not be removed from site, but are to be stockpiled for reuse.

H. Tree stumps shall be removed in accordance with Division 31 Section, TREE PRUNING & REMOVAL of this Specification. Stumps shall be legally disposed of off-site.

1. Cut trees and shrubs directed to be removed flush to grade and treat stumps with herbicide tinted with dye. The dye allows for easy visual metering during application and proof that work has been completed. Stumps shall be wiped or wicked with herbicide immediately following cutting. Spray is not permitted for this application.
2. Provide herbicide that will inhibit re-sprouting or re-growth of the plant such as Garlon or Milestone. Glyphosate is not permitted to be used. All chemicals and herbicides shall be approved by federal Environmental Protection Agency and the Massachusetts Department of Food and Drug Agriculture for the intended uses and application rates. Application shall be by a Massachusetts licensed Applicator. Herbicide shall be specifically formulated for use for application and vegetation type within this scope of work. Submit for approval by Landscape Architect.
3. For herbicide treatment of herbaceous vegetation, a glove-wipe herbicide application shall be used. Spray is not permitted. Glyphosate is not permitted. These species include treatment of black swallowwort, reed canary grass, or other species as directed by the Landscape Architect.
4. For herbicide treatment of *Phragmities*, Japanese knotweed, multiflora rose, or other species for which stem wicking or wiping is not feasible, targeted spray is permitted with the following provisions: 1) the contractor shall first cut the plants to near ground level and return to spray the new growth; 2) dye will be added to the herbicide to target the application; 3) Clearcast or another DEP approved herbicide (not Glyphosate) may be used. A Massachusetts licensed

aquatic applicator will be required for any treatment within wetlands, and a DEP issued "License to Apply" shall be obtained prior to treatment.

5. Spraying or other application of herbicide shall be completed State-licensed professionals. Submit proof of applicator's license for herbicide application to Landscape Architect. Before commencing with vegetation removal in this area and herbicide application, hold on-site conference with Landscape Architect and Owner to review the scope of work, herbicide to be used, application methods, and schedule.

3.2 PROTECTION OF EXISTING TREES

A. The Contractor shall make every effort not to damage existing plant materials to remain. The Contractor is required to install protection as necessary to assure undamaged plant material and adjacent conditions.

B. Trees designated to remain (all that are not noted to be removed on Contract Documents) shall be protected by the placement of a tree protection fence. The Contractor shall provide tree protection enclosure fence at the drip line of trees noted on Contract Drawings. All other trees noted to be protected shall have fence protecting the trunks and critical root zones from damage.

C. Place tree protection additionally at all other locations where trees and/or shrubs may be jeopardized by construction activities. Tree protection fencing shall be supported with specified stakes at maximums established in Part 2 of this Division 31 Section.

D. Tree protection shall remain in place and be maintained in working condition by the Contractor until directed for removal by the Landscape Architect. All tree protection devices shall be removed from the site by the Contractor at the completion of the work.

E. Vehicles shall not be parked within the dripline or where damage may result to trees to be saved. No construction materials shall be stored beneath the dripline of trees to be saved.

3.3 TREE PRUNING & REMOVAL

A. Pruning shall be specified, performed, and paid for under the work of the Division 32 Section, TREE PRUNING & REMOVAL, of this Specification.

B. Tree removal shall be specified, performed, and paid for under the work of the Division 32 Section, TREE PRUNING & REMOVAL, of this Specification.

C. Trees and plants designated to be saved shall be protected during pruning operations and all subsequent construction. The Contractor shall provide the handwork necessary to complete pruning operations without damage to adjacent trees as specified, performed, and paid for under the work of the Division 32 Section, TREE PRUNING & REMOVAL, of this Specification. The Contractor shall provide the means necessary to prevent scrapes and scars to trunks and branches, and such damage shall require the Contractor to be assessed as previously specified above, or to replace damaged material to the satisfaction of the Landscape Architect.

3.4 INVASIVE VEGETATION MANAGEMENT

A. Plants are listed as invasive plants by the Massachusetts Prohibited Plants List from the State's Office of Energy and Environmental Affairs, or by the Massachusetts Invasive Plant Advisory Group shall be removed from the site, as designated on the Contract Documents.

B. Before commencing with vegetation removal or herbicide application, hold an on-site conference with the Landscape Architect, and the Owner to review the scope of work, herbicide to be used, application methods, and schedule.

C. Prior to commencing with invasive vegetation removal, the Contractor shall review the final Order of Conditions (DEP File No. 091-0327 (Arlington)) dated TBD and DEP File No. 201-1204 (Lexington) dated TBD, included herein as an appendix, and shall follow all stipulated conditions. Any questions or concerns shall be addressed to the Landscape Architect and Owner immediately.

B. Qualifications for invasive management: Contractor shall have five years' experience with invasive vegetation management, shall hold a Massachusetts Pesticide Application License or a Massachusetts Invasive Plant Certificate.

D. Prior to commencing with invasive vegetation removal, the Contractor shall review the final Order of Conditions (DEP File No. 091-0327 (Arlington)) dated TBD and DEP File No. 201-1204 (Lexington) dated TBD, included herein as an appendix, and shall follow all stipulated conditions. Any questions or concerns shall be addressed to the Landscape Architect and Owner immediately. The Contractor shall install signage at the site entrance with these two DEP file numbers.

C. Qualifications for invasive management: Contractor shall have five years' experience with invasive vegetation management, shall hold a Massachusetts Pesticide Application License, and a Massachusetts Invasive Plant Certificate, or proof of five years' experience of treating invasive species.

D. The contractor shall take care not to damage, destroy, or kill trees, shrubs, or other plants that are located adjacent to the invasive plants to be removed. These plants shall be protected by means determined necessary by the Contractor.

E. Several types of invasive plant species are to be controlled in this scope of work. Below is a list of the species that are to be addressed and the methods to be employed:

1. Japanese Knotweed *Polygonum cuspidatum*): Cut stems down between the second and third node (from the ground) and inject or drip 5 ml of herbicide into the step. Contractor shall re-apply herbicide (a second application) in the succeeding autumn. An approved alternate method is to cut the stems, allow for low re-growth of shoots, and spray new growth. Two applications will be required.
2. Multiflora rose (*Rosa multiflora*): Cut shrubs 2 to 4 inches above finished grade and wipe or wick apply herbicide immediately on the cut stems. An approved alternative method is to cut the stems, allow for low re-growth of shoots, and spray new growth.
3. Norway maple (*Acer platanoides*): Pull seedlings when soil is moist. For larger plants, dig them out including all roots. For large trees, cut trunk flush to grade, cut back any shoots, and grind stump. Treat and remaining stumps or roots with herbicide using wipe or wick method around the outer ring of the stump. Treat in early spring or between June 1 and September 30.
4. Oriental bittersweet (*Celastrus orbiculatus*): Cut vines 2 to 4 inches above finished grade and apply herbicide by wiping or wicking immediately on the cut stems.
5. Buckthorn (*Rhamnus cathartica*): Cut shrubs 2 to 4 inches above finished grade and apply herbicide by wiping or wicking immediately on the cut stems.
6. Black locust (*Robinia pseudoacacia*): Treat large trees after girdling with a basal bark application of herbicide by wiping or wicking around the outer ring of the stump. Treat between mid-July and December 31st.
7. Poison Ivy (*Toxicodendron radicans*): Apply herbicide as a foliar spray treatment following the herbicide manufacturer's recommended application rate. No glyphosate may be used. Add dye to herbicide to target spray application. Two weeks following the foliar application, cut the stems and apply herbicide immediately to the cut stems.
8. Burning Bush (*Euonymus alatus*): Pull seedlings up to 2 feet tall when soil is moist. Larger plants and root systems shall be removed using a spading fork or weed wrench. Larger shrubs shall be cut 2 to 4 inches above finished grade and apply herbicide by wiping or wicking immediately on the cut stems.

F. Herbicide to be applied immediately following vegetation being cut. Herbicide shall include a colored dye to identify which stems have been treated.

G. Remove all vines and cut trunks, branches, and brush from the site.

H. All invasive vegetation management shall be performed between July 15 and September 15 unless otherwise noted.

END OF SECTION

SECTION 31 20 00: EARTH MOVING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SUMMARY

A. The work of this Section consists of providing labor, equipment, materials, incidental work, and construction methods necessary to complete the work included in this Division 31 Section, EARTH MOVING, as indicated in the Contract Documents, and as specified.

B. Provide all labor, equipment, materials, incidental work, and construction methods necessary to complete the work included in this Division 31 Section, EARTH MOVING which includes, but is not necessarily limited to the following:

1. Unclassified excavation
2. Common trench excavation for piping and structures
3. Excavating and backfilling for new walkways
4. Fill materials, fill and compaction
5. Trench backfill
6. Drainage and dewatering as necessary to perform work in the dry
7. Rough grading
8. Removal of surplus or unsuitable materials
9. Frost protection
10. Rock removal
11. Preparation of subgrade for footings, foundations, slabs, pavements, and landscaping

1.3 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 01 Section – TEMPORARY EROSION & SEDIMENT CONTROL
2. Division 02 Section – SITE PREPARATION
3. Division 03 Section – CAST-IN-PLACE CONCRETE
4. Division 32 Section – ASPHALT PAVING
5. Division 32 Section – POROUS FLEXIBLE PAVING
6. Division 32 Section – POROUS FLEXIBLE PAVING (TRAIL) – Add Alternate
7. Division 32 Section – REINFORCED CONCRETE PAVING
8. Division 32 Section – CRUSHED GRANITE SURFACING
9. Division 32 Section – STABILIZED CRUSHED GRANITE SURFACING
10. Division 32 Section – RESILIENT PLAYGROUND SURFACING
11. Division 32 Section – PROTECTIVE PLAYGROUND SURFACING

1.4 REFERENCES

A. The following standards shall apply to the work of this Section.

1. Associated General Contractors of America, Inc. (AGC):
   Manual of Accident Prevention in Construction
2. American Society for Testing and Materials (ASTM):

D 422	Particle - Size Analysis of Soils
D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
D 1556	Density of Soil In-Place by the Sand Cone Method

D 1557	Test Method for Laboratory Compaction Characteristics of Soil Using Modified Method Effort
D 2167	Density and Unit Weight of Soil In-Place by the Rubber Balloon Method
D 2487	Classification of Soils for Engineering Purposes (Unified Soil Classification System)
D 2922	Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth)
D 2937	Density of Soil In-Place by the Drive-Cylinder Method
D 3017	Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
D 4318	Liquid Limit, Plastic Limit, and Plasticity Index of Soils
D 4491	Test Methods for Water Permeability of Geotextiles by Permittivity
D 4632	Test Method for Grab Breaking Load and Elongation of Geotextiles
D 4751	Test Method for Determining the Apparent Opening Size of a Geotextile
D 4759	Practice for Determining the Specification Conformance of Geosynthetics

3. Massachusetts Department of Transportation (MassDOT)

Specifications	Standard Specifications for Highways and Bridges

4. American Association of State Highway and Transportation Officials (AASHTO):

T11	Material Finer than 75 um (No. 200) Sieve in Mineral Aggregates by Washing
T27	Sieve Analysis of Fine and Coarse Aggregates

1.5 SUBMITTALS

A. Provide submittals a minimum of 7 days prior to delivery of materials.

B. Soil Samples: A 70-pound sample of each off-site material proposed for use, and of any on-site material when so requested by the Landscape Architect or testing laboratory, shall be submitted for approval.

1. Samples shall be delivered to office the Owner's testing laboratory, as directed.
2. Samples required in connection with compaction tests will be taken by and transported to the testing laboratory.

C. Product Data: Submit product data for the following:

1. Each type of plastic warning tape.

D. Test Reports: In addition to test reports required under the Paragraph, Quality Control Testing Requirements of Part 1, submit the following:

1. Mechanical gradation (sieve analysis) of each soil material proposed for fill and backfill from on-site materials and off-site borrow sources. Mechanical gradation shall be performed on off-site sources of fill and backfill materials using the same sieves as the materials specified. Mechanical gradation shall be performed on on-site fill and backfill materials using the same sieves or testing procedures as would be required for off-site borrow materials for which the on-site materials are proposed to replace.
2. One optimum moisture-maximum density curve for each soil material.
3. Report of actual unconfined compressive strength and/or results of bearing tests of each stratum tested.

1.6 QUALITY CONTROL TESTING REQUIREMENTS

A. Contractor shall select, and the Landscape Architect shall approve, a qualified independent geotechnical engineering testing agency to perform testing during the following phases of the construction operations. Independent geotechnical engineering testing agency shall be paid directly by the Contractor. All test results shall be available to the Landscape Architect.

1. Classify proposed on-site and borrow soils to verify that soils comply with specified requirements and to perform required field and laboratory testing.
2. Observation during excavation and replacement of existing fill under paved areas.
3. Observation of compaction of excavation subgrade and paved area subgrade.
4. Observation during placement and compaction of fills.

5. Laboratory testing and analysis of fill and bedding materials specified, as required by the Landscape Architect.
6. Observe construction and perform water content, gradation, and compaction tests at a frequency and at locations determined by the testing laboratory and approved by the Owner. The results of these tests will be submitted to the Landscape Architect, copy to the Contractor, on a timely basis so that the Contractor can take such action as is required to remedy indicated deficiencies. During the course of construction, the testing laboratory will advise the Landscape Architect in writing with copy to Contractor if, at any time, in his opinion, the work is not in substantial conformity with the Contract Documents.
7. Observation of fills following interruptions by rains or other inclement weather.

B. Contractor shall perform field in-place density tests according to ASTM D 1556, ASTM D 2167, or ASTM D 2937, as applicable. Testing laboratory shall submit test results directly to the Landscape Architect for review and acceptance.

1. Field in-place density tests may also be performed by the nuclear method according to ASTM D 2922, provided that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. With each density calibration check, check the calibration curves furnished with the moisture gages according to ASTM D 3017.
2. When field in-place density tests are performed using nuclear methods, make calibration checks of both density and moisture gauges at beginning of work, on each different type of material encountered, and at intervals as directed by the Landscape Architect.
3. Footing Subgrade: At footing subgrade, perform at least one test of each soil stratum to verify design bearing capacities. Subsequent verification and approval of other footing subgrade may be based on a visual comparison of each subgrade with related tested strata when acceptable to the Landscape Architect.
4. Paved Areas: At subgrade and at each compacted fill and backfill layer, perform at least one field in-place density test for every 2,000 square feet or less of paved area, but in no case fewer than three tests as directed by the Landscape Architect.
5. Fills and Embankments: For each 500 cubic yards or fraction thereof per shift, perform at least one field in-place density test as directed by the Landscape Architect.

C. When subgrade, fills or backfills are below specified density, scarify, and moisten or aerate, or remove and replace soil to the depth required, re-compact and retest until required density is obtained.

D. Testing of soils shall be in accordance with the following:

Property	ASTM Test Method
Particle - Size Analysis	D 422
Liquid Limit	D 4318
Plasticity Index	D 4318

E. The testing laboratory's presence does not include supervision or direction of the actual work by the Contractor, his employees, or agents. Neither the presence of the testing laboratory, nor any observations and testing performed by the testing laboratory shall excuse the Contractor from defects discovered in his work.

F. The Owner reserves the right to modify or waive testing laboratory services.

1.7 QUALITY ASSURANCE

A. Codes and Standards: Perform the work included in this Division 31 Section, EARTH MOVING complying with requirements of authorities having jurisdiction.

B. Comply with applicable requirements of NFPA 495.

C. Pre-installation Conference: Conduct conference at Project site.

1. Before commencing work included in this Division 31 Section, EARTH MOVING, meet with representatives of the governing authorities, Owner, Landscape Architect, consultants, geotechnical engineer, independent testing agency, and other concerned entities. Review work included in this Division 31 Section, EARTH MOVING procedures and responsibilities including testing and inspection procedures and requirements. Notify participants at least three working days

prior to convening conference. Record discussions and agreements and furnish a copy to each participant.

D. Compliance: Comply with local safety regulations and with provisions of "Accident Prevention in Construction" published by the Associated General Contractors of America, Inc.

1.8 EXAMINATION OF EXISTING CONDITIONS

A. The Contractor shall become thoroughly familiar with the existing conditions of the site, consult records and drawings of adjacent structures and of existing utilities and their connections, and note all conditions which may influence the work of this Section, work included in this Division 31 Section, EARTH MOVING.

1. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted in writing by the Landscape Architect and then only after acceptable temporary utility services have been provided.
2. Provide a minimum 48-hours' notice to the Landscape Architect and receive written notice to proceed before interrupting any utility.
3. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shutoff services if lines are active.

B. By submitting a bid, the Contractor affirms that he has carefully examined the site and all conditions affecting work under this Division 31 Section, EARTH MOVING. No claim for additional costs will be allowed because of lack of full knowledge of existing conditions.

C. The Contractor may, at his own expense, conduct additional subsurface testing as required for his own information with permission from Owner.

1.9 PROJECT CONDITIONS

A. Protection: Ensure the safe passage of persons and traffic around the areas of earthwork. Provide bracing as may be required to support sides of excavation.

B. Dust control: Take effective measures to minimize and control windblown dust. Do not create ice hazards by water spraying in freezing weather.

C. Erosion control: Take effective action to control erosion and runoff from site. Prevent siltation of drainage systems and pollution of waterways and water bodies. Install erosion controls prior to beginning site clearing and earthwork.

D. Utilities: Locate all utilities and maintain and keep utilities in service and protected from damage, except utilities indicated to be removed and relocated. Excavation and uncover all utilities requiring work or service.

1.10 INFORMATION NOT GUARANTEED

A. Information in the Contract Documents relating to subsurface conditions, natural phenomena, and existing utilities and structures is from the best sources presently available. Such information is furnished only for the information and convenience of the Contractor, and the accuracy or completeness of this information is not guaranteed.

B. Plans, surveys, measurements, and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall examine them for himself during the bidding period. Compensation for unforeseen subsurface conditions shall be in accordance with the general provisions of contract, including:

1. General and Supplementary Conditions and Division 01 Specification Sections

1.11 PERMITS, CODES & SAFETY REQUIREMENTS

A. Comply with all rules, regulations, laws and ordinances of the Town and State, and all other authorities having jurisdiction over the project site. All labor, materials, equipment, and services necessary to

make the work comply with such requirements shall be provided by the Contractor without additional cost to the Owner.

B. Comply with the provisions of the Manual for Accident Prevention in Construction of the Associated General Contractors of America, Inc., and the requirements of the Occupational Safety and Health Administration, United States Department of Labor.

C. The Contractor shall procure and pay for all permits and licenses required for the complete work specified herein and shown on the Contract Drawings.

D. Obtain all inspection certificates required and deliver to Landscape Architect.

E. The Contractor shall not close or obstruct any street, sidewalk, or passageway without written permission from authorities having jurisdiction. The Contractor shall so conduct his operations as to interfere as little as possible with the use ordinarily made of roads, driveways, or other facilities near enough to the work to be affected thereby.

F. The Contractor shall secure a DIG SAFE permit number for the project to certify notification of gas, electrical and telephone utilities. All other affected utilities shall be contacted by the Contractor who shall secure notification receipts in accordance with requirements of Massachusetts law. The phone number is 811. Contractors shall notify "Dig Safe" of contemplated excavation, demolition, or explosive work in public or private ways, and utility company right-of-way or easement. This notification shall be made at least 72 hours prior to the work, but not more than sixty days before the contemplated work. Such notice shall set forth the name of the street or the route number of said way and an accurate description of the location and nature of the proposed work. The Landscape Architect requires that the notification be sent to "Dig Safe" by certified mail, with copies to the Owner. The Architect requires a copy of the signed receipt of the delivery. "Dig Safe" is required to respond to the notice within 72 hours from the time said notice is received by designating at the locus the location of pipes, mains, wires, and conduits. Contractor shall not commence work until "Dig Safe" has responded as noted above. The work shall then be performed in such a manner, and with reasonable precaution taken to avoid damage to utilities under the surface in said areas of the work.

G. Contractor shall contact all utility companies whose utilities might be affected by the work included in this Division 31 Section, EARTH, and notify these utility companies of contemplated excavation, demotion, or explosive work in public or private ways, and utility right-of-way easement. This notification shall be made at least 72 hours prior to the work, but not more than sixty days before the contemplated work. Such notice shall set forth the name of the street or the route number of said way and an accurate description of the location and nature of the proposed work. Contractor shall secure notification receipts for submission to the Landscape Architect prior to the start of the contemplated work. Contractor shall not commence work until all utility companies have responded and provided the necessary receipts. The work shall then be performed in such a manner, and with reasonable precaution taken to avoid damage to utilities under the surface in said areas of the work.

1.12 LAYOUT & GRADES

A. Benchmarks: The Contractor shall maintain and/or reestablish benchmarks and survey monuments necessary for the work of these Contract Documents and as shown in the Contract Documents or found to exist on the site to provide a base reference for the construction. Replace any which may become destroyed or disturbed. The Contractor shall employ and pay all costs for a registered Civil Engineer or Surveyor who is licensed within the jurisdiction of the project site to lay out all lines and grades in accordance with the Drawings and as directed by the Landscape Architect, and as necessary or required for the construction. The selection of the registered Civil Engineer or Surveyor shall be subject to the Landscape Architect's approval.

1.13 PROTECTION OF EXISTING STRUCTURES & UTILITIES

A. Observe all rules and regulations governing the respective utilities in executing work included in this Division 31 Section, EARTH MOVING. The work shall be executed in such manner as to prevent any damage to adjacent property and any other property and existing improvements such as, but not limited to streets, curbs, paving, utility lines and structures, monuments, benchmarks, and other public and private property. Protect existing structures and foundations from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by work included in this Division 31 Section, EARTH MOVING operations.

B. In case of any damage or injury caused in the performance of the work, the Contractor shall, at his own expense, make good such damage or injury to the satisfaction of, and without cost to the Owner. Existing roads, sidewalks, and curbs damaged during the project work shall be repaired or replaced to their original condition at the completion of operations. The Contractor shall replace, at his own cost, existing benchmarks, monuments, and other reference points which are disturbed or destroyed.

C. Buried structures, utility lines, and the like, including those which project less than 18 inches above grade, which are subject to damage from construction equipment shall be clearly marked to indicate the hazard. Markers shall indicate limits of danger areas, by means which will be clearly visible to operators of trucks and other construction equipment and shall be maintained at all times until completion of Project.

D. Locate and mark underground utilities to remain in service before beginning the work. Protect all existing utilities to remain during operations. Do not interrupt existing utilities except when authorized in writing by authorities having jurisdiction.

E. When an active utility line is exposed during construction its location and elevation shall be plotted on the Record Drawing by the Contractor and both the Landscape Architect and the Utility Owner notified in writing.

F. Provide barricades, fences, lights, signs, and all other safety devices required for the protection of the public.

1.14 DEFINITIONS

A. Base Course: The layer placed between the subbase course and surface pavement in a paving system.

B. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.

C. Drainage Fill: Course of washed granular material supporting slab-on-grade placed to cut off upward capillary flow of pore water.

D. Embankment: Any area on the site where the Contractor is required to raise grades to proposed subgrade elevations. Embankments are placed in layers to a predetermined elevation and cross section.

E. Excavation: The removal of material encountered to subgrade elevations and the reuse of the material on site as Backfill, Fill or Ordinary Borrow material as it conforms to these specifications or disposal of materials removed.

F. Finish Grade: Final grade elevations indicated on the Drawings. Spot elevations shall govern over proposed contours. Where not otherwise indicated, project site areas shall be given uniform slope between points for which finished grades are indicated or between such points and existing established grades. Spot elevations shall govern over proposed contours. No ponding of surfaces shall be allowed due to lack of improper pitches across surfaces that will not allow proper drainage to occur.

G. Rock: A sound and solid mass, layer, or ledge of mineral matter in place of such hardness and texture that it:

1. Mechanical Definition of Rock: Cannot be effectively loosened or broken down by ripping in a single pass with a late model tractor-mounted hydraulic ripper equipped with one digging point of standard manufacturer's design adequately sized for use with and propelled by a crawler type tractor rated between 210- and 240-net flywheel horsepower, operating in low gear.
2. Manual Definition of Rock: In areas where the use of the ripper described above is impracticable, rock defined as sound material of such hardness and texture that it cannot be loosened or broken by a 6-pound drifting pick. The drifting pick shall have a handle not less than 34 inches in length.

H. Rough grade: The top surface of subbase or base courses such as gravel, crushed stone, ordinary fill, and the like, ready to receive the final surface material application. Unless stated otherwise, all rough grades shall represent compacted material depths, as specified herein.

I. Soil: All earth materials, organic or inorganic, which have resulted from natural processes such as weathering, decay, and chemical action of in situ rock or the deposition of unconsolidated material in which more than 35 percent by weight will pass a No. 200 sieve.

J. Surplus Materials: On-site materials not used during the course of construction.

K. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.

L. Structural Backfill: The designated material as indicated in the Contract Documents to attain the proposed grades abutting or adjacent to site structures.

M. Subbase Course: The layer placed between the subgrade and base course in a paving system or the layer placed between the subgrade and surface of a pavement or walk.

N. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase course, drainage fill, or topsoil materials.

O. Topsoil: The upper layer of the soil profile which is supporting the growth of vegetation as evidenced by the existence therein of numerous roots and other organic matter.

P. Unauthorized excavation: Removing materials beyond indicated subgrade elevations or dimensions without direction by the Landscape Architect. Unauthorized excavation, as well as remedial work directed by the Landscape Architect, shall be at the Contractor's expense.

Q. Unclassified excavation: Removal of materials encountered when establishing required grade elevations to the depths and extents shown on the Contract Documents. Unclassified excavation includes removal and disposal of pavements and other obstructions visible on ground surface, underground structures and utilities indicated to be demolished and removed, material of any classification indicated in data on subsurface conditions.

R. Unsuitable Material: Material that is classified as "unsuitable" shall be material having at least one of the following properties:

1. Material with a maximum unit dry weight per cubic foot less than 90 pounds as determined by ASTM D 1557.
2. Material containing visible organic matter, topsoil, organic silt, peat, construction debris, frozen material, roots, and stumps.
3. Material which has a Liquid Limit greater than 55 when tested in accordance with ASTM D 4318.
4. Material designated in the field by the Landscape Architect or the testing laboratory.

S. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within building lines.

T. Utility Trench Backfill: The area bounded by the proposed finished subgrade and the cover material over the respective pipe or conduit. This material shall conform with applicable requirements for embankment or structural backfill depending on the area or zone into which the utility is installed.

1.15 COORDINATION

A. Prior to start of EARTH MOVING the Contractor shall arrange an on-site meeting with the Landscape Architect for the purpose of establishing Contractor's schedule of operations and scheduling inspection procedures and requirements.

B. As construction proceeds, the Contractor shall be responsible for notifying the Landscape Architect prior to start of EARTH MOVING operations requiring inspection and/or testing.

In the event that the Contractor does not notify the Landscape Architect prior to the start of EARTH MOVING operations and inspections and tests are not made or performed by the Owner's testing agents, the Landscape Architect may require the Contractor to remove all EARTH MOVING performed without the necessary inspections and replaced under the required supervision, review, inspections or tests at no additional cost to the Owner.

C. The Contractor shall be responsible for obtaining test samples of soil materials proposed to be used and transporting them to the site sufficiently in advance of time planned for use of these materials for testing of materials to be completed. Use of these proposed materials by the Contractor prior to testing and approval or rejection, shall be at the Contractor's risk.

PART 2 – PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide approved borrow soil materials from off-site when sufficient approved soil materials are not available from excavations. Gradation requirements shall be determined by AASHTO T11 and T27.

1. Borrow material shall from on-site or off-site sources shall contain salt levels less than 1.0 milliohms/cm as measured by electrical conductivity (EC2) of a 1:2 soil-water suspension (Test minus sieve #4 material.). Borrow material with levels of salt in excess of this level will be considered unsuitable material and shall be removed from the site by the Contractor at no additional cost to the Owner.
2. Borrow material from on-site and off-site sources shall contain levels of heavy metals or PCB less than the currently mandated levels, as established by the Massachusetts Contingency Plan, latest edition. Toxic elements included therein are:

   Toxic Elements
   a. Arsenic
   b. Boron
   c. Cadmium
   d. Chromium
   e. Copper
   f. Lead
   g. Mercury
   h. Molybdenum
   i. Nickel
   j. Selenium
   k. Zinc
   l. PCBs

   Borrow material with levels of heavy metals and PCBs in excess of these levels will be considered unsuitable material and shall be removed by the Contractor from the site and disposed of legally at no additional cost to the Owner.

3. Satisfactory Soil Materials: ASTM D 2487 soil classification groups GW, GP, SW, and SP; free of rock or gravel larger than 2 in. in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
4. Unsatisfactory Soil Materials: ASTM D 2487 soil classification groups GC, GM, SC, SM, ML, MH, CL, CH, OL, OH, and PT.

B. Backfill and Fill Materials: Satisfactory soil materials as described above. On-site material for use in compacted backfill shall be natural, inorganic, granular soil, taken from areas of excavation after stripping of topsoil and removal of unsatisfactory soil materials as described above.

1. Use only backfill materials meeting the requirements of satisfactory soil materials that are free from rocks greater than 4 inches in diameter or length that have largest dimension no greater than three-quarters of the lift thickness or are no greater than ½ $ft.^3$ in volume. Do not use any foreign matter, such as construction debris, trash, wood, roots, leaves, sod, organic matter, or soft clay and silt. Sound pieces of building stone, masonry, and concrete from on-site sources subject to the same size limitations as stone, may be employed in backfill. Individual pieces shall be mixed into

general backfill material, leaving no voids between pieces. Backfill shall be clean, non-organic material, of non-swelling character, capable of being readily compacted to form a solid, stable embankment. Pieces of bituminous pavement shall be excluded from the backfill unless their use is expressly permitted by the Landscape Architect, in which case they shall be broken up as directed. Materials containing ice or frozen lumps shall not be employed.

2. Backfill and fill materials for use under turf, seeded, and planted areas shall be free draining materials that drain at a rate greater than or equal to one inch per hour after compaction to the specified levels.
3. Suitable Excavated Material:
   a. Free from clods, silt lumps or balls of clay
   b. Free from stones or rock fragments over 50 pounds
   c. Free from organics, peat, etc.
4. Frozen Material:
   a. Do not backfill with or on frozen materials
   b. Remove, or otherwise treat as necessary, previously placed material that has frozen prior to placing backfill.
5. Wet Material:
   a. Do not mechanically or hand compact material that is, in the opinion of the Engineer, too wet.
   b. Do not continue backfilling until the previously placed and new materials have dried sufficiently to permit proper compaction.

C. Ordinary borrow shall conform to ASTM D2487 soil classification groups GW, GP, SW, and SP, and be well graded, natural inorganic soil, meeting the following requirements:

1. It shall be free of organic or other weak or compressible materials, of frozen materials, and of stones larger than 4 inches maximum dimension.
2. It shall be of such nature and character that it can be placed to form embankments and compacted to the specified densities in a reasonable length of time.
3. It shall be free from highly plastic clays, from all materials subject to decay, decomposition, or dissolution and from cinders or other materials which will corrode piping or other metal.
4. It shall have a maximum dry density of not less than 100 lbs. per cubic foot.
5. Material from excavation on the site may be used as ordinary fill if it meets the above requirements and is approved by the Landscape Architect.

D. Gravel borrow shall consist of inert material that is hard, durable stone and coarse sand, free from loam and clay, surface coatings, and deleterious materials. Gradation shall conform to the following:

Sieve No.	% Passing by Weight
1/2” (12.5mm)	50 – 85
#4 (4.75mm)	40 – 75
#50 (300um)	8 – 28
#200 (75 um)	0 – 8

E. Dense graded crushed stone shall consist of inert angular material derived from a stone quarry that is hard, durable stone and stone screenings, free from loam and clay, surface coatings, and plastic materials. Gradation shall conform to the following:

Sieve No.	% Passing by Weight
3/4” (19 mm)	100
1-1/2” (37.5 mm)	70 – 100
3/4” (19.0 mm)	50 – 85
#4 (4.75 mm)	30 – 55
#50 (300 um)	8 – 24
#200 (75 um)	3 – 10

F. Processed Gravel shall consist of inert material that is hard, durable stone and coarse sand, free from loam and clay, surface coatings, and deleterious materials. Gradation shall conform to the following:

Sieve No.	% Passing by Weight
3” (75 mm)	100
1-1/2” (37.5 mm)	70 – 100
3/4” (19 mm)	50 – 85
#4 (4.75um)	30 – 60

#200 (75 um)	0 – 10

G. Three-quarter of an inch crushed stone shall consist of inert angular material derived from a stone quarry that is hard, durable, washed stone, free of deleterious materials. Gradation shall conform to the following:

Sieve Size	% Passing by Weight
1” (25 mm)	100
3/4” (19 mm)	90 – 100
1/2” (12.5 mm)	10 – 50
3/8” (9.5 mm)	0 – 20
No. 4 (4.75 mm)	0 – 5

H. Two-inch stone shall consist of an angular material derived from a stone quarry that is hard, durable, double-washed stone, free of deleterious materials. Gradation shall conform to the following:

Sieve Size	% Passing by Weight
3” (75 mm)	100
2-1/2” (62.5 mm)	90-100
2” (19 mm)	35-70
1-1/2” (37.5 mm)	0-15
3/4” (19 mm)	0-5

I. Structural fill shall be gravel, sandy gravel, or gravelly sand, free form organic material. Loam, trash. Snow, ice, frozen soil, and other objectionable material and well-graded with the following limits:

Sieve Size	% Passing by Weight
3” (75 mm)	100
No. 4 (4.75 mm)	30 – 90
No. 40 (425 um)	10 – 50
No. 200 (75 um)	0 – 8

J. Crushed stone shall be clean, washed, crushed stone, free of fine materials and graded within the following limits:

Sieve Size	% Passing by Weight
1” (25 mm)	100
3/4” (19 mm)	90 – 100
1/2” (12.5 mm)	10 – 50
No. 4 (4.75 mm)	0 – 5
No. 40 (425 um)	0 – 5
No. 200 (75 um)	0 – 5

K. Sand shall be clean, washed sand, free of silt and clay components and graded within the following limits:

Sieve Size	% Passing by Weight
No. 4 (4.75 mm)	100
No. 8 (2.36 mm)	95 – 100
No. 16 (1.18 mm)	70 – 100
No. 30 (600 um)	40 – 75
No. 50 (300 um)	10 – 35
No. 100 (150 um)	2 – 15

L. Riprap shall be sound, durable rock which is angular in shape. Sized shall be 4 inches to 8 inches and shall contain no fines.

1. Riprap shall conform to MassDOT Specifications Section M2.02.0.

2.2 USES OF MATERIALS

A. Uses of Fill Materials: Fill materials listed above shall be utilized as follows and as otherwise indicated on the Drawings, specified, or directed.

1. Gravel Borrow:
   a. Subbase for bituminous concrete road and parking lot pavements.
   b. Backfill for footings and structures.
   c. As shown on the Contract Documents.

2. Dense Graded Crushed Stone:
   a. Base for bituminous concrete road and parking lot pavements.
   b. As shown on the Contract Documents.

3. Processed Gravel:
   a. Drainpipe bedding and backfill.
   b. Backfill for drainage and utility structures.
   c. As shown on the Contract Documents.

4. Crushed Stone:
   a. Drainage layer under pavement slab.
   b. Underdrain filter aggregate.
   c. Structural fill for footings and structures.
   d. As shown on the Contract Documents.

5. Ordinary Borrow:
   a. For footings and structures.
   b. For backfill of utility trenches
   c. General site fills.
   d. As shown on the Contract Documents.

6. Backfill and Fill Materials:
   a. For footings and structures.
   b. For backfill of utility trenches
   c. General site fills.
   d. As shown on the Contract Documents.

2.3 FILTER FABRIC

A. Filter fabric shall be Nonwoven, needle-punched continuous filament with flow rate range from 110 to 330 gpm/sq. ft. when tested according to ASTM D 4491.

PART 3 – EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by the work included in this Division 31 Section, EARTH MOVING operations.

B. Protect subgrade and foundation soils against freezing temperatures or frost. Provide protective insulating materials, as necessary.

3.2 GRADES AND ELEVATIONS

A. The Contract Documents indicate, in general, alignments, grade elevations and invert elevations. Establish the lines and grades in conformity with the Contract Documents. The Landscape Architect, however, may make such adjustments in the field in grades and alignments as are found necessary in order to avoid interference with any special conditions encountered.

B. Spot elevations shall govern over proposed contours. Where not otherwise indicated, project site areas shall be given uniform slopes between points for which finished grades are indicated or between such points and existing established grades.

C. Establish and maintain suitable stakes over all areas to be graded as directed, specified, or required. Maintain sufficient reference points at all times during construction to properly perform the contract installation.

3.3 UNCLASSIFIED EXCAVATION

A. The work of excavation shall be conducted at such locations, at such rates of progress and in such a manner as will ensure the continued progress of the work, with a minimum inconvenience to the general public.

B. All material encountered during excavation shall be unclassified excavation and shall include the removal of boulders up to 3 cubic yards, earth, rock, concrete, covered pavements, abandoned utilities, abandoned foundations and all miscellaneous materials encountered as required for excavation. Boulders and rock over 3 cubic yards shall be covered under “Rock Excavation” in this Division 31 Section, EARTH MOVING. The sequence of all excavation operations shall be such as to ensure the most efficient reuse of acceptable excavated borrow materials for particular improvement application. Acceptable materials shall be used or stockpiled for later use in backfill and subgrade preparation.

C. Excavate all materials to the elevations, dimensions and form as shown in the Contract Documents and as specified for the construction of drainage structures, utilities, turf, and site improvements necessary for the completion of the utilities and site work. Excavate to elevations indicated or required within a tolerance of plus or minus 0.10 foot and as will allow footings to rest on firm, undisturbed earth, or rock, free of loose materials, and as will permit rough grades to be at indicated or specified depths. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

D. Unauthorized Excavation: Fill unauthorized excavation under foundations or wall footings by extending indicated bottom elevation of concrete foundation or footing to excavation bottom, without altering required top elevation.

1. Any excavation which has been carried, through error, beyond specified depths or dimensions, shall be backfilled by the Contractor at his own expense with compacted gravel borrow, with concrete, or with other material as directed by the Landscape Architect.

E. Hand Excavation: In general, machine excavation will be permitted with the exception of work in the vicinity of trees to remain, existing utilities and excavation of pipe bells which will be hand work. Excavate to 6 inches below the bottom of pipe or as shown on Drawings. Excavation to final grade shall be made in such a manner as to maintain the undisturbed bearing character of the soil exposed at the excavation level.

F. Inspection: After completion of the excavation and prior to commencement of foundation footings, pavements and concrete slab construction, the excavation will be inspected by the Landscape Architect to ensure that foundation elevations have been reached.

3.4 ROCK EXCAVATION

A. The work shall include the removal of boulders 3 cubic yard or greater in size that are unsuitable to be reused elsewhere in the project limits.

B. Rock Excavation shall be measured as follows:

1. Rock excavation in post and bound holes not already paid for in previous rock excavation shall be based on an area 2 feet square multiplied by the depth of rock encountered in the post or bound hole required plus 6 inches.
2. Boulders which are to be included in the item for rock excavation will be measured at the point of removal.

C. Rock excavation will be paid for at the Contract unit price per cubic yard as established in Division 01 Section, UNIT PRICES of this specification, which price shall include all labor, materials, equipment, and incidental costs required for the work.

3.5 TRENCH EXCAVATION

A. Trench Excavation: If the Contractor encounters unsuitable soils materials at the specified depths during trench excavation, he shall contact the Landscape Architect and request instructions from the Geotechnical Engineer before proceeding further.

1. Excavate trenches to indicated slopes, lines, depths, and invert elevations.
   a. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line and to meet the inverts noted on the Drawings.

2. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
   a. Clearance: 12 inches each side of pipe or conduit.

3. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove stones and sharp objects to avoid point loading.
   a. For pipes or conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
   b. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
   c. Where encountering rock or another unyielding bearing surface, carry trench excavation 6 inches below invert elevation to receive bedding course.

3.6 STOCKPILING

A. Stockpiling: No excavation shall be deposited or stockpiled at any time so as to endanger portions of the new or an existing structure, either by direct pressure or indirectly by overloading banks contiguous to the operation. Stockpile soil materials away from edge of excavations. Material, if stockpiled, shall be stored so as not to interfere with the established sequence of the construction. If there is not sufficient area available for stockpiling within the limits of the project, the Contractor will be required to furnish his own area for stockpiling, and for moving the material back and forth from the storage area, at no additional cost to the Owner. No excavation shall be deposited within existing tree protection zones. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water away from existing drainage structures, ponds, basins, or wetland areas.

B. Cover stockpiles to prevent wind-blown dust and dispersal of materials by stormwater. The Contractor shall provide and install all erosion control specified under the Division 01 Section, EROSION & SEDIMENTATION CONTROL and receive payment for this work under this Division 31 Section, EARTH MOVING.

1. Throughout the course of the work the Contractor shall provide and maintain all erosion control systems for stockpiled materials as specified in the Division 01 Section, EROSION & SEDIMENTATION CONTROL and paid for under the work of this Division 31 Section, EARTH MOVING.

3.7 FILLING, BACKFILLING & COMPACTION

A. Placing Fills and Compacting:

1. Preparation: All areas to be filled or backfilled shall be free of vegetation, topsoil, wet materials, unsatisfactory soil materials, obstructions, deleterious materials, construction debris, refuse, compressible or decayable materials and standing water from ground surface prior to placing fills. Do not place fill when fill materials or material below it are frozen. No fill materials containing ice or frozen lumps shall be used.

a. Plow, furrow, till or break up sloped surfaces steeper than 1 vertical to 4 horizontal (1:4) so fill material will bond with existing surface.

2. Remove all concrete formwork, temporary shoring, bracing, and sheeting prior to inspection by Landscape Architect. If approved in writing by the Landscape Architect, leave concrete formwork, temporary shoring, bracing, or sheeting in place.
3. The Contractor shall notify the Landscape Architect when excavation is ready for formal inspection. Filling and backfilling shall not be started until conditions have been approved by the Landscape Architect.
4. At the completion of excavation and before placing any fills, proof-roll compact subgrades to the same compaction levels required for placed fills as required hereinafter. Compaction procedure shall be approved by the Landscape Architect.
   a. Notify Landscape Architect when excavations have reached required subgrade.
   b. When test results determines that unforeseen unsatisfactory soil is present, stop excavation work immediately and contact the Landscape Architect to determine whether or not to continue excavation work and replace the unsatisfactory soil material with compacted backfill or fill material as directed by the Landscape Architect.
5. Unforeseen additional excavation and replacement material will be paid according to the Contract provisions for changes in Work.
6. Reconstruct subgrade damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the Landscape Architect.
7. Subgrade compaction shall be tested by the testing laboratory before proceeding further.
8. All fill is to be placed "in-the-dry", to which end dewatering may be required. Spreading and drying of each layer may also be required. Dewatering, as necessary, shall be a part of the work of this Section, EARTH MOVING, and shall be done at no additional cost to the Owner
9. Conversely, if the testing laboratory determines that the fill is too dry for proper compaction, water shall be added to provide the specified optimum moisture content, as necessary for proper compaction.
10. Compaction of each lift shall be as specified herein and as determined by ASTM Test, Designation D1556. Fill shall be placed in successive horizontal lifts no thicker than 6 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers. Compact fill to the required density as specified in this Section, EARTH MOVING. Maximum dry density shall be determined in accordance with ASTM D1557, Method D. The following percentages of minimum to maximum dry densities shall be achieved for fill materials or prepared subgrades.
    a. Under structures, footings, paved surfaces, drainage piping, utilities and other improvements:

	Minimum	Maximum
All fills	95%	98%
Top twelve inches of subgrades in cut	95%	98%
Fills within turf, seeded, and planting areas to within eighteen inches of finished subgrade	85%	90%

    Maximum dry density for topsoil and loam shall be determined in accordance with ASTM D698. The following percentages of minimum to maximum dry densities shall be achieved for fill materials or prepared subgrades.

    b. In turf, seeded areas, and plant beds:

	Minimum	Maximum
Fills within turf areas and planting areas in top eighteen inches of finished grade	80%	85%

11. Place backfill and fill materials evenly on all sides of structures to required elevations. Place backfill and fill uniformly along the full length of each structure.
12. In the case of turf and planting areas, compaction requirements for subgrades and fills shall be considered minimums and maximums within the density percentages called for, and any over-compaction of subgrades or fills which would be detrimental to turf, seeded areas, or planting

objectives shall be corrected by loosening subgrades or fills through tilling or other means and re-compacting to specified compaction limits.

13. The Contractor shall notify the Landscape Architect three days in advance when the rough grades are established and ready for formal inspection. No loam shall be placed on rough grades before inspection by the Landscape Architect.

3.8 AGGREGATE BASE COURSE FOR PAVEMENTS

A. Aggregate subbase and base courses for paving and the spreading, grading, and compaction methods employed shall conform to standard requirements for usual base course of this type for first class road work, and the following:

1. MassDOT Specifications Section 100

B. Compaction of aggregate base courses shall be to 95 percent of maximum density as determined by ASTM D 1557, Method D. Stone greater than two inches shall be excluded from course.

C. Width of base courses shall be greater than or equal to the width of pavement surface, if continuous lateral support is provided during rolling, and shall extend a distance of at least twice the base thickness beyond edge of the course above, if not so supported.

D. Aggregate material shall be applied in lifts less than or equal to 6 inches thick, compacted measure. Each lift shall be separately compacted to specified density.

1. Material shall be placed adjacent to wall, manhole, catch basin, and other structures only after they have been set to required grade and level.
2. Rolling shall begin at sides and progress to center of crowned areas and shall begin on low side and progress toward high side of sloped areas. Rolling shall continue until material does not creep or wave ahead of roller wheels.
3. Surface irregularities which exceed 1/2 inches measured by means of a 10-foot long straightedge shall be replaced and properly compacted.

E. Subgrade, subbase course and base course shall be kept clean and uncontaminated. Less select materials shall not be permitted to become mixed with gravel or dense graded crushed stone. Materials spilled outside pavement lines shall be removed and area repaired.

F. Portions of subgrade or of construction above which become contaminated, softened, or dislodged by passing of traffic, or otherwise damaged, shall be cleaned, replaced, and otherwise repaired to conform to the requirements of this specification before proceeding with next operation.

3.9 BACKFILLING OF TRENCHES AND STRUCTURES

A. All requirements for description, placement, compaction and spreading of fill materials as specified in this Division 31 Section, EARTH MOVING, shall be applicable to backfilling operations for trenches and structures. If the Contractor encounters unsuitable soils materials at the specified depths during trench excavation, he shall contact the Landscape Architect and request instructions before proceeding further.

B. Backfill materials as specified in this Division 31 Section, EARTH MOVING, shall be used as bedding and backfill around drainage pipes, around structures and for other uses as shown on the Contract Documents.

C. Approvals Prior to Backfilling: Do not commence backfilling operations for trenches and structures until all piping and other underground utilities or structures have been installed, tested, and approved, and the locations of all pipe and appurtenances have been recorded.

D. Placement in Trenches: Bedding materials as specified shall be placed to the full width of the trench as indicated on the Drawings. Place and compact bedding course on rock and other unyielding bearing surfaces. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. After a pipe is bedded, the trench shall be filled to the centerline of the pipe with additional bedding material as specified except at the joint. After the joint is inspected, that portion shall be filled in. Material under and around the pipe shall be carefully and thoroughly compacted to the densities specified in this Division 31 Section, EARTH MOVING.

E. From the centerline of the pipe to a point 12 inches above the top of the pipe place additional bedding material as backfill by hand and compacted with mechanical tampers to not less than 95% of maximum density at optimum moisture content of the material. Above this point, backfill shall be placed by machine or by hand in layers 6 inches deep and compacted to the densities specified in this Division 31 Section, EARTH MOVING. This backfill shall be extended as shown in the Contract Documents. Backfill simultaneously on all sides of pipe or structure. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.

F. Place concrete backfill in all utility trenches that pass under concrete footing or within 18 inches of footings. Place concrete to level of bottom of footings.

G. Provide four-inch thick concrete base slab support for piping or conduit less than two feet-three inches below surface of roadways. After installation and testing, completely encase piping or conduit in a minimum of four inches of concrete before backfilling or placing roadway subbase course.

H. Coordinate backfilling with utilities testing.

I. Fill voids with approved backfill materials as shoring and bracing, and sheeting is removed.

J. Place and compact final backfill of satisfactory soil material to final subgrade.

K. Install warning tape directly above utilities, twelve inches below finished grade, except six inches below subgrade under pavements and slabs.

3.10 ROUGH GRADING

A. Rough grading shall include the shaping, trimming, rolling, and refinishing of all surfaces of the subbase and base courses, shoulders, and earth slopes in preparation for final, finish grading of pavements, loams and site improvements as shown on the Contract Drawings. The rough grading of shoulders and sloped areas may be done by machine methods. All ruts shall be eliminated. Traffic of men and equipment across soil subgrade areas shall be prohibited following excavation to the required lines and grades.

1. Shape subbase and base courses to required crown elevations and cross-slope grades.
2. When thickness of compacted subbase or base course is 6 inches or less, place materials in a single layer.
3. When thickness of compacted subbase or base course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

B. If, during the progress of the Work, any pipe, drain, or other construction is damaged due to operations under this Contract, the Contractor shall repair all damage at no additional cost to the Owner and restore damaged areas to their original conditions.

C. Do all other cutting, filling, and grading to the lines and grades indicated on the Drawings. Grade evenly to within the dimensions required for grades shown in the Contract Documents and as specified herein. No stones larger than 3 inches in largest dimension shall be placed in upper 6 inches of the subgrade. Fill shall be left in a compacted state at the end of the workday and sloped to drain.

D. Slope grades to direct water away from buildings and to prevent ponding. Rough grade to required elevations within the following tolerances:

1. Turf or Unpaved Areas: Plus/minus 0.10 foot.
2. Paved Areas: Plus/minus 0.05 foot.

E. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders at least twelve inches wide of acceptable soil materials and compact simultaneously with each subbase course and base course layer.

F. The Contractor shall bring all areas to grades as shown in the Contract Documents and in the details. The Landscape Architect, however, may make such adjustments in grades and alignments as are found necessary to avoid special conditions encountered.

G. No rubbish of any description shall be allowed to enter fill material. Such material shall be removed from the site.

H. Wherever streets, turf or seeded areas, or sidewalks or other items contained within or outside the Limit of Contract lines have been excavated in fulfilling the work required under this Contract, the Contractor shall furnish and install all materials necessary to bring finish surfaces level with the existing adjacent surfaces. All work shall be installed to match the existing conditions in accordance with the governing authority. Notify the proper authorities prior to restoring surfaces outside the Contract Limit Lines.

I. Placed fill materials that become disturbed shall be regraded and re-compacted. Fill materials that become contaminated shall be removed and replaced, as directed by the Landscape Architect.

J. Contractor shall clean the subgrade of all stones greater than two inches and all debris and rubbish. Such material shall be removed from the site, not raked to the edges and buried. Notify the Landscape Architect that the subsoil has been cleaned and request his/her attendance on site to review and approve subgrade conditions prior to spreading additional specified material over the subgrade.

3.11 REMOVAL OF SURPLUS & UNSUITABLE MATERIALS

A. Surplus excavated or surplus off-site borrow materials not required to complete site construction and unsuitable excavated materials shall, unless directed otherwise by the Landscape Architect, become the property of the Contractor who shall remove such materials from the site and legally dispose of it at no additional cost to the Owner.

3.12 DRAINAGE & DEWATERING

A. The Contractor shall control the grading in areas under construction on the site so that the surface of the ground will properly slope to prevent accumulation of water in excavated areas and adjacent properties. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrade, and from flooding Project site and surrounding area. The Contractor shall grade and ditch the site as necessary to direct surface runoff away from open excavations and subgrade surfaces. Positive drainage (minimum 1.0 percent slope) shall be maintained at all times.

B. Protect subgrade and foundation soils from softening and damage by rain or water accumulation.

C. Should surface, rain or ground water be encountered during the operations, the Contractor shall furnish and operate pumps or other equipment and provide all necessary piping to keep all excavation clear of water at all times and shall be responsible for any damage to work or adjacent properties from such water. All piping exposed above surface for this use shall be properly covered to allow foot traffic and vehicles to pass without obstruction.

D. Water from trenches and excavations shall be disposed of in such a manner as will not cause injury to public health nor to public or private property, nor to existing work, nor to the work completed or in progress, nor to the surface of roads, walks, and streets, nor cause any interference with the use of the same by the public. Methods of disposal of pumped effluent shall not cause erosion or siltation.

1. Provide and install all erosion and sedimentation control as specified on the Contract Drawings and be paid for this work under the scope of this Division 31 Section, EARTH MOVING.

E. There shall be sufficient pumping equipment, in good working order, available at all times to remove water.

F. Presence of ground water in soil will not constitute a condition for which an increase in the Contract price may be made. Do not place concrete fill, lay piping or install appurtenance under any circumstances in excavation containing free water.

G. Under no circumstances place fills, pour concrete, or install piping and appurtenances in excavations containing free water.

H. Where, in the opinion of the Landscape Architect, pumping of excavations is not effective in maintaining a dry firm subgrade, provide other dewatering methods acceptable to the Landscape Architect.

3.13 FROST PROTECTION

A. Do not excavate to full indicated depth when freezing temperatures may be expected unless footings or slabs can be poured immediately after the excavation has been completed. Protect the excavation from frost if placing of concrete is delayed.

B. Completed foundations that have not been backfilled shall be protected from freezing by temporary additional earth cover, insulating blankets, heaters, or other methods acceptable to the Landscape Architect.

C. Frozen material shall not be placed as fill or backfill.

D. No work shall be installed on frozen ground.

E. Should protection fail, remove frozen materials, and replace with concrete or gravel borrow as directed by the Landscape Architect at no additional cost to the Owner.

3.14 DUST CONTROL

A. During the construction period, the Contractor shall take special measures including, but not limited to, wetting down to control dust on site, in order to prevent annoyance/and or damage to adjacent property, whether public or private. Calcium chloride or any other chemical material may not be used on subgrades of areas to be seeded or planted.

B. The Contractor shall take all necessary measures to keep streets, over which equipment, and service for project travel, clean and free from dirt, dust, mud, and debris resulting from construction operations. The actions taken shall meet the requirements of all authorities having jurisdiction.

3.15 CLEANUP

A. At the end of all excavation, filling, and grading operations and before acceptance of the work, the Contractor shall remove all debris, rubbish, garbage, trash, and discarded material, from the site. He shall dispose of them in a manner satisfactory to the Landscape Architect. The premises shall be left clean, presentable, and satisfactory.

END OF SECTION

SECTION 32 01 90: TREE PRUNING & REMOVAL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SUMMARY

A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to perform selective pruning and related trenching within the limits indicated on the Contract Documents and as specified herein. Work shall include, but not be limited to, the following:

1. Root pruning
2. Air spading
2. Crown cleaning
3. Crown thinning
4. Crown raising
5. Tree removal
6. Stump removal

1.3 REFERENCES

A. The following standards shall apply to the work of this Section. All references relate to the latest edition. The Contractor shall be responsible for being aware of current industry standards.

1. American National Standards Institute (ANSI):
   A300 Tree Care Operations; Tree, Shrub, and Other Woody Plant Maintenance, Standard Practices, latest edition:
   a. Part 1, Pruning
   b. Part 2, Fertilization
   c. Part 3, Support Systems a. Cabling, Bracing, and Guying
   Z133.1 Safety Requirements for Pruning, Trimming, Repairing, Maintaining and Removing Trees, and for Cutting Brush
2. Tree Care Industry Association (TCIA)
3. Massachusetts Food and Agriculture Department (MA)
   Pest Identification Guide for Weeds, Insects and Diseases of Woody Ornamentals
4. Occupational Safety & Health Administration (OSHA)

1.4 RELATED SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 02 Section – SITE PREPARATION & DEMOLITION
2. Division 02 Section – TEMPORARY BARRIERS & ENCLOSURES
2. Division 31 Section – SITE CLEARING

1.5 SUBMITTALS

A. At least 90 days prior to the start of construction activities, submit to the Landscape Architect name of professional Certified Arborist hired to perform the work of this Section and proof of arborist's certification.

1.6 QUALITY ASSURANCE

A. Selective pruning methods shall conform to the applicable requirements of ANSI Z133.1.

B. Work of this Section shall be completed by a professional Certified Arborist with a minimum five years' experience, who has successfully completed a certification program equal to the Massachusetts Certified Arborist (MCA) program/examination sponsored by the Massachusetts Arborists Association, Natick, MA, or is certified by the International Society of Arboriculture.

1.7 COORDINATION

A. Notify Landscape Architect at least 48 hours before work that requires inspection or testing or both.

B. Do not perform hand trenching and/or tunneling work until required root and crown pruning is complete and Landscape Architect is present for inspection.

1.8 WARRANTY

A. Damage and Destruction of Trees shall be in accordance with the requirements of Division 31 Section, SITE CLEARING of this Specification.

PART 2 – PRODUCTS

2.1 MATERIALS – ROOT & CROWN PRUNING

A. Peat moss and mulch materials shall be as specified under Division 32 Section, PLANTING SOIL MIXING of this Specification and shall be paid for under the work of this Division 31 Section, TREE PRUNING.

B. Fertilizer shall be a commercial product complying with the State and United States fertilizer laws. Deliver to the site in the original unopened containers that shall bear the manufacturer's certificate of compliance covering analysis. Liquid fertilizer for subsurface hydraulic injection to correct soil nutrient deficiencies shall be a product meeting the requirements of ANSI 300 and as modified by this paragraph. Liquid fertilizer shall include a slow release form of nitrogen (50% of N to be water insoluble), phosphorus and potassium; shall be chloride free; shall have a low salt content; and shall have a wetting agent to aid with dispersion. Fertilizer shall contain required micro-nutrients established by soil test analysis.

C. Dormant oil spray when recommended by certified arborist upon inspection of the project plant material shall be a dormant miscible spray equal to "Volck Oil", manufactured by Ortho; "Scalicide", manufactured by Southern Mill Creek; "Horticultural Superior Oil Spray", manufactured by Rockland; or approved equal.

D. Insecticides for use in controlling disease, insects and other pests shall approved for use under MA Ref. 1. Submit manufacturer's product data on insecticides proposed for review and approval by the Architect.

PART 3 – EXECUTION

3.1 PREPARATION

A. The Contractor shall be responsible for the protection of all existing trees and plants designated to remain for the length of the construction period, including liability for all damages as specified in this Section.

3.2 ROOT PRUNING

A. Where construction will be in close proximity to existing trees designated to remain, roots shall be pruned prior to trenching and tunneling operations. Root pruning shall be performed as early as possible before trenching or tunneling operations. Proximity shall be as determined in the field by the Landscape Architect.

B. Root pruning is the physical cutting of tree roots to minimize root damage and promote healing. Root prune using a sharpened spade for all roots smaller than one inch diameter. Root prune using an ax or

chainsaw for all roots greater than one inch diameter. Any method which tears roots or disturbs the soil beyond the grading limit is unacceptable. Do not use backhoe bucket or any other excavating machine to root prune.

C. Backfill root pruning trench with existing soil mixed with peat moss to a mixture of approximately 75% loam and 25% humus by volume. Tamp soil in six-inch lifts. Each lift shall be compacted to a point at which a footprint makes only a 1/16 inch impression.

D. Apply mulch to a depth of 4 inches at minimum 10-foot to 15-foot radius around tree to reduce compaction and increase moisture retention.

3.3 AIR SPADING

A. Using high pressure air, excavate the entire area 18 inches deep. Stockpile excavated soil for re-use after amendment. Perform root surgery on any girdling roots encountered, as directed by the Landscape Architect.

3.4 TREE PRUNING

A. Trees designated to be pruned during construction shall be pruned by an approved Arborist at the direction of the Landscape Architect.

B. Any accidental injuries to the bark, trunk or branches of any tree shall be repaired immediately as directed by the Landscape Architect.

1. All pruning must be done in compliance with American National Standards Institute Z133 and A300 standards.
2. Prior to the start of work all trees to be pruned shall be inspected by an Arborist certified by the Massachusetts Certified Arborist or the International Society of Arboriculture. Proof of certification is required prior to granting of contract. Any unusual safety or tree health concerns must be recorded and presented to the Landscape Architect.
3. All pruning cuts shall be made according to ANSI A300 section 5.2.5. No stubs shall be left nor shall flush cuts be made; the branch collar shall be left intact. Severed limbs shall be removed before the end of the workday. Wound dressing shall not be applied.
4. Tree branches shall be removed in a manner that does not damage the tree, other plants, or property. Where necessary, ropes shall be used to lower large branches. Not more than 1/4 of the leaf surface of a tree shall be removed. Upon completion of pruning, one half of the foliage shall remain evenly distributed in the lower two thirds of the tree crown and on individual limbs.
5. The following classes of pruning shall be used as designated on the Drawings:
   a. Crown cleaning: Trees designated for crown cleaning shall have dead, dying, diseased, and/or weak branches one inch in diameter and larger removed. Not more than one out of 4 water sprouts shall be removed when present. One stem of weakly attached "V-crotches" less than 4 inches in diameter shall be removed. The presence of larger V-crotches shall be noted and provided to the Landscape Architect.
   b. Crown thinning: Trees designated for crown thinning shall have all branches specified in crown cleaning removed and in addition shall have 10 to 15 percent of the live branches removed, mainly from the outer crown of the tree. Preference shall be given to the removal of branches outside the normal shape of the tree crown. The majority of the live branches to be removed shall be between 1/4- and 1-inch in diameter.
   c. Crown raising: Trees may be designated for crown raising as well as one of the two other types of pruning. Crown raising shall consist of removal of lower limbs at the trunk or the removal of smaller branches that will allow the upward movement of a lower limb to provide 8 feet of clearance.
6. All appropriate safety regulations must be followed. A ground person must be situated to direct pedestrian traffic and to maintain a safe work site.

3.5 TREE REMOVAL

A. Trees designated for removal on the plans shall be removed from the site. This work shall include the felling of the trees in such a way as to not injure trees to be saved, utility lines and poles, houses, garages, turf areas, plantings, and pavement. Tree removal also shall include the satisfactory disposal

of all tree trunks, branches, stumps, and vegetative debris produced through the tree removal operation.

1. Tree removals shall be in accordance with Division 31 Section, SITE CLEARING of this Specification.

B. Prior to the commencement of tree removal operations the Contractor shall review with the Landscape Architect which trees shall be removed. Under no circumstances shall the tree removal operation commence without the written concurrence of the Landscape Architect.

C. Select trees that are to be felled, only as directed by the Landscape Architect, will not be removed from site, but are to be stockpiled for reuse.

3.6 STUMP REMOVAL

A. Wetland bank areas: Stumps designated on the Contract Drawings to be removed shall be ground flush to surrounding grade. Tree trunk and all roots 3 inches in dimeter or greater shall be removed to a depth of 18 inches. All wood fiber to be removed and disposed of and the area backfilled with topsoil flush to surrounding grades and seed.

B. Beach and parking area: Stumps designated on the Contract Drawings to be removed shall be ground to 6 inches below existing grade. Tree trunk and all roots 3 inches in dimeter or greater shall be removed to a depth of 18 inches. All wood fiber to be removed and disposed of and the area backfilled with topsoil flush to surrounding grades and seed.

3.7 PUBLIC HEALTH AND SAFETY

A. Upon encountering any condition of tree work or tree health which might threaten the public health, safety, or welfare and which is not directly addressed by this Section the certified arborist and the Contractor shall notify the Landscape Architect and Town Arborist/Tree Warden immediately and shall make recommendations pertaining to the resolution of said conditions.

END OF SECTION

SECTION 32 12 16: ASPHALT PAVING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SUMMARY

A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to furnish and install the bituminous concrete pavement, permits, traffic control and police detail, as indicated on the Contract Documents and as specified herein.

1.3 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 02 Section – SITE PREPARATION & DEMOLITION
2. Division 31 Section – EARTH MOVING
3. Division 31 Section – SITE CLEARING
4. Division 32 Section – POROUS FLEXIBLE PAVING
5. Division 32 Section – REINFORCED CONCRETE PAVING

1.4 REFERENCES

A. The following standards shall apply to the work of this Section.

1. American Association of State Highway and Transportation Officials (AASHTO):
   M 20 Penetration Graded Asphalt Cement
   M 82 Cut-Back Asphalt (Medium Curing Type)
   M 140 Emulsified Asphalt
2. American Society for Testing and Materials (ASTM):
   D 1557 Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10-pounds (4.54-kg) Rammer and 18-in. Drop
3. Massachusetts Department of Transportation (MassDOT):
   Specifications Standard Specifications for Highways and Bridges
4. Federal Specifications:
   SS-S-1401 Sealing Compound, Hot Applied, for Concrete and Asphalt Pavements

1.5 SAMPLES AND SUBMITTALS

A. At least 30 days prior to intended use, the Contractor shall provide job mix formula for all bituminous concrete specified in this Section, listing quantities and pertinent ingredient properties for review and approval by the Landscape Architect. Do not order materials until Landscape Architect's approval of mix formula has been obtained. Delivered materials shall closely match the approved samples.

1.6 QUALITY ASSURANCE

A. Unless otherwise specified, work and materials for construction of the bituminous concrete pavement shall conform to the applicable portions of the following:

1. MassDOT Specifications Sections 400

B. Paving work, base course installation, top course installation, and the like, shall be done only after excavation and construction work which might damage them has been completed. Damage caused during construction shall be repaired before acceptance.

C. Pavement subbase shall not be placed on a muddy or frozen subgrade. Pavement courses shall not be placed on frozen or contaminated base course or binder course.

D. Existing pavement under state or local jurisdiction shall, if damaged during the course of this project, be repaired or replaced as specified, performed and paid for under this section of the Specification. Materials and construction shall match local or state paving standards and cross sections, whichever is most stringent.

1.7 TESTING & INSPECTION

A. The Owner reserves the right to retain an independent testing laboratory to perform inspection and testing of paving and associated work in accordance with Division 01 Section, QUALITY CONTROL.

PART 2 – PRODUCTS

2.1 BASE COURSE

A. Material for base course shall be specified, provided, installed, and paid for under the work of the Division 31 SECTION, EARTH MOVING, of this Specification.

2.2 SUBBASE COURSE

A Material for subbase course shall be specified, provided, installed, and paid for under the work of the Division 31 SECTION, EARTH MOVING, of this Specification.

2.3 BITUMINOUS CONCRETE

A. Bituminous concrete shall be a standard plant-mixed, hot-laid paving material for road work, consisting of clean, crushed rock aggregate, mineral filler, and asphalt conforming to the following:

1. MassDOT Specifications Section M3

B. Bituminous Concrete Mixtures: Bituminous concrete for roadway and parking lot pavements and patching shall be Class I, Type I-1, furnished in accordance with MassDOT Specifications Section M3, except as modified herein.

1. Bituminous concrete pavement for roadways, pathways, and other areas shown on the Contract Documents shall consist of 2 courses of bituminous concrete with a minimum finished pavement depth after rolling equal to the following:
   a. Total Compacted Pavement Thickness shall be as indicated on the Contract Documents.
   b. Binder course shall consist of one lift of Binder Course bituminous concrete to thickness as shown on the Contract Documents.
   c. Finished top course shall consist of one lift of Top Course bituminous concrete to thickness as shown on the Contract Documents.

2. Bituminous concrete patch shall consist of the following:
   a. Top Course and Binder Course bituminous concrete in depths to match existing roadways.

C. Hot Mix Asphalt

1. Pavement mixtures shall be within the composition limits of base courses, binder courses, top courses, and surface treatment, in accordance with MassDOT M3.11.6, with constituents that conform to table below.

Percent by Mass Passing Sieve Designation						
Standard Sieves (inches)	Reclaimed Subbase	Base Course	Binder Course	Top Course	Modified Top Course	Surface Treatment
3 inches	100%					
2 inches		100%				
1-1/2 inch	70-100					
1 inch		55-80	100%		100%	
3/4 inch	50-85		80-100		95-100	
5/8 inch				100%		
1/2 inch		40-65	55-75	95-100	79-100	
3/8 inch				80-100	68-80	100%
No. 4	30-60	20-44	28-50	50-76	46-68	80-100
No. 8		15-33	20-38	37-54	33-53	64-85
No. 16				26-40	20-40	46-68
No. 30		8-17	8-22	17-29	14-30	26-50
No. 50	8-24	4-12	5-15	10-21	9-21	13-31
No. 100				5-16	6-16	7-17
No. 200	0-100	0-4	0-5	2-7	2-6	3-8
Binder (Bitumen)		4-5	4.5-5.5	5.5-7	5-6	7-8

a. Percentages shown for aggregate sizes are stated as proportional percentages of aggregate for the mix.

2. Unless authorized by the Landscape Architect, no Job-Mix Formula will be approved which specifies:
   a. More than 45% passing No. 8 for Top and Dense Binder Courses
   b. More than 38% passing No. 8 for Modified Top Course
   c. More than 55% passing No. 8 for Dense Mix
   d. Less than 4% passing No. 200 for Top Course
   e. Less than 6% bitumen for Top Course

2.4 BITUMINOUS MATERIALS

A. Bituminous crack sealer shall be a hot-applied bituminous sealer conforming to Federal Specification SS-S-1401.

B. Tack coat shall consist of asphalt emulsion, Type RS-1 or RS-2 conforming to MassDOT Specifications.

C. Prime coat shall be Asphalt Primer conforming to MassDOT Specifications M3: Asphalt Materials, and in accordance with the requirements of AASHTO M116.

PART 3 – EXECUTION

3.1 GRADING

A. Areas to be paved shall be compacted and brought approximately to subgrade elevation as specified, performed, and paid for under the work of the Division 31 Section, EARTH MOVING, before work of this section is performed. Final fine grading, filling, and compaction of subgrade to receive paving, as required to form a firm, uniform, accurate, and unyielding subgrade at required elevations and to required lines, shall be specified, performed, and paid for under the Division 31 Section, EARTH MOVING, of this Specification.

B. Existing subgrade material that will not readily compact as required shall be removed and replaced with satisfactory materials. Additional materials needed to bring subgrade to required line and grade and to replace unsuitable material removed shall be material specified, delivered, installed, and paid for under the Division 31 SECTION, EARTH MOVING, of this Specification.

C. Subgrade of areas to be paved shall be re-compacted as required to bring top 8 inches of material immediately below gravel base course to a compaction of at least 95 percent of maximum density, as determined by ASTM D 1557, Method D. Subgrade compaction shall extend for a distance of at least 12 inches beyond pavement edge.

D. Excavation required in pavement subgrade shall be completed before fine grading and final compaction of subgrade are performed. Where excavation must be performed in completed subgrade or subbase subsequent backfill and compaction shall be performed as directed by the Landscape Architect as specified, performed, and paid for under the work of the Division 31 Section, EARTH MOVING, of this Specification. Completed subgrade after filling such areas shall be uniformly and properly graded.

E. Areas being graded or compacted shall be kept shaped and drained during construction. Ruts greater than or equal to 2 inches deep in subgrade, shall be graded out, reshaped as required, and re-compacted before placing pavement.

F. Materials shall not be stored or stockpiled on subgrade.

G. Disposal of debris and other material excavated and/or stripped as specified, performed, and paid for under the work of this section, and material unsuitable for or in excess of requirements for completing work of this section, shall conform to the following:

1. Material shall be legally disposed of off-site.

H. Prepared subgrade will be inspected by the Landscape Architect. Subgrade will be approved by the Landscape Architect before installation of paving base course. Disturbance to subgrade caused by inspection procedures shall be repaired as specified, performed, and paid for under Division 31 Section, EARTH MOVING, of this Specification.

3.2 AGGREGATE BASE COURSE

A. Aggregate base course for bituminous paving shall be provided, installed, and paid for under the Division 31 Section, EARTH MOVING, of this Specification.

3.3 BITUMINOUS PAVING

A. Bituminous paving mixture, equipment, methods of mixing and placing, and precautions to be observed as to weather, condition of base, and related requirements shall conform to the following:

1. MassDOT Specifications Section 400 - Class I Bituminous Concrete Pavement for roadway and parking areas.

B. Bituminous binder and wearing surface courses shall each be applied individually, in single lifts of full thickness indicated on the Contract Documents.

C. No mix shall be placed on wet or damp surfaces. No mix shall be placed when ambient temperatures are 40 degrees Fahrenheit and falling.

D. The temperature of bituminous concrete mixture when delivered to the site shall conform to MassDOT Specifications Section 400.

E. The Landscape Architect may require the Contractor to remove and replace at this own expense any defective mix not conforming to the specified job mix formula.

1. If, at any time before the final acceptance of the work, any soft, imperfect places or spots shall develop in the surface, all such places shall be removed and replaced with new materials and then compacted until the edges at which the new work connects with the old become invisible.

F. Adjacent paving and curb work shall be protected from stain and damage during entire operation. Damaged and stained areas including curbs shall be replaced or repaired to equal their original condition.

J. Deliveries shall be timed to permit spreading and rolling all material during daylight hours, unless artificial light, satisfactory to Landscape Architect, is provided. Loads which have been wet by rain or otherwise will not be accepted. Hauling over freshly laid or rolled material will not be permitted.

K. Spreading and Finishing:

1. The equipment for spreading and finishing shall be mechanical, self-powered pavers, capable of spreading and finishing the mixture true to lines, grade, width, and crown by means of fully automated controls for both longitudinal and transverse slope.
2. If, during construction, it is found that the spreading and finishing equipment in use leaves tracks or indented areas, or produces other permanent blemishes in the pavement, which are not satisfactorily corrected by the scheduled operations, the use of such equipment shall be discontinued and other satisfactory spreading and finishing equipment shall be provided by the Contractor.
3. The mixtures shall be placed and compacted only at such times as to permit the proper inspection and checking by the Landscape Architect.
4. The mixtures shall be placed only upon approved surfaces that are clean from foreign materials and dry; and when weather conditions are suitable.
5. The contact surfaces of curbing, manholes, catch basins or other appurtenant structures in pavement shall be painted thoroughly with a thin uniform coating of bitumen (MassDOT Specifications RS-1) just before any mixture is placed against them. This requirement shall be included as work incidental to paving operations.
6. Machine Spreading: All mixtures shall be deposited in an approved mechanical spreader and immediately spread thereby, and then struck off in a uniform layer to the full width required and of such depth that each course, when compacted, shall have the required thickness and shall conform to the grade and cross section contour specified.
7. Hand Spreading: Spreading by hand methods will be permitted only for particular locations in the work which because of irregularity, inaccessibility or other unavoidable obstacles do not allow mechanical spreading and finishing.

L. Placing and rolling of mixture shall be as nearly continuous as possible. Rolling shall begin as soon after placing as mixture will bear the operation without undue displacement. Delays in rolling freshly spread mixture will not be permitted. Rolling shall proceed longitudinally, starting at edge of newly placed material and proceeding toward previously rolled areas. Rolling overlap on successive strips shall be greater than or equal to 1/2 width of roller rear wheel. Alternate trips of roller shall be of slightly different lengths. Corrections required in surface shall be made by removing or adding materials before rolling is completed. Skin patching of areas where rolling has been completed will not be permitted. Course shall be subjected to diagonal rolling, crossing lines of the first rolling while mixture is hot and in compactable condition. Displacement of mixture or other fault shall be corrected at once by use of rakes and application of fresh mixture or removal of mixture, as required. Rolling of each course shall be continued until roller marks are eliminated. Roller shall pass over unprotected edge of course only when paving is to be discontinued for sufficient time to permit mixture to become cold.

M. In places not accessible to roller, mixture shall be compacted with hand tampers. Hand tampers shall weigh at least 50 pounds and shall have a tamping face less than or equal to 100 square inches. Mechanical tampers capable of equal compaction will be acceptable in areas in which they can be employed effectively.

N. Edges of bituminous concrete that meet turf areas shall be shaped to provide a neat, clean edge and shall be hand tamped.

O. Compaction:

1. After the paving mixture has been properly spread, compaction shall be obtained by the use of power rollers of approved design and weight per inch of roller. The rollers shall be steel wheeled supplemented with pneumatic-tired rollers where required.
2. Along curbs, structures, and all places not accessible with a roller, the mixture shall be thoroughly compacted with mechanical tamping devices. The surface of the mixture after compaction shall be smooth and true to the established line and grade.
3. The densities of the completed pavement shall be not less than 95 percent of the density obtained from laboratory compaction of a mixture composed of the same materials in like proportions.

P. Portions of pavement courses which become mixed with foreign material or are in any way defective shall be removed, replaced with fresh mixture, and compacted to density of surrounding areas. Bituminous material spilled outside lines of finished pavement shall be immediately and completely removed. Such material shall not be employed in the work.

Q. Joints shall present same texture, density, and smoothness as other sections of the course. Continuous bond shall be obtained between portions of existing and new pavements and between successive placements of new pavement. New material at joints shall be thick enough to allow for compaction when rolling. Compaction of pavement, base, and subgrade at joints shall be such that there is no yielding of new pavement relative to existing pavement when subjected to traffic.

R. Contact surfaces of previously constructed pavement (if greater than or equal to two days since binder placed), manholes, and similar structures shall be thoroughly cleaned and painted with a thin uniform coating of bitumen immediately before fresh mixture is placed. Tack coat shall be applied at rate which will leave bituminous residue of 5 to 7 gallons/100 $yd.^2$ after evaporation of vehicle. Base surface shall be dry and clean when tack coat is applied. Bituminous paving material shall not be placed until vehicle has completely evaporated from tack coat. Adjoining new paving shall be placed before tack coat has dried or dusted over.

S. Earth or other approved material shall be placed along pavement edges in such quantity as will compact to thickness of course being constructed, allowing at least 12 inches of shoulder width to be rolled and compacted simultaneously with rolling and compacting surface. Pavement edge shall be trimmed neatly to line before placing earth or other approved material along edge.

T. Variations in pitch of finished surface shall be less than or equal to the following tolerances when tested with a 10-foot straightedge, applied both parallel to and at right angles to centerline of paved area.

1. At joint with existing pavement, and at other locations where an essentially flush transition is required, pavement elevation tolerance shall not exceed 0.01 feet.
2. At other areas pavement elevation tolerance shall not exceed $\pm$ 0.05 feet.
3. Irregularities exceeding these amounts, or which retain water on surface, shall be corrected by removing defective work and replacing with new material as specified, performed, and paid for under this section.

U. No vehicular traffic of any kind shall be allowed to pass over the newly finished surface until it has had time to set. Seventy-two hours will be considered sufficient time for the pavement to set in most cases, but this period may be extended by the Landscape Architect as required by weather or other reasons. Under all circumstances, damage to the pavement caused by the Contractor's or public vehicles driving over the pavement before the pavement has fully cured shall be repaired as specified, performed, and paid for under this section, at no additional cost to the Owner.

END OF SECTION

SECTION 32 12 43

POROUS FLEXIBLE PAVING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes

1. Perform subgrade preparation and provide underlying porous media beds and porous asphalt pavement course in accordance with this Section and applicable reference standards listed in Article 1.03.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and payment requirements: per Division 01 General Requirements.

1.03 REFERENCES

A. Reference Standards

1. American Association of State Highway and Transportation Officials (AASHTO)

   a. AASHTO T209 Standard Method of Test for Theoretical Maximum Specific Gravity (Gmm) and Density of Hot Mix Asphalt (HMA)

   b. AASHTO M320)

2. MassDOT

   a. Standard Specifications and Supplements, and Construction Standard Details

3. University of New Hampshire Stormwater Center (UNHSC)

   a. Design Specifications for Porous Asphalt Pavement and Infiltration Beds

4. National Asphalt Paving Association (NAPA)

   a. Design, Construction, and Maintenance of Open-Graded Friction Courses, Information Series 115

   b. Design, Construction, and Maintenance Guide for Porous Asphalt Pavements, Information Series 131

5. U.S. Department of Transportation, Federal Highway Administration

a. Hydraulic Engineering Circular No, 11 (HEC-11), Design of Riprap Revetment

B. Definitions

1. Porous media bed: the material layers underlying the porous asphalt pavement.

2. Choker Course: a 4-inch Layer below the porous pavement.

3. Filter Blanket: a 3-inch intermediate setting layer between the choker course and the reservoir course.

4. Reservoir Course: a 10-inch layer between the filter blanket and subgrade.

5. Porous asphalt pavement: the compacted mix of modified asphalt, aggregate, and additives.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination, sequencing, and scheduling: per Division 01 General Requirements.

B. Conduct a pre-installation meeting with Owner, Engineer and paving Subcontractor to discuss the step by step process for installing the porous media bed Work.

1.05 SUBMITTALS

A. Submit in accordance with Division 01 General Requirements.

B. List of materials proposed including name and address of the materials producers and locations where materials are to be obtained.

C. Step by step installation procedure for the Work including list of equipment to be used.

D. Manufacturer's certificates: signed by manufacturers, materials producers and relevant subcontractors verifying conformance with specified requirements and for the following information.

1. Choker Course; Reservoir Course

a. Gradation, maximum wash loss, minimum durability index, maximum abrasion loss and air voids (reservoir course only).

2. Filter Blanket (Graded Filter)

a. Gradation.

3. Striping Paint

4. Binder

   a. Performance Graded Asphalt Binder certification.

5. Coarse Aggregate

   a. Gradation, wear and fracture faces (fractured and elongated).

6. Fine Aggregate

   a. Gradation.

7. Silicone

8. Fibers (optional)

9. Mineral Filler (optional)

10. Fatty Amines (optional anti-strip)

11. Hydrated Lime (optional anti-strip)

E. Testing Results

   1. Trial batch test result for porous pavements confirming required drain down is met.

   2. Trial batch test result for porous pavements confirming required moisture susceptibility and asphalt stripping from the aggregate is met.

F. Closeout and maintenance material submittals: per Division 01 General Requirements.

G. Submit a mix design at least 10 working days prior to the beginning of production. The Contractor shall make available samples of coarse aggregate, fine aggregate, RAP, fibers and a sample of the PGAB that will be used in the design of the mixture. A certificate of analysis (COA) of the PGAB will be submitted with the mix design. The COA will be certified by a laboratory meeting the requirements of AASHTO R18. The Laboratory will be certified by MassDOT, regional equivalent (e.g. NETTCP), and/or qualified under ASTM D3666. Technicians will be certified by the regional certification agency (e.g. NETTCP) in the discipline of HMA Plant Technician. MOVE TO PART 1 SUBMITTALS - MODIFY TO INCLUDE SAMPLES IN 1.06

1.06 QUALITY ASSURANCE

A. Provide in accordance with Division 01 General Requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Provide in accordance with Division 01 General Requirements.

1.08 SITE CONDITIONS

A. Existing conditions: per Division 01 General Requirements.

PART 2 – PRODUCTS

2.01 POROUS MEDIA INFILTRATION BED

A. From top to bottom: a 4-inch minimum thickness crushed stone choker course layer; a 3-inch minimum thickness pea gravel filter blanket layer; and a 10-inch minimum thickness crushed stone reservoir course layer as indicated on the Drawings, with an embedded 4-inch polyvinyl chloride (PVC) perforated underdrain laid flat.

B. Material for choker course and reservoir course

1. Maximum Wash Loss: 0.5 percent.

2. Minimum Durability Index: 35.

3. Maximum Abrasion Loss: 10 percent for 100 revolutions, and maximum of 50 percent for 500 revolutions.

C. Gradations of the choker and reservoir course materials

US Standard Sieve Size Inches - mm	Percent Passing (%)		
	Choker Course (AASHTO No. 57/ No. 67*)	Reservoir Course (AASHTO No. 3)	Reservoir Course Alternative** (AASHTO No. 5)
6 - 150	-	-	-
2-1/2 - 63	-	100	-
2 - 50	-	90-100	-
1-1/2 - 37.5	100	35-70	100
1 - 25	95-100	0-15	90-100
3/4 - 19	-	-	20-55
½ - 12.5	25-60	0-5	0-10
3/8 - 9.5	-	-	0-5
#4 - 4.75	0-10	-	-
#8 - 2.36	0-5	-	-
#200 - 0.075	-	-	-

* Alternate gradations (e.g. AASHTO No. 67) may be accepted upon Engineer's approval.
** Alternate gradations (e.g. AASHTO No. 5) may be accepted upon Engineer's approval.

1. Material for choker course and reservoir course: AASHTO No. 57 and AASHTO No. 3 gradations, respectively. If the AASHTO No. 3 gradation cannot be met, AASHTO No. 5 is acceptable with approval of Engineer. AASHTO No. 3 is also suitable for choker course.

D. Filter blanket material between the choker course and the reservoir course: 3/8 inch pea gravel. Acceptable gradation based on selected gradations of the choker course and reservoir course using criteria outlined in the HEC-11.

Sieve Size	Percent Passing (%)
3/8-inch	95-100
#4	0-30
#8	0-15
#200	0-2

2.02 POROUS ASPHALT MIX

A. Mix materials: performance grade asphalt binder (PGAB), coarse and fine aggregates, and optional additives such as polymer modified asphalt (PMA), fibers, or other select additives meeting the requirements of the NAPA's Design, Construction, and Maintenance of Open-Graded Friction Courses, Information Series 115 and Design, Construction, and Maintenance Guide for Porous Asphalt Pavements, Information Series 131, except if otherwise specified or approved in writing by Engineer.

B. Polymer Modified PGAB

1. Asphalt binder: polymer and/or fiber modified PGAB used in production of Superpave Hot Mix Asphalt (HMA) mixtures. Provide PGAB is 2 grades stiffer than that required for dense mix asphalt (DMA) parking lot installations.

2. PGAB polymer modifiers: either styrene butadiene rubber (SBR) or styrene butadiene styrene (SBS).

a. Dosage of fiber additives: added at 1.5 percent by total mixture volume.

b. Binder: per AASHTO M320.

C. Anti-Stripping Mix Additives

1. The mix shall be tested for moisture susceptibility and asphalt stripping from the aggregate by AASHTO T283, or improved updated method. If the retained tensile strength (TSR) < 80% upon testing, a heat stable additive shall be furnished to improve the anti-stripping properties of the asphalt binder. Test with one freeze-thaw cycle (rather than five recommended in NAPA IS 115). The amount and type of additive (e.g. fatty amines or hydrated lime) to be used shall be based on the manufacturer's recommendations, the mix design test results, and shall be approved by the Engineer.

2. Silicone shall be added to the binder at the rate of 1.5 mL/m^3 (1 oz. per 5,000 gal).

3. Fibers may be added per manufacturer and NAPA IS 115 recommendation if the drain down requirement cannot be met (18%, or >16% as tested with CoreLok device).

D. Coarse Aggregate

1. Coarse aggregate shall be that part of the aggregate retained on the No. 8 sieve; it shall consist of clean, tough, durable fragments of crushed stone, or crushed gravel of uniform quality throughout.

2. Coarse aggregate shall be crushed stone or crushed gravel and shall have a percentage of wear as determined by AASHTO T96 of not more than 40 percent. In the mixture, at least 75 percent, by mass (weight), of the material coarser than the 4.75 mm (No. 4) sieve shall have at least two fractured faces, and 90 percent shall have one or more fractured faces (ASTM D5821). Coarse aggregate shall be free from clay balls, organic matter, deleterious substances, and not more than 8.0% of flat or elongated pieces (>3:1) as specified in ASTM D4791.

E. Fine Aggregate

1. The fine aggregate shall be that part of the aggregate mixture passing the No. 8 sieve and shall consist of sand, screenings, or combination thereof with uniform quality throughout. Fine aggregate shall consist of durable particles, free from injurious foreign matter. Screenings shall be of the same or similar materials as specified for coarse aggregate. The plasticity index of that part of the fine aggregate passing the No. 40 sieve shall be not more than 6 when tested in accordance with AASHTO T90. Fine aggregate from the total mixture shall meet plasticity requirements.

2. Recycled asphalt pavement (RAP) can be used to supplement, or in place of, fine aggregate. RAP RAP: 1/2-inch minus or properly managed product

with known asphalt content in quantities not to exceed more that 10 percent by weight

F. Porous Asphalt Mix Design

1. Design mixture according to the NAPA IS 131, with the exception of testing for air void content. Bulk specific gravity (SG) used in air void content calculations shall not be determined and results will not be accepted using AASHTO T166 (saturated surface dry), since it is not intended for open graded specimens (greater than 10 percent AV). Bulk SG shall be calculated using AASHTO T275 (paraffin wax) or ASTM D6752 (automatic vacuum sealing, such as CoreLok). Air void content shall be calculated from the bulk SG and maximum theoretical SG (AASHTO T209) using ASTM D3203.

2. The materials shall be combined and graded to meet the composition limits by mass (weight) as shown below.

Sieve Size (inch/mm)	Percent Passing (%)
0.75/19	100
0.50/12.5	85-100
0.375/9.5	55-75
No.4/4.75	10-25
No.8/2.36	5-12
No.200/0.075 (#200)	2-4
Binder Content (AASHTO T164)	5.8-6.5
Air Void Content (ASTM D6752)	16.0-22.0
Draindown (ASTM D6390)*	less than equal to 0.3
Retained Tensile Strength (AASHTO 283)**	Greater than equal to 80
Cantabro abrasion test on unaged samples	less than equal to 20
Cantabro abrasion test on 7 day aged samples	less than equal to 23

* Either method is acceptable
**Cellulose, mineral, or polyester fibers may be used to reduce draindown.
***If the TSR (retained tensile strength) values fall below 80% when tested per NAPA IS 131 (with a single freeze thaw cycle rather than 5), the contractor shall employ an antistrip additive, such as hydrated lime (ASTM C977) or a fatty amine, to raise the TSR value above 80%.

3. The above preparation of aggregates does not apply for drum-mix plants.

2.03 SOURCE QUALITY CONTROL

A. Provide in accordance with Division 01 General Requirements. Comply with applicable reference standards listed in Article 1.03.

PART 3 – EXECUTION

3.01 GENERAL

A. Place hot mix asphalt between April 1 and November 15, unless otherwise specified by Owner.

B. Do not place hot mix asphalt mixture unless breakdown and intermediate rolling can be completed by time material has cooled to 175 degrees F and provided density of completed pavement attains at least 92.5 percent of maximum theoretical density as determined by AASHTO T209.

C. Do not place mix on wet or damp surfaces, or when ambient temperature is 40 degrees F and falling, unless otherwise specified by Owner.

D. When air temperature falls below 50 degrees F, take extra precaution drying aggregates, controlling temperatures of materials, placing, and compacting mixtures.

E. Utilize approved dial type thermometer and infrared pistol thermometer for each paving machine.

1. Fahrenheit or Celsius selectable.

2. Portable and battery operated.

3. Repeatability: plus or minus 5 degrees F.

4. LCD display: to nearest 1 degree.

5. Accuracy: plus or minus 2 percent.

6. Emissivity: present at 0.95.

7. Temperature operation range: 0 degrees F to 750 degrees F.

F. Subdrains are elevated a minimum of 4 inches from the reservoir course bottom.

3.01 INSTALLATION

A. Mixing

1. The dried aggregate shall be combined in the mixer in the amount of each fraction of aggregate required to meet the job-mix formula and thoroughly mixed prior to adding the asphalt material.

2. The dried aggregates shall be combined with the asphalt material in such a manner as to produce a mixture that when discharged from the pugmill is at

a target temperature in the range that corresponds to a recommended range supplied by the PGAB supplier.

3. The asphalt material shall be measured or gauged and introduced into the mixer in the quantity determined by the Engineer for the particular material being used and at the temperature specified in the relevant specification.

4. After the required quantity of aggregate and asphalt material has been introduced into the mixer, the materials shall be mixed until a complete and uniform coating of the particles and a thorough distribution of the asphalt material throughout the aggregate is secured and there is no residual moisture in the coated aggregate.

5. All plants shall have a positive means of eliminating oversized and foreign material from being incorporated into the mixer.

B. Preparation of Aggregates

1. The aggregate for the mixture shall be dried and heated at the mixing plant before being placed in the mixer. Flames used for drying and heating shall be properly adjusted to avoid damaging the aggregate and depositing soot or unburned fuel on the aggregate.

2. Mineral filler, if required to meet the grading requirements, shall be added in a manner approved by the Engineer after the aggregates have passed through the dryer.

C. Porous Media Beds

1. Grade Control

a. Establish and maintain required lines and elevations. Notify Engineer for review and approval of final stake lines for the Work before construction begins. Finished surfaces shall be true to grade and even, free of roller marks, and free of puddle-forming low spots. All areas must drain freely. Excavation elevations should be within plus or minus 0.1 ft.

b. Provide additional Work and retest Work not meeting the requirements specified based on testing reports and inspections at no additional cost to Owner.

c. Compaction of each of the layers: less than 95 percent maximum.

2. Notification. The Engineer shall be notified at least 24 hours prior to all porous media bed and porous pavement work.

D. Subgrade preparation

1. The existing native subgrade material under all bed areas shall NOT be compacted or subject to excessive construction equipment traffic prior to stone bed placement. Compaction is acceptable if an impermeable liner is used at the base of the porous asphalt system and infiltration is not desired.

2. Where erosion of the native material subgrade has caused accumulation of fine materials and/or surface ponding at the base of the excavation, this material shall be removed with light equipment and the underlying soils scarified to a minimum depth of 6 inches with a York rake or equivalent and light tractor.

3. Bring subgrade of stone porous media bed to line, grade, and elevations indicated. Fill and lightly regrade any areas damaged by erosion, ponding, or traffic compaction before the placing of the stone. For parking lots all bed bottoms are level grade to promote uniform infiltration.

E. Porous Media Bed Installation

1. Upon completion of subgrade work, the Engineer shall be notified and shall inspect at his/her discretion before proceeding with the porous media bed installation.

2. Install coarse aggregate in lifts no greater than 8-inches (20 cm). Lightly compact each lift with equipment, keeping equipment movement over storage bed subgrades to a minimum. Install aggregate to grades indicated on the drawings.

3. Install choker base course (see Materials section) aggregate evenly over surface of filter blanket layer, sufficient to allow placement of pavement, and notify Engineer for approval. Choker base course thickness shall be sufficient to allow for even placement of the porous asphalt but no less than 4-inches in depth.

4. Take any necessary steps to prevent sediment from washing into beds during site construction. When the site is fully stabilized, temporary sediment control devices shall be removed.

F. Porous Asphalt Pavement Installation

1. The mixing plant, hauling and placing equipment, and construction methods shall be in conformance with NAPA IS 131.

2. The use of surge bins shall not be permitted.

3. Hauling Equipment. The open graded mix shall be transported in clean vehicles with tight, smooth dump beds that have been sprayed with a non-petroleum release agent or soap solution to prevent the mixture from adhering to the dump bodies. Mineral filler, fine aggregate, slag dust, etc.

shall not be used to dust truck beds. The open graded mix shall be covered during transportation with a suitable material of such size sufficient to protect the mix from the weather and also minimize mix cooling and the prevention of lumps. When necessary, to ensure the delivery of material at the specified temperature, truck bodies shall be insulated, and covers shall be securely fastened. Long hauls, particularly those in excess of 25 miles, may result in separation of the mix and its rejection.

4. Placing Equipment. The paver shall be a self-propelled unit with an activated screed or strike-off assembly, capable of being heated if necessary and capable of spreading and finishing the mixture without segregation for the widths and thicknesses required. In general, track pavers have proved superior for Porous Asphalt placement. The screed shall be adjustable to provide the desired cross-sectional shape. The finished surface shall be of uniform texture and evenness and shall not show any indication of tearing, shoving, or pulling of the mixture. The machine shall, at all times, be in good mechanical condition and shall be operated by competent personnel. Pavers shall be equipped with the necessary attachments, designed to operate electronically, for controlling the grade of the finished surface. The adjustments and attachments of the paver will be checked and approved by the Engineer before placement of asphalt material.

5. Rollers. Rollers shall be in good mechanical condition, operated by competent personnel, capable of reversing without backlash, and operated at speeds slow enough to avoid displacement of the asphalt mixture. The mass (weight) of the rollers shall be sufficient to compact the mixture to the required density without crushing of the aggregate. Rollers shall be equipped with tanks and sprinkling bars for wetting the rolls. Rollers shall be two-axle tandem rollers with a gross mass (weight) of not less than 8 tons and not more than 12 tons and shall be capable of providing a minimum compactive effort of 44 kN/m (250 pounds per inch) of width of the drive roll. All rolls shall be at least 42 inches in diameter. A rubber-tired roller is not required on the open graded asphalt friction course surface.

6. Conditioning of Existing Surface. Contact surfaces such as curbing, gutters, and manholes shall be painted with a thin, uniform coat of Type RS-1, or equivalent emulsified asphalt immediately before the asphalt mixture is placed against them.

7. Temperature Requirements. The temperature of the asphalt mixture, at the time of discharge from the haul vehicle and at the paver, shall be between 135-163°C (275 to 325°F), within 6 °C (10 °F) of the compaction temperature for the approved mix design.

8. Spreading and Finishing

a. Place porous Asphalt in 2 lifts at 1.5 to 2 inches . Take care to ensure that the porous asphalt layers join completely. This means: keeping the time between layer placements minimal; keeping the first layer clear from dust and moisture, and minimizing traffic on the first layer. Take care to allow sufficient time for the asphalt placement to set, generally the following day or when the surface temperature of the first lift cools to 38 degrees C (100 degrees F). Avoid damaging or impairing permeability of the base course if a multiple lift scenario is chosen. If significant site work will take place between placement of base and wearing courses higher durability mixes should be used for both layers.

b. Protect exposed surfaces that are not to be treated from damage during all phases of the pavement operation.

c. The asphalt mixture shall be spread and finished with the specified equipment. The mixture shall be struck off in a uniform layer to the full width required and of such depth that each course, when compacted, has the required thickness and conforms to the grade and elevation specified. Pavers shall be used to distribute the mixture over the entire width or over such partial width as practical. On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture shall be spread and raked by hand tools.

d. No material shall be produced so late in the day as to prohibit the completion of spreading and compaction of the mixture during daylight hours, unless night paving has been approved and established for the project.

e. No traffic will be permitted on material placed until the material has been thoroughly compacted and has been permitted to cool to below 38 °C (100 °F). The use of water to cool the pavement is not permitted. The Engineer reserves the right to require that all work adjacent to the pavement, such as guardrail, cleanup, and turf establishment, is completed prior to placing the wearing course when this work could cause damage to the pavement.

9. Compaction

a. Immediately after the asphalt mixture has been spread, struck off, and surface irregularities adjusted, it shall be thoroughly and uniformly compacted by rolling. The compaction objective is 16% - 19% in place void content (Corelock).

b. Breakdown rolling shall occur when the mix temperature is between 135-163°C (275 to 325°F). This is typically achieved with 1-2 passes with a 8 – 12 ton vibratory roller.

c. Finish rolling shall occur when the mix temperature is between 66-93°C (150 to 200°F). This is typically achieved with a 1-ton roller

with no vibratory compaction. Finish rolling is largely aesthetic and done for a smooth finished surface. Care should be taken so as to not continually roll the same location for instance back and forth to a water source.

d. The cessation temperature occurs at approximately 79°C (175°F), at which point the mix becomes resistant to compaction. If compaction has not been performed at temperatures greater than the cessation temperature, the pavement will not achieve adequate durability. The temperatures referenced here are guidelines and have been used in the field to oversee successful porous asphalt installations.

e. The surface shall be rolled when the mixture is in the proper condition and when the rolling does not cause undue displacement, cracking, or shoving.

f. Rollers or oscillating vibratory rollers, ranging from 8 – 12 tons, shall be used for breakdown compaction. The number, mass (weight), and type of rollers furnished shall be sufficient to obtain the required compaction while the mixture is in a workable condition.

g. To prevent adhesion of the mixture to the rollers, rollers shall be kept moist with water or water mixed with very small quantities of detergent or other approved material. Excess liquid will not be permitted.

h. Along forms, curbs, headers, walls, and other places not accessible to the rollers, the mixture shall be thoroughly compacted with hot or lightly oiled hand tampers, smoothing irons or with mechanical tampers. On depressed areas, either a trench roller or cleated compression strips may be used under the roller to transmit compression to the depressed area.

i. Other combinations of rollers and/or methods of compacting may be used if approved in writing by the Engineer, provided the compaction requirements are met.

j. The speed of the roller shall be slow and uniform to avoid displacement of the mixture, and the roller should be kept in as continuous operation as practical. Finish rolling shall continue below the threshold temperature until all roller marks and ridges have been eliminated.

k. Rollers will not be stopped or parked on the freshly placed porous asphalt.

l. Any mixture that becomes loose and broken, mixed with dirt, or is in any way defective shall be removed and replaced with fresh hot mixture. The mixture shall be compacted to conform to the surrounding area. Any area showing an excess or deficiency of binder shall be removed and replaced. These replacements shall be at the Contractor’s expense.

m. If the Engineer determines that unsatisfactory compaction or surface distortion is being obtained or damage to highway components and/or adjacent property is occurring using vibratory compaction equipment, immediately cease using this equipment and proceed with the Work using roller without turning on vibration.

10. Joints

a. Joints between old and new pavements, between porous and impervious pavements, or between successive day's work shall be made to ensure a thorough and continuous bond between the old and new mixtures. Whenever the spreading process is interrupted long enough for the mixture to attain its initial stability, the paver shall be removed from the mat and a joint constructed.

b. Butt joints shall be formed by cutting the pavement in a vertical plane at right angles to the centerline, at locations approved by the Engineer. The Engineer will determine locations by using a straightedge at least 10 feet long. The butt joint shall be thoroughly coated with Type RS-1 or equivalent emulsified asphalt just prior to depositing the pavement mixture when pavement resumes.

c. Longitudinal joints that have become cold shall be coated with Type RS-1 or equivalent emulsified asphalt before the adjacent mat is placed. If directed by the Engineer, joints shall be cut back to a clean vertical edge prior to applying the emulsion.

11. Surface Tolerances. The surface will be tested by the Engineer using a straightedge at least 10 feet in length at selected locations parallel with the centerline. Any variations exceeding 3/8 inch between any two contact points shall be satisfactorily eliminated. A straightedge at least 10 feet in length may be used on a vertical curve. The straightedges shall be provided by the Contractor.

12. Work shall be done expertly throughout, without staining or injury to other work. Transition to adjacent impervious asphalt pavement shall be merged neatly with flush, clean line. Finished pavement shall be even, without pockets, and graded to elevations shown on drawing.

13. Repair of Damaged Pavement. Any existing pavement on or adjacent to the site that has been damaged as a result of construction work shall be repaired to the satisfaction of the Engineer without additional cost to the Owner.

3.02 FIELD QUALITY CONTROL

A. Provide in accordance with the following and Division 01 General Requirements.

1. The Contractor shall hire and independent testing company to perform the following testing:

a. Confirm that the delivery tickets Materials meet the requirements of the specifications.

b. Check the temperatures of the materials being installed. Check the temperature of asphalt in the truck before materials are installed. Check the temperature of the material after half the load has been installed.

c. Check the compacted depth of the asphalt as the materials are being installed. Check the depth of the asphalt on each side of the paving machine every 50 feet.

d. Test the plane of the finished surface with a straight edge as specified in MassDOT 460.67.

e. Field compaction testing

1) Submit daily field reports documenting earthwork activity and field-testing for each day. At minimum, reports shall include:

a) Description of day's activities;

b) Results of in-place density testing including in-place dry density, moisture content, percent compaction, elevation of test and description of soil; and

c) Sketch indicating extent of each day's Work and location of testing.

3.03 CLOSEOUT ACTIVITIES

A. Provide in accordance with Division 01 General Requirements.

END OF SECTION

SECTION 32 12 43.13: POROUS FLEXIBLE SURFACING (TRAIL) – Add Alternate

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SUMMARY

A. The work in this section includes but is not limited to:

1. Supply and install single pass porous flexible paving surfacing system.
2. Review for approvals, density reports provided by owner's testing agency prior to installing porous surfacing system.
3. See drawings and specifications for complete extent of work in this section.

1.3 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 31 Section – EARTH MOVING
2. Division 32 Section – ASPHALT PAVEMENT
3. Division 32 Section – SITE IMPROVEMENTS
4. Division 32 Section – CRUSHED GRANITE PAVEMENT
5. Division 32 Section – STABILIZED CRUSHED GRANITE PAVEMENT

1.4 REFERENCES

A. The following standards shall apply to the work of this Section:

1. ASTM: American Society for Testing and Materials
2. CPSC: U.S. Consumer Product Safety Commission
   Public Playground Safety Handbook

1.5 SUBMITTALS

A. Material Samples: Following the review of Shop Drawings by Landscape Architect, provide one material sample for each of the items listed below, including final finishing as applicable. Fabrication for the following items shall follow the Landscape Architect's approval of material sample. Any alternate product must be submitted with prior approval packages a minimum of ten (10) days prior to bid date.

1. Porous Flexible Paving: Submit manufacturer's sample (6" x 6") of each specified color. Contractor shall provide three (3) samples of each color or color blend to determine exact blend ratio. Contact Landscape Architect prior to ordering samples for required color blend variations.

B. Submittal packages for resilient safety surfacing shall include but not be limited to:

1. Reference list per all of the requirements of contractor pre-qualifications.
2. Certificates stating that materials meet or exceed the specified contract requirements.
3. Written guarantee from manufacturer of the proposed product against all defects in material and/or workmanship

4. Impact attenuation (per fall height requirements and depth specified), accessibility of surface systems, coefficient of friction, permeability, flammability, toxicity, and tensile strength test results from independent approved and certified testing laboratories
5. Proof of specified insurance requirements
6. MSDS and Product Data Sheets
7. Manufacturer's literature: porous flexible paving & filter fabric
8. Certificate of Compliance: Submit manufacturer's certificate of compliance indicating materials comply with specified requirements.

C. Furnish independent test results supplied by the manufacturer to the Landscape Architect demonstrating that the surfacing product meets the CPSC/ASTM test procedures and the ADA law for handicap accessibility.

D. Test Results: Porous flexible paving

1. Impact Attenuation: ASTM F1292 and ASTM F1292: Impact attenuation test results will be provided to the Owner or Landscape Architect. These test results shall be certified and submitted on the letterhead of an independent testing lab. Impact attenuation test results shall meet or exceed Consumer Product Safety Commission Guidelines for impact attenuation (G-max and Head Injury Criteria "H.I.C"). Both test results must be administered and evaluated under the same test and these results must be shown for three drops at each required temperature: -6° C, 23° C, and 49° C; yield less than 100 G-Max and less than 800 H.I.C at a minimum 13-ft. fall height. Testing laboratory must be certified to meet calibration program requirements of MIL-STD-45662A. Additionally, upon request, manufacturer will provide at the installed site impact attenuation testing with the TRIAX 2000 for a fee.
2. Accessibility of Surface Systems – ASTM F1951: All playground surfacing products must pass testing to ensure wheelchair access under and around playground equipment as required by the Americans with Disabilities Act.
3. Slip resistance/static coefficient of friction – ASTM Standard F1677: The minimum value 0.20-0.25 is the minimum required to prevent slips for most people walking normally.
4. Water Absorption – ASTM D-570: 0.15 (% by weight)
5. National Fire Protection Association Life Safety Code Class II Rating – ASTM E-648: NFPA Designation no. 253. Critical Radiant Flux watts/cm2 Average 0.37
6. Tensile Properties (Die C) Tensile Strength/Elongation at Break – ASTM D-412: 2190 PSI – 300%
7. Type 2 surfacing shall be coated with an odorless, colorless, non-leaching, durable, broad-spectrum anti-microbial.
8. Installation shall be provided by a certified installer.

1.6 DELIVERY, STORAGE & HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage

1. Store materials in accordance with manufacturer's instructions.
2. All rubber and stone materials are to be transported in weather resistant bags protecting against adverse weather conditions.
3. The urethane shall be shipped and stored in containers that protect against water intrusion.

C. All materials are to be protected on site against adverse weather conditions. If freezing overnight temperatures are anticipated, heated storage shall be provided by the owner or contractor for proper storage of the urethane binding agent.

D. Handling: Protect materials during handling and installation to prevent damage.

1.7 QUALITY ASSURANCE

A. Manufacturer's Qualifications

1. Flexible porous paving shall be supplied by a manufacturer with at least 10 years' experience that can supply references for similar applications and installations in the USA.

B. Contractor Qualifications

1. Certified by manufacturer for installation of the flexible porous paving system.
2. Approved by manufacturer. The porous flexible paving shall be supplied by a manufacturer with at least 10 years' experience and which can supply references to prove the experience.

C. Insurance Requirements

1. All bidders must carry minimum insurance of $1,000,000 general liability including products and completed operations**.**

D. Weather:

1. Porous flexible paving shall not be installed when the ambient air temperature in the shade near the installation site is above 110° F or below 50° F. Temperatures below 50° F can extend the curing time and would fall outside of normal "use ready in 24 hours" guidelines.
2. The urethane binder shall be stored on site at between 59°- 77° F and used within 6 months of delivery.
3. The Contractor shall not pave on days when rain is forecast unless a change in the weather results in favorable paving conditions as determined by the Landscape Architect.
4. In the event of rain on days prior to installation, the sub-base must be dry and not contain any standing or moving water.

E. Installation of the flexible porous paving will be considered acceptance of the sub-base material by the Contractor/installer.

1.8 WARRANTY

A. Materials and Workmanship: Porous flexible surfacing shall be warranted against installation defects for a period of one year commencing 24 hours (curing time) after the date the installation is complete. A written, dated warranty certificate will be issued by the manufacturer.

B. Performance: Playground safety surfacing shall be warranted to meet drop height performance requirements of ASTM F 1292 for 10 years from date of substantial completion and acceptance by the Contracting Officer.

PART 2 – PRODUCTS

2.1 GENERAL

A. Porous flexible paving shall be designed in accordance with ASTM F1292-09 for safety surface applications and shall have a critical fall height of 7 ft. based on 2¼ inches material depth.

B. Porous flexible paving shall be slip-resistant and ADA compliant, in accordance with ASTM D 2047 testing.

C. Porous flexible paving shall be sound absorbent, in accordance with ASTN C423 / E795 testing.

D. Porous flexible paving shall have a leachate less than 6 parts per billion and containing no organic compounds or heavy metals.

2.2 MATERIALS

A. Basis of Design: The basis of design for the porous flexible paving materials is the KBI Flexi-Pave system as manufactured by K.B. Industries, Inc. (KBI), of Clearwater, Florida, or approved equal.

B. Makeup of porous flexible paving wearing course:

1. All components, materials and compounds shall be 100% sourced and manufactured in the USA.
2. Flexible paving system shall be made from recycled passenger tires and a urethane binding agent.
3. The material must adhere to ASTM C 666/C/666M Freeze-Thaw Testing that showed no cracks or breaks through 300 cycles of testing.
4. The material shall be resistant to the following elements: transmission, hydraulic, and brake fluids, gasoline, diesel, saltwater, oil, chlorine, ozone, bromine, and muriatic acid.

C. The porous flexible paving system will have the following technical specifications:

1.	Accelerated weathering 3000 hours	No change
2.	Thermal stability range of	53 degrees to 212 degrees
3.	Freeze thaw at 250 cycles	No change

4. Surface for fitness equipment at 2-1/4 inches thick to meet ASTM 1292 and F355 criteria with FP35 or FP45 with no aggregate. The product will have a HIC rating of 1000 or less and G-Max force of 200 or less at 73 degrees Fahrenheit for a 6-foot critical fall height.

D. The porous flexible paving system shall be one of the standard offered colors. (Natural color: Cypress or Granite.) To be selected by the Owner.

E. The porous flexible paving shall be cured and fit for use within 24 hours of installation.

2.3 SUB-BASE

A. Sub-base shall be provided, installed, and paid for by Division 31 Section: EARTH MOVING. Sub-base shall be AASHTO #57 aggregate.

B. Sub-base shall be a minimum of 4 inches thick after the compaction process reaches a density value of 95% minimum.

2.4 FILTER FABRIC

A. Filter fabric layer under infield system shall be a non-woven, 100 percent polypropylene staple filaments, 4.5 ounces per square yard, meeting the following requirements:

1.	Tensile strength (ASTM D-4632)	120 lbs.
2.	Elongation at break (ASTM D-4632)	50%
3.	Mullen burst (ASTM D-3786)	230 psi
4.	Puncture strength (ASTM D-4833)	65 lbs.
5.	Trapezoidal tear (ASTM D-4533)	50 lbs.
6.	AOS – US Standard Sieve (ASTM D-4751)	70
7.	Permittivity (ASTM D-4491)	1.5 (-1) sec.
8.	UV Resistance	70%
9.	Flow Rate	120 gal/min/sf

PART 3 – EXECUTION

3.1 EVALUATION

A. Prior to installation of porous flexible paving, a certified system installer and approved technicians will inspect the sub-base visually for performance qualities. If the sub-base is found to be unsatisfactory for the porous flexible paving installation, the Contractor shall notify the Landscape Architect immediately.

3.2 COMMENCING WORK AFTER REMEDIAL ACTIONS BY OTHERS

A. Installation will take place only after all known defects in the substrate are repaired, tested and approved by the proper authorities overseeing the project.

B. Prior to the installation of the porous flexible paving materials, the Contractor shall confirm the required structural properties of the sub-base material and that it has been placed to a minimum of 95% compaction via testing as designated in this Division 32 Section.

3.3 CONDITIONS

A. An ambient temperature of 50 degrees Fahrenheit or greater with a relative humidity reading of under 75% shall prevail during the installation and for at least 24 hours after the completion time of that day's work to allow for proper curing of the materials.

B. The urethane binder shall be stored on site at between 59-77 degrees Fahrenheit and used within 6 months of delivery.

C. All materials incorporated into the Porous flexible paving system are to be protected before, during and after installation until fully cured.

D. Work will not take place when it is raining, or the humidity is too high to install Porous flexible paving materials.

3.4 INSTALLATION

A. Contractors installing the porous flexible paving installation will be certified by the manufacturer.

B. The layer of porous flexible paving shall be allowed to cure with no foot, machine, load-bearing equipment, or vehicle traffic for a minimum of 24 hours from the end of the day's work.

3.5 MONITORING AND MAINTENANCE

A. The porous flexible paving installer shall be responsible for the entire installation of the contract work. The installer shall monitor the curing of the materials until it has cured to ensure no damage has occurred prior to acceptance of the work by the owner or authorized representative.

B. The Contractor shall protect the work area from traffic or loads until the product has fully cured.

C. Once the porous flexible paving system has been installed and fully cured, cleaning may be accomplished by use of a leaf blower, broom, or hose.

END OF SECTION

SECTION 32 13 13: REINFORCED CONCRETE PAVING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SUMMARY

A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to furnish and install REINFORCED CONCRETE PAVING, as indicated on the Contract Documents, and as specified herein.

1.3 REFERENCES

A. The following standards shall apply to the work of this Section:

1. American Concrete Institute (ACI)
   - 306R Cold Weather Concreting
   - 316R Recommendations for Construction of Concrete Pavements and Concrete Bases
2. American Society for Testing and Materials (ASTM)
   - A 185 Specification for Steel Welded Wire Fabric. Plain, for Concrete Reinforcement
   - A 615 Specification for Deformed and Plain Billet - Steel Bars for Concrete Reinforcement
   - C 33 Specifications for Concrete Aggregates
   - C 94 Specifications for Ready-Mixed Concrete
   - C 143 Test Method for Slump of Hydraulic Cement Concrete
   - C 150 Specification for Portland Cement
   - C 171 Specification for Sheet Materials for Curing Concrete
   - C 231 Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
   - C 309 Specification for Liquid Membrane-Forming Compounds for Curing Concrete
   - C 494 Specification for Chemical Admixtures for Concrete
   - C 1116 Standard Specification for Fiber Reinforced Concrete & Shotcrete
   - D 226 Specification for Asphalt-Saturated Organic Felt Used in Roofing & Waterproofing
   - D 545 Test Methods for Preformed Expansion Joint Fillers for Concrete Construction (Non-extruding and Resilient Types)
   - D 1557 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort [56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)]
   - D 1752 Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
3. Massachusetts Department of Transportation (MassDOT)
   Specifications Standard Specifications for Highways and Bridges

1.4 RELATED SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 02 Section – SITE PREPARATION & DEMOLITION
2. Division 03 Section – CAST-IN-PLACE CONCRETE
3. Division 07 Section – JOINT SEALANTS
4. Division 31 Section – EARTH MOVING
5. Division 32 Section – SITE IMPROVEMENTS

1.5 SUBMITTALS

A. Description of Methods and Sequence of Placement. For each type of specially-finished concrete provide description of methods and sequence of placement.

B. Submit manufacturer's product data for the following:

1. Form release agent
2. Prefabricated control joint
3. Preformed joint filler
4. Sealants
5. Curing materials

C. Submit samples of the following:

1. Prefabricated control joint
2. Preformed joint filler
3. Color chart for selection of sealant color

D. Construct Concrete Sample Panels:

1. Construct 6-foot x 6-foot sample panels of finished concrete pavement for approval, at least 15 days prior to final concrete paving work. Samples shall not be constructed in an area of proposed finish work. Samples shall be constructed within the vicinity of the proposed finish work to facilitate comparisons during construction. The samples shall demonstrate the typical installation of concrete, including score lines, expansion joint and sealant, curing and finishing material, surface texture, color, and edge treatment. The accepted sample, upon approval, shall be maintained as the standard of minimal quality for approval of all proposed concrete pavement work required for the project. If the original sample panel is not approved, the Contractor shall provide additional sample panels, as required, at no additional cost to the Owner until an approved sample is obtained. Unacceptable sample panels shall immediately be removed from the site.

E. Test reports for concrete, per paragraph 1.07 – TESTING & INSPECTION of this specification.

1.6 QUALITY ASSURANCE

A. Unless otherwise specified, work and materials for construction of the reinforced Portland cement concrete paving shall conform to ACI 316R, and applicable portions of the following:

1. MassDOT Specifications Section 400 Cement Concrete Pavement.

B. Surfaces of curb ramps and handicapped access ramps shall be stable, firm and slip resistant. Construct ramps so that water does not accumulate on ramp surfaces.

C. Paving work, base course installation, top course installation, and the like, shall be done only after excavation and construction work which might injure them have been completed. Damage caused during construction shall be repaired before acceptance.

D. Existing paving areas shall, if damaged or removed during course of this project, be repaired or replaced under this SECTION, REINFORCED CONCRETE PAVING. Workmanship and materials for such repair and replacement, except as otherwise noted, shall match as closely as possible those employed in existing work installed under this Contract.

E. Pavement, base, or subbase shall not be placed on a muddy or frozen subgrade.

1.7 TESTING & INSPECTION

A. The Contractor shall perform slump and compressive strength tests for concrete paving. Slump tests shall be performed on every truck delivery. Compressive strength tests shall be performed every 50 cubic yards delivered. Compressive strength testing shall include three cylinder per test (one each for 7 days, 28 days, and a reserve). All tests shall be paid by the Contractor.

PART 2 – PRODUCTS

2.1 AGGREGATE BASE COURSE

A. Base course shall be existing aggregate base re-graded and compacted. Existing base shall be supplemented with similar materials as required to meet the proposed elevations.

2.2 STEEL REINFORCEMENT

A. Welded wire fabric (WWF) reinforcement shall conform to the applicable requirements of ASTM A 185. Fabric reinforcement shall be furnished in flat sheets. Fabric reinforcement in rolls will not be permitted.

1. Provide 6 inches x 6 inches W2.9 x W2.9 WWM for 6 inch thick concrete pavement, 6 inches x 6 inches W3.4 x W3.4 WWM for 8 inches thick concrete pavement and 6 inches x 6 inches W1.4 x W1.4 WWM for 4 inches concrete pavement.

B. Steel reinforcing bars shall conform to ASTM A 615.

1. Bars employed as reinforcement shall be deformed type.
2. Unless otherwise indicated on the Contract Documents, reinforcing bars shall be Grade 60.

C. Steel expansion dowels shall be hot-rolled plain steel rounds conforming to the requirements of AASHTO M31, Grade 60 and consisting of a 1/2 inches by 24 inches smooth steel dowel and compatible waxed tube sleeve, by 12 inches in length.

1. Dowels and sleeves shall be as furnished by A.H. Harris & Sons, Inc., by U.S. Steel Corp., by Edgecombe Steel Corporation, or approved equal.
2. Dowels shall be epoxy coated.

2.3 PORTLAND CEMENT CONCRETE

A. Cast-in-place concrete shall be air-entrained concrete with minimum 28-day compressive strength of 4,000 pounds per square inch (30 MPa), conforming to the requirements and applicable provisions of MassDOT Specifications Section M4.

1. Air Entrainment: Concrete shall be air-entrained 7 percent minimum +/-1 percent, by volume.
2. Slump: Concrete shall have a slump of 2 inches to 4 inches slump.
3. Maximum Aggregate Size: Aggregate size shall be a maximum of 3/4 inches.
4. Thickness of Concrete: Depths shall be as noted on the Contract Documents.

2.4 CURING MATERIALS FOR PLAIN CONCRETE

A. Curing shall be by moist curing or by use of curing compound.

B. Curing paper shall be non-staining, fiber reinforced laminated kraft bituminous product conforming to ASTM C 171. Four mil polyethylene sheeting may be substituted for curing paper.

C. Curing compound shall be a resin-base, white pigmented compound conforming to ASTM C 309, Type 1.

2.5 EXPANSION JOINTS

A. Provide expansion joints as indicated and in accordance with the following:

1. Unless otherwise indicated on the Contract Documents, expansion joints shall be located 20 feet on center maximum.
2. Location of expansion joints are indicated on the Contract Documents.

B. Expansion Joint Filler:

1. Closed cell polymer foam meeting requirements of ASTM D 1752, Sections 3.1 to 3.4, based on compression requirement of 10 pounds per square inch minimum and 25 pounds per square inch maximum. Recovery rate following 50 percent compression shall exceed 99 percent recovery, per ASTM D 545. Foam shall be equal to Ceramar Foam Filler, manufactured by W.R. Meadows. Inc., or an approved equal.
2. Expansion joint filler shall have a removable cap cover for the joint filler with integral permanent plastic bond breaker such as Snap-Cap from Seal Tight manufactured by W.R. Meadows, Inc., or approved equal. Cover width shall be sized to match width of joint filler.

2.6 CONTROL JOINTS

A. Control joints in concrete shall be made using a preformed contraction joint equal to the Plastic Contraction Joint distributed by A.H. Harris & Sons, Inc., Medfield, MA, or approved equal.

1. Preformed contraction joint shall be specifically designed to form construction and weaken plane joints.
2. Dimension of prefabricated joint former shall be as indicated on the Contract Drawings.
3. Joints shall be placed 5 feet on center, maximum or as shown on the Contract Drawings.

2.7 CONSTRUCTION JOINTS

A. Transverse construction joints shall be placed whenever placing of concrete is suspended for more than 30 minutes.

1. Butt joint with dowels or thickened edge joint shall be used if construction joints occur at location of control joint. Submit sketch to Landscape Architect for review and acceptance of proposed system.
2. Keyed joints with tie bars shall be used if the joint occurs at any other location.

2.8 SEALANT

A. Joint sealant and primer shall be polyurethane-based, one component, elastomeric sealants, complying with Fed. Spec. TT-S-00230C, Class A Type 1. Color shall be as selected by the Owner. Sealants shall be self-leveling pour grade type.

1. Vulkem 45, as manufactured by Mameko International, 4475 East 175th Street, Cleveland, Ohio, (800) 321-6412.
2. Urexpan NR-210, as manufactured by Pecora Corporation, 165 Wambold Road, Harleysville, Pennsylvania, (215) 723-6051
3. PSI 951, as manufactured by Polymeric Systems Inc., Phoenixville, Pennsylvania, (800) 228-5548.
4. Approved equal

B. Provide only materials which are known to be fully compatible with the actual installation condition, as shown by the manufacturer’s published data or certification. Use manufacturer’s recommended joint primer.

2.9 DETECTABLE TACTILE WARNING

A. Detectable Tactile warning surface shall conform to the requirements of MassDOT as shown on the Construction Standard Details, most recent version (Standard Drawing 107.6.5R) and shall be charcoal gray in color.

2.10 GRANITE CURB

GRANITE CURB

A. Granite curb shall be as noted herein and fabricated to the sizes and dimensions indicated on the Contract Documents and approved Shop Drawings.

B. Size/type:

1. Granite curb shall be MassDOT curb Type VA4 (6 inches wide by 17-19 inches tall by 72 inches length), with reveal as designated on the Contract Drawings.

C. Granite curb shall be “Chelmsford” granite, or a fine grained, light gray approved equal granite.

D. The granite curb concrete base and footing shall be as specified, installed, and paid for according to Division 32 Section, CAST-IN-PLACE CONCRETE.

PART 3 – EXECUTION

3.1 PREPARATION OF SUBGRADE

A. Subgrade of areas to be paved shall be re-compacted as required to bring top 8 inches of material immediately below aggregate base course to a compaction at optimum moisture of at least 95 percent of maximum density, as determined by ASTM D 1557. Subgrade compaction shall extend for a distance of at least 12 inches beyond pavement edge.

3.2 FORMWORK

A. All forms shall be joined neatly and tightly, shall be set true to line and grade, well-staked and braced, and shall have uniform bearing throughout their length. Remove all forms and miscellaneous appurtenances from pavement edges and dispose of all formwork and appurtenances at the end of the construction project.

1. Forms shall not be moved for 72 hours after the concrete has been placed, or for a longer period if directed by the Landscape Architect.
2. Remove all forms. Extreme care shall be taken in removing forms in order that no damage will be done to the concrete.
3. Under no condition shall any bar, pick or other tool be used which depends upon leverage on the concrete for removal of the forms.

3.3 STEEL REINFORCEMENT

A. Before being placed in position, reinforcing for reinforced concrete shall be thoroughly cleaned of loose mill and rust scale, dirt, ice, and other foreign material which may reduce the bond between the concrete and reinforcing. Where there is delay in placing concrete after reinforcement is in place, bars shall be re-inspected and cleaned when necessary.

B. Welded Wire Mesh: Wire mesh used for reinforcement shall be spread flat before placing concrete. Mesh reinforcement shall be held firmly in place against vertical or transverse movement by means of satisfactory devices. Where mesh reinforcement is spliced, it shall be lapped at least 12 inches.

1. Unless designated otherwise on the Contract Documents, wire mesh shall be placed midway within the depth, and parallel to the finished surface of concrete pavements.
2. Do not pour concrete over top of reinforcement unless it is supported underneath.
3. Contractor shall pull reinforcement up immediately after pouring concrete to make sure that the reinforcement is in the middle of the slab and not sitting on the bottom.

C. Reinforcing Steel: After forms have been coated with form release agent, but before concrete is placed, reinforcing steel anchors shall be securely wired in the exact position called for, and shall be maintained in that position until concrete is placed and compacted.

1. Any bar showing cracks after bending shall be discarded.
2. Chair bars and supports shall be provided in a number and arrangement satisfactory to the Landscape Architect.

D. Unless otherwise indicated on the Contract Documents, reinforcing shall extend within 2 inches of formwork and expansion joints.

1. Reinforcing shall continue through control joints.

E. The Owner may do core testing to make sure that reinforcement is in the proper position. If testing shows otherwise concrete will be rejected and the Contractor shall remove all rejected slabs and re-pour new slabs at no additional cost. Contractor shall repair cored holes as directed by the Landscape Architect.

3.4 EXPANSION JOINTS

A. Expansion joints shall be one-half inch wide and shall be as located on the Contract Documents. Expansion joint shall be formed in the concrete to required width with preformed joint filler in place. Joint filler shall extend the full depth of the slab. Joint filler shall extend the full length of the expansion joint.

1. For concrete banding and concrete pavements and pads, depth of joint filler shall be as required to form a three-quarter inch deep sealant recess below finished concrete surface.

B. Place expansion joints spaced 20 feet on center maximum. When provided, clarification documents that show specific locations of expansion joints shall direct the Contractor where to place expansion joints. Such clarification documents may place joints closer than 20 feet on center. In the absence of clarification documents the language of this SECTION, REINFORCED CONCRETE PAVING, shall govern.

1. Expansion joints shall be placed where pavement meets flush foundations and footings, concrete or bituminous concrete curbing or other vertical structures, including light bases, hydrants, walls, buildings, piers, and walls, and at other conditions as shown on the Contract Documents.
2. Contractor shall request the presence of the Landscape Architect to review the layout of expansion joints prior to pouring the concrete.
3. Follow the manufacturer's application recommendations for joint filler and sealer.
4. Joint alignment shall be straight and true.

C. Where expansion dowels are use in the expansion joints, dowels, and greased sleeves shall be set parallel with the top and bottom surfaces of the concrete slab.

3.5 REINFORCED PORTLAND CEMENT CONCRETE PAVING

A. Paving mix, equipment, methods of mixing and placing, and precautions to be observed as to weather, condition of base and the like, shall meet the requirements of ACI 316R. Pavement shall be constructed in accordance with the Contract Documents.

B. The Landscape Architect shall be notified of concrete placement sufficiently in advance of start of operation to allow his representative to complete preliminary inspection of the work, including subgrade, forms, and reinforcing steel, if used.

1. No concrete shall be deposited until the Landscape Architect has inspected the placing of reinforcement and given permission to place concrete.

C. Normal concrete placement procedures shall be followed. Concrete shall arrive at the job site so that no additional water will be required to produce the desired slump. When conditions develop that required addition of water to produce the desired slump, permission of the Landscape Architect must be obtained. The concrete shall be transported from the mixer to its place of deposit by a method that will prevent segregation or loss of material.

1. Concrete pavement shall be placed in a series of alternate pours such that every other panel bounded by expansion joints shall be poured first.
2. The intervening panels shall then be poured as a secondary operation only after the first panels have hardened sufficiently to allow the removal of all temporary transverse forming supports.
3. Concrete shall be placed in one course, to full depth, as detailed on the Contract Documents.

D. Work shall not be performed during rainy weather or when temperature is less than 40° Fahrenheit. In the event that unforeseen rain occurs, cover all broom finished concrete surfaces with plastic sheet covering to prevent alteration of texture. Concrete slabs with textured concrete surfaces altered by rain shall be removed from the site as directed by the Landscape Architect.

E. Adjacent work shall be protected from stain and damage during entire operation. Damaged and stained areas shall be replaced or repaired to equal their original conditions.

F. Existing concrete, earth, and other water-permeable material against which new concrete is to be placed shall thoroughly damp when concrete is placed. There shall be no free water on surface.

G. Concrete which has set or partially set before placing shall not be employed. Re-tempering of concrete will not be permitted.

H. Concrete shall be thoroughly spaded and tamped to secure a solid and homogeneous mass, thoroughly worked around reinforcement and into corners of forms.

I. When joining fresh concrete to concrete which has attained full set, latter shall be cleaned of foreign matter, and mortar scum and laitance shall be removed by chipping and washing. Laitance is the accumulation of fine particles on the surface of freshly poured concrete caused by an upward movement of water through the concrete. This can be caused by too much mixing water, by excessive tamping, or by vibration of the concrete. Clean, roughened base surface shall be saturated with water, but shall have no free water on surface. A coat of 1:1 cement-sand grout, approximately one-eighth inch thick, shall be well scrubbed into thoroughly dampened concrete base. New concrete shall be placed immediately, before grout has dried or set.

3.6 FINISHING

A. Concrete flatwork surfaces shall be screeded off and hand floated and finished true to line and grade, and free of hollows and bumps. Surface shall be dense, smooth, and at exact level and slope required.

1. Finished concrete surface for subbases for unit pavement systems shall be wood-floated to a slightly rough surface. Surface shall not deviate more than one-quarter inch in 10 feet.
2. Finished concrete surface for concrete walks, pads, and concrete bands shall be wood-floated and steel troweled to a smooth surface. Surface shall not deviate more than one-eighth inch in 10 feet.

B. Unless otherwise indicated, horizontal surfaces of concrete pavement which will be exposed shall be given a light broomed finish, with direction of grooves in concrete surface perpendicular to length of concrete sidewalks, landings, and pads. After concrete has set sufficiently to prevent coarse aggregate from being torn from surface, but before it has completely set, brooms shall be drawn across it to produce a pattern of small parallel grooves. Broomed surface shall be uniform, with no smooth, unduly rough or porous spots, or other irregularities. Coarse aggregate shall not be dislodged by brooming operation.

C. Where finishing is performed before end of curing period, concrete shall not be permitted to dry out, and shall be kept continuously moist from time of placing until end of curing period, or until curing membrane is applied.

D. Immediately following finishing operations, arrises at edges and both sides of expansion joints shall be rounded to one-quarter inch radius.

E. Control Joints:

1. Control joints shall be sawcut with scored joints made by scoring into slab surface with saw blade.
2. Control joints shall be saw-cut according to the Contract Drawings.

F. All scoring, saw-cutting, and finishing of the concrete shall be subject to the review and approval of the Landscape Architect at any time during the construction project. The Contractor shall remove and replace, at no additional cost to the Owner, all concrete which is not acceptable to the Landscape Architect.

G. Where finishing is performed before end of curing period, concrete shall not be permitted to dry out, and shall be kept continuously moist from time of placing until end of curing period, or until curing membrane is applied.

3.7 CURING

A. It is essential that concrete be kept continuously damp from time of placement until end of specified curing period. It is equally essential that water not be added to surface during floating and troweling operations, and not earlier than 24 hours after concrete placement. Between finishing operations surface shall be protected from rapid drying by a covering of waterproofing paper. Surface shall be damp when the covering is placed over it and shall be kept damp by means of a fog spray of water, applied as often as necessary to prevent drying, but not sooner than 24 hours after placing concrete. None of the water so applied shall be troweled or floated into surface.

B. Concrete surfaces shall be cured by completely covering with curing paper or application of a curing compound.

1. Concrete cured using waterproof paper shall be completely covered with paper with seams lapped and sealed with tape. Concrete surface shall not be allowed to become moistened between 24 and 36 hours after placing concrete. During curing period surface shall be checked frequently and sprayed with water as often as necessary to prevent drying, but not earlier than 24 hours after placing concrete.
2. If concrete is cured with a curing compound, compound shall be applied at a rate of 200 square feet per gallon, in two applications perpendicular to each other.
3. Curing period shall be seven days minimum.

3.8 CONTROL JOINTS

A. Unless otherwise indicated, control joints shall be sawcut into the concrete slab, with 3 inches wide border and troweled edges, in pattern indicated on the Contract Documents, or every 5 feet on center maximum. Joint shall be made after concrete is finished and when the surface is stiff enough to support the weight of workmen without damage to the slab, but before slab has achieved its final set.

1. Scoring shall cut into slab surface 1 inch minimum, but in no case shall scoring be less than 25 percent of slab depth.

3.9 COLD WEATHER CONCRETING

A. Materials for concrete shall be heated when concrete is mixed, placed, or cured when the mean daily temperature is below 40 degrees Fahrenheit or is expected to fall to below 40 degrees Fahrenheit within 72 hours, and the concrete after placing shall be protected by covering, heat, or both.

B. Details of handling and protecting of concrete during freezing weather shall be subject to the approval and direction of the Landscape Architect. Procedures shall be in accordance with provisions of ACI 306R.

3.10 HOT WEATHER CONCRETING

A. Concrete just placed shall be protected from the direct rays of the sun and the forms and reinforcement just prior to placing shall be sprinkled with cold water. Every effort shall be made to minimize delays which will result in excessive mixing of the concrete after arrival on the job.

B. During periods of excessively hot weather (95 degrees Fahrenheit., or above), ingredients in the concrete shall be cooled insofar as possible and cold mixing water shall be used to maintain the temperature of the concrete at permissible levels all in accordance with the provisions of ACI 305. Any concrete with a temperature above 95 degrees Fahrenheit, when ready for placement will not be acceptable, and will be rejected.

C. Temperature records shall be maintained throughout the period of hot weather giving air temperature, general weather conditions (calm, windy, clear, cloudy, and the like.) and relative humidity. Records shall include checks on temperature of concrete as delivered and after placing in forms. Data should be correlated with the progress of the work so that conditions surrounding the construction of any part of the structure can be ascertained.

3.11 PROTECTION OF CONCRETE SURFACES

A. Concrete surfaces shall be protected from traffic or damage until surfaces have hardened sufficiently. If necessary one-half inch, thick plywood sheets shall be used to protect the exposed surface.

B. The Contractor shall provide adequate surveillance for all poured-in-place concrete pavements until concrete has set firmly, to prevent unwarranted markings of the concrete surface. Any unauthorized marking or graffiti in the finished surfaces shall be a cause for rejection by the Landscape Architect and replacement by the Contractor.

3.12 GRANITE CURB

A. Vertical face of all curbing shall be plumb, with curb top parallel to adjacent surface.

B. Curb shall be set accurately to line and grade. Curb alignment shall be uniform, with smooth and continuous arris lines. Radius curbs shall meet with a common tangent. Curb units shall be fitted together as closely as possible.

C. After proper alignment of curbing and concrete foundation have been established, place additional concrete surround, of wetter consistency, to extend concrete up each face of curbing as detailed on the Contract Documents.

D. Backfill material on each side of curb and curb cradle shall be as specified for adjacent surface and shall be thoroughly compacted by means of power tampers. Extreme care shall be taken not to destroy curb alignment. Curb sections disturbed during backfilling or otherwise shall be reset to line and grade, and properly backfilled.

3.13 ACCEPTANCE STANDARDS

A. The following acceptance standards shall be applied to this Contract. These standards are considered superior to typical industry standards. Any portion of the concrete paving that does not come up to these required acceptance standards shall be removed at the direction of the Landscape Architect. Saw cut pavement at nearest adjacent joint, remove concrete pavement and discard off site in a legal manner and replace with new concrete pavement meeting the requirements of this Section, REINFORCED CONCRETE PAVING.

1. Pavement surfaces shall be free of all cracking.
2. Pavement surfaces shall not pond water.
3. Pavement surfaces shall be free of visible high and low spots.
4. Steel mesh reinforcing shall not penetrate the surfaces or sides of the concrete slab.
5. Sawcut joints and all expansion joints shall be straight, true, uniform in width and free from twists, bends, kinks and misalignments.
6. Sawcut joints shall be free of chips and spauling at joint edges.
7. Edges and the associated edging patterns shall be consistent, true, crisp, and complete.
8. Broom finish shall not be too coarse in the opinion of the Landscape Architect.
9. Broom finish shall be constant and complete between joints without bare spots, lifts, or disconnections in broom pattern.
10. Pavement shall show no graffiti. Pavement shall show no rubbed surfaces indicative of attempts to erase graffiti.
11. Expansion joints and score joints shall be placed as required by the Contract Documents.
12. Concrete surfaces shall be free of all stains, including those created during the course of the construction by the Contractor, caused by natural events, or caused by vandalism.
13. All sawcut joints and expansion joints shall be flush.
14. Stains from construction or from natural causes
15. Pours different in color as determined by the Landscape Architect.
16. Pours without expansion joints cast into them.
17. Pours not conforming to the Contract Documents.
18. All forms shall be removed from the site.

END OF SECTION

SECTION 32 15 00: CRUSHED GRANITE SURFACING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SUMMARY

A. The work of this Section consists of providing labor, equipment, materials, incidental work, and construction methods necessary to furnish and install the crushed granite pavement, including binding agent, crushed granite, and aggregate base, as indicated on the Contract Drawings and as specified.

1.3 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 31 Section – EARTH MOVING
2. Division 32 Section – STABILIZED CRUSHED GRANITE PAVEMENT
3. Division 32 Section – POROUS FLEXIBLE SURFACING (TRAIL) – Add Alternate #6

1.4 SUBMITTALS

A. Submit for Landscape Architect's approval:

1. One-pound sample of crushed granite paving
2. Crushed aggregate gradation indicating that the product meets specifications

1.5 SITE CONDITIONS

A. Ensure that the subgrade and base are properly graded and compacted to required specifications.

B. Protect all nearby surfaces, plants, and structures from possible contamination from materials or damage by equipment.

1.6 DELIVERY, HANDLING & STORAGE

A. Storage: Protect crushed aggregate mix from contamination. Store undercover.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Material for processed gravel base shall be specified, provided, installed, and paid for under the work of the Division 31 Section: EARTH MOVING, of this Specification.

B. Crushed granite shall be decomposed granite meeting the following requirements:

1. Crushed granite material shall consist of sound, angular, durable particles. Stonedust will not be accepted.
2. Gradation, in accordance with ASTM C136:

Optimal Gradation Sieve	Sieve Size (mm)	Percent Passing
4	4.75	80-100%
8	2.36	65-90%
16	1.18	40-65%
30	0.6	25-55%
50	0.3	15-35%
100	0.15	10-20%
200	0.075	5-15%

PART 3 – EXECUTION

3.1 CRUSHED GRANITE SURFACING

A. Processed gravel base shall be placed on the compacted base course per Division 31 Section: EARTH MOVING section.

B. Crushed granite surfacing shall be placed only after excavation and construction work that might injure the surfacing have been completed. Damage to edging, crushed granite surfacing, adjacent grades or materials occurring during construction shall be repaired by the Contractor before acceptance at no additional cost to the Owner.

C. Crushed granite surfacing shall be constructed on the compacted base course.

D. Crushed granite shall be spread evenly over the base in 4 inch maximum lifts and compacted to 95 percent of maximum density as determined by ASTM D 1557.

E. Water shall be added to crushed granite surface as required to achieve a dense, hard packed surface conforming to the finish grades indicated.

F. Variations in smoothness of finished crushed granite surface shall be less than or equal to 1/4 inch when tested with a 10-foot straightedge, applied both parallel to and at right angles to centerline of Crushed granite surface areas. Irregularities exceeding these amounts or which retain water on surface shall be corrected by removing defective work and replacing with new material conforming to this specification.

END OF SECTION

SECTION 32 15 10: STABILIZED CRUSHED GRANITE PAVEMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SUMMARY

A. The work of this Section consists of providing labor, equipment, materials, incidental work, and construction methods necessary to furnish and install the stabilized crushed granite pavement, including binding agent, crushed granite, and aggregate base, as indicated on the Contract Drawings and as specified.

1.3 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 31 Section – EARTH MOVING
2. Division 32 Section – CRUSHED GRANITE PAVEMENT

1.4 REFERENCES

A. The following standards shall apply to the work of this Section:

1. Massachusetts Department of Transportation (MassDOT): Standard Specifications for Highways and Bridges
2. American Society for Testing and Materials (ASTM)

ASTM C136 / C136M	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D2419	Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregates

1.5 SUBMITTALS

A. Submit for Landscape Architect's approval:

1. Manufacturer’s product data sheet
2. One-pound sample of stabilized crushed granite paving
3. Stabilized crushed aggregate gradation indicating that the product meets specifications
4. Three-inch diameter sample of aggregate with binder to review color and texture
5. Manufacturer’s data on binding agent
6. Manufacturer’s Material Safety Data Sheet

B. Sample Panel

1. Construct a sample panel of stabilized crushed granite pavement before start of any finished paving. Sample panel shall be a minimum of twenty feet long by the full walkway width and shall show profile, color, texture, and shall include shoulder grading.
2. Landscape Architect will inspect and accept sample panels. If the original sample is not acceptable, construct additional panels at no cost to the Owner until an acceptable panel is constructed. The acceptable panel shall become the standard for the entire job and shall remain undisturbed until completion of all paving. Remove panel from the site upon completion of paving.

1.6 SITE CONDITIONS

A. Ensure that the subgrade and base are properly graded and compacted to required specifications.

B. Do not install stabilized crushed granite pavement during rain. Rainfall within 3 to 5 days after installation will increase curing time.

C. Protect all nearby surfaces, plants, and structures from possible contamination from materials or damage by equipment.

D. It is not recommended to install when temperatures are below 40 degrees Fahrenheit.

1.7 DELIVERY, HANDLING & STORAGE

A. Delivery: Delivery of binder pre-blended with crushed granite aggregate is available from select distributors.

B. Handling: When dealing with un-blended binder or crushed granite, wear appropriate respirator when ventilation is inadequate. Avoid contact with skin and eyes.

C. Storage: Protect stabilized crushed aggregate mix from contamination. Store undercover. If the blended and hydrated aggregate is sitting for long periods of time (longer than 48 hours), or when subject to rainfall, it needs to be turned with a skid steerer or loader to ensure consistent moisture content throughout prior to installation. Verify hydration level with snowball test before installation. For any questions regarding storage, contact the manufacturer or local dealer.

PART 2 – MATERIALS

2.1 STABILIZED CRUSHED GRANITE

A. Basis of Design: Basis of Design is Organic-Lock as manufactured by Envirobond Products Corporation of Toronto, Ontario, Canada and distributed locally by:

1. Read Custom Soils
Wareham, MA
(781) 828-6300
www.readcustomsoils.com

B. Material for processed gravel base shall be specified, provided, installed, and paid for under the work of Item 152. PROCESSED GRAVEL, of this Specification.

C. Material shall be crushed granite meeting the following requirements:

1. Crushed granite material shall consist of sound, angular, durable particles. Stonedust will not be accepted.
2. Gradation, in accordance with ASTM C136:

Optimal Gradation

Sieve	Sieve Size (mm)	Percent Passing
4	4.75	80-100%
8	2.36	65-90%
16	1.18	40-65%
30	0.6	25-55%
50	0.3	15-35%
100	0.15	10-20%
200	0.075	5-15%

2.2 BINDING AGENT

A. Patented powdered organic binder designed to be blended with crushed granite.

B. Made from 100% naturally occurring materials.

C. The elastomeric binder components shall be shipped in sealed and water-tight containers as specified by the Manufacturer.

PART 3 – EXECUTION

3.1 GRADING

A. Areas to be paved shall be compacted and brought approximately to subgrade elevation as specified, performed, and paid for under the work of Division 31 Section, EARTH MOVING, before work of this section is performed. Final fine grading, filling, and compaction of subgrade to receive paving, as required to form a firm, uniform, accurate, and unyielding subgrade at required elevations and to required lines, shall be specified, performed and paid for under the Division 31 Section, EARTH MOVING, of this Specification.

B. Existing subgrade material that will not readily compact as required shall be removed and replaced with satisfactory materials. Additional materials needed to bring subgrade to required line and grade and to replace unsuitable material removed shall be material specified, delivered, installed, and paid for under the Division 31 Section, EARTH MOVING, of this Specification.

C. Subgrade of areas to be paved shall be re-compacted as required to bring top 8 inches of material immediately below gravel base course to a compaction of at least 95 percent of maximum density, as determined by ASTM D 1557, Method D. Subgrade compaction shall extend for a distance of at least 12 inches beyond pavement edge.

D. Excavation required in pavement subgrade shall be completed before fine grading and final compaction of subgrade are performed. Where excavation must be performed in completed subgrade or subbase subsequent backfill and compaction shall be performed as directed by the Engineer as specified, performed and paid for under the work of the Division 31 Section, EARTH MOVING, of this Specification. Completed subgrade after filling such areas shall be uniformly and properly graded.

E. Areas being graded or compacted shall be kept shaped and drained during construction. Ruts greater than or equal to 2 inches deep in subgrade, shall be graded out, reshaped as required, and re-compacted before placing pavement.

F. Materials shall not be stored or stockpiled on subgrade.

H. Disposal of debris and other material excavated and/or stripped as specified, performed and paid for under the work of this section, and material unsuitable for or in excess of requirements for completing work of this section, shall conform to the following:

1. Material shall be legally disposed of off-site.
2. Material shall be disposed of in waste disposal area indicated on the Contract Documents.

I. Prepared subgrade will be inspected and approved by the Engineer before installation of paving base course. Disturbance to subgrade caused by inspection procedures shall be repaired as specified, performed, and paid for under Division 31 Section, EARTH MOVING, of this Specification.

3.2 BASE COURSE

A. Compaction of base course shall be to 95 percent of maximum density as determined by ASTM D 1557.

B. Subgrade and base course shall be kept clean and uncontaminated. Less select materials shall not be permitted to become mixed with base course. Materials spilled outside stabilized crushed granite pavement shall be removed and area repaired.

3.3 STABILIZED CRUSHED GRANITE PAVEMENT

A. Processed gravel base shall be placed on the compacted base course per Division 31 Section, EARTH MOVING section.

B. Stabilized crushed granite pavement shall be placed only after excavation and construction work that might injure the surfacing have been completed. Damage to edging, crushed granite pavement surfacing, adjacent grades or materials occurring during construction shall be repaired by the Contractor before acceptance at no additional cost to the Owner.

C. Stabilized crushed granite pavement shall be constructed on the compacted base course.

D. Proper hydration of the stabilized crushed granite pavement is crucial to the installation and longevity of the surface.

E. Achieve best results installing the stabilized crushed granite pavement in dry conditions and temperatures above 40° Fahrenheit. Both wet and cold conditions slow down the curing/drying process.

F. Prepare the Subgrade

1. Excavate the area to the depth required so that finish grade can be established as noted on plans.
2. Pedestrian areas require a full depth of 7-9 inches: 4-6 inches of compacted base depth together with 3 inches of compacted stabilized crushed granite pavement.
3. Compact the subgrade to 95% Modified Proctor Density.

G. Prepare the Base

1. Install the base material as per MassDOT road base guidelines. Clear stone or ungraded base is NOT acceptable.
2. Depending upon the method of compaction the installation of base material may require separate lifts. 4 inches can be compacted in a single lift with a minimum 2-ton compaction roller.
3. Compact the subgrade to 95% Modified Proctor Density using a single or double drum static roller or vibratory compactor.

3.4 SPREADING

A. The use of a paving machine is highly recommended for large projects to evenly spread stabilized crushed aggregate at the specified depth. Screed material to ensure the depth is consistent for smaller projects or projects with tight areas.

B. Spread the loose and uncompacted stabilized crushed aggregate over the compacted base material.

C. Typically, a lift of 4 inches of loose, pre-wet stabilized crushed aggregate will compact to the required 3-inch depth for pedestrian areas.

3.5 COMPACTION

A. Make 4 to 6 passes using a 1-ton double or single static drum roller, or equivalent. Pedestrian areas will typically require one lift, compacted to 3 inches.

B. Compaction will vary with different aggregates due to particle shape and size. It will compact 20-25%, less if using paving machinery. This level of compaction needs to be monitored as early as possible (starting during the test plot) to determine the actual degree of compaction. It is better to put down too much material and to remove it from the top than to put down too little and add a layer later.

C. Compact to 95% Modified Proctor Density.

D. Vibratory compaction is acceptable for the base material but generally not suitable for stabilized crushed aggregate as it risks disassociating the bonds of the stabilized aggregate or allowing the fines and moisture to migrate to the surface, causing the surface to take on a smooth, concrete-like appearance. stabilized crushed aggregate should be compacted using a single or double drum static roller wherever possible. For tight spaces that are not accessible by drum rollers, a hand tamper is recommended. However, in certain circumstances, a vibratory or plate tamper can be used where the installer deems it to be more effective as hand-tamping over large spaces will create inconsistent results.

E. Provided the moisture content of the stabilized crushed aggregate is adequate, additional hydration should not be necessary. On dry, sunny days, however, the surface layer may start to dry out while installing, in which case, a light misting would be appropriate to prevent surface cracks from appearing during compaction.

3.6 COMPLETING INSTALLATION

A. Apply a light spray to the surface of the material to give a clean appearance. Apply water until the water begins to run-off.

B. Do not allow any traffic on the newly installed pathway until fully cured, a minimum of 24-72 hours.

3.7 REPAIRS AND PROTECTION

A. Excavate the damaged area and scarify exposed stabilized crushed aggregate.

B. Pre-blend the replacement crushed granite aggregate material with binder at 28-34 pounds per imperial ton. Apply the material to the excavated area and compact. Thoroughly water the material to achieve an 8-10% moisture content.

3.8 ACCEPTANCE

A. Variations in smoothness of finished stabilized crushed granite pavement shall be less than or equal to 1/4 inch when tested with a 10-foot straightedge, applied both parallel to and at right angles to centerline of Stonedust surface areas. Irregularities exceeding these amounts, or which retain water on surface shall be corrected by removing defective work and replacing with new material conforming to this specification.

3.9 MAINTENANCE

A. All outdoor products require a level of maintenance analysis. It is recommended to do a thorough analysis of your installed stabilized crushed granite pavement 7 days after installation followed by monthly analysis to ensure no alterations are required.

B. Excess Loose Material: Directly after the installation, the aggregate surface will be smooth because of the weight of the fresh compaction. As the surface weathers with traffic and time, the larger particles of the aggregate will loosen on the surface to create a natural look and feel which is often sought after. The loose aggregate particles on your surface should not exceed 1⁄4 of an inch in depth.

C. Sweeping off the excess particles can be accomplished in areas where excess 1⁄4 of an inch chip is not detrimental. These loose particles can also be shoveled and removed from site. The remaining surface will eventually chip loose again, so new material is recommended as a top up after doing this more than once.

D. If material exceeds a 1⁄4 of an inch, redistribute the particles over a greater surface, scarify the surface to a depth of 1 inch and water to a 1-inch depth and compact with a roller of no less than 1000 pounds. Keep traffic off for 24-72 hours.

E. Removing Debris: Remove grass clippings, soil, debris, or organic material by mechanically blowing or hand raking as needed.

END OF SECTION

SECTION 32 17 23: PAVEMENT MARKINGS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SUMMARY

A. The work of this Section consists of providing labor, equipment, materials, incidental work, and construction methods necessary to furnish and install pavement markings, as indicated on the Contract Documents and as specified.

1.3 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 32 Section – ASPHALT PAVING
2. Division 32 Section – POROUS FLEXIBLE PAVING

1.4 REFERENCES

A. The following standards shall apply to the work of this Section.

1. Massachusetts Department of Transportation (MassDOT)
Specifications Standard Specifications for Highways and Bridges
2. Manual of Uniform Traffic Control Devices and the Standard Municipal Traffic Code (MUTCD), latest edition

1.5 SUBMITTALS

A. Submit product data for pavement markings for Landscape Architect's approval.

1.6 QUALITY ASSURANCE

A. Unless otherwise specified, work and materials for pavement marking shall conform to the applicable portions of the following:

1. MassDOT Specifications Section 860

1.7 LAYOUT OF WORK

A. The Contractor shall furnish to the Landscape Architect for approval a schedule of pavement marking operations in accordance with the following:

1. MassDOT Specifications Section 860.61

1.8 TRAFFIC CONTROL

A. Suitable warning signs shall be placed near the beginning of the work site and well ahead of the work site for alerting approaching traffic from both directions.

B. Place traffic cones along newly painted lines to control traffic and prevent damage to newly painted surfaces. Remove when paint has dried fully.

C. Painting equipment shall be marked with large warning signs indicating slow moving painting equipment in operation.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Materials for pavement markings shall conform to MassDOT Specifications Section 860.40 as applicable for the material required.

1. Crosswalk pavement marking materials shall conform to MassDOT Specifications M7.01, as applicable for the material to be used: paint.
2. Pavement markings shall be White, unless otherwise noted.

B. Paint and reflective media shall be in sealed containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer's name, formulation number and directions, all of which shall be plainly legible at time of use.

C. Paint shall be homogeneous, easily mixed to smooth consistency, and shall show no hard settlement or other objectionable characteristics during a storage period of six months.

2.2 MARKING EQUIPMENT

A. Machines, tools, and equipment used in the application of pavement markings shall conform to MassDOT Specifications Section 860.60 and shall be approved and maintained in satisfactory operating condition.

B. The equipment for applying paint to pavements shall be self-propelled or mobile-drawn pneumatic spraying machine with suitable arrangements of atomizing nozzles and controls to obtain the specified results. The machine shall have a speed during application not less than 5 mph and shall be capable of applying the stripe widths indicated, at the paint coverage rate specified in paragraph "Application", below, and of even uniform thickness with clear-cut edges. Equipment used for marking streets and highways shall be capable of placing the prescribed number of lines at a single pass as solid lines, intermittent lines or a combination of solid and intermittent lines using a maximum of three different colors of paint as specified. The paint applicator shall have paint reservoirs with tanks of sufficient capacity and suitable gages to apply paint in accordance with requirements specified. Tanks shall be equipped with suitable air-driven mechanical agitators. The spray mechanism shall be equipped with quick-action valves conveniently located and shall include necessary pressure regulators and gages in full view and reach of the operator. Paint strainers shall be installed in paint supply lines to ensure freedom from residue and foreign matter that may cause malfunction of the spray guns. Pneumatic spray guns shall be provided for hand application of paint in areas where the mobile paint applicator cannot be used.

C. Push-type machines of a type commonly used for application of paint to pavement surfaces shall be acceptable for marking roadway and parking areas. Applicator machine shall have the necessary paint tanks and spraying nozzles and shall be capable of applying paint uniformly at coverage specified. Hand-operated spray guns shall be provided for use in areas where push-type machines cannot be used.

2.3 MARKINGS

A. Crosswalks shall conform to details shown in the Contract Drawings.

B. The following pavement marking shall conform to the Manual of Traffic Control Devices, as noted:

1. International Symbol of Accessibility Parking Space Marking, MUTCD Figure 3B-22.
2. “One-Way”, MUTCD Figure 3B-23.
3. One-Way Traffic Arrow, MUTCD Figure 3B-24.

2.4 ROAD SIGNAGE

A. Road signage shall be provided by the Owner. Contractor shall coordinate with the Machine Shop to have signs produced and installed.

PART 3 – EXECUTION

3.1 SURFACE PREPARATION

A. New pavement surfaces shall be allowed to cure for a period of not less than 48 hours before application of marking materials.

B. Dust, dirt, and other granular surface deposits shall be removed by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods, as required. Rubber deposits, surface laitance, existing paint markings, and other coatings adhering to the pavement shall be completely removed using scrapers, wire brushes, sandblasting, approved chemicals, or mechanical abrasion, as directed.

C. Where oil or grease are present on old pavements to be marked, affected areas shall be scrubbed with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinsed thoroughly after each application. After cleaning, oil-soaked areas shall be sealed with cut shellac to prevent bleeding through the new paint.

A.2 APPLICATION – GENERAL

A. Marking materials shall be applied to clean, dry surfaces in accordance with the requirements of MassDOT Specifications Section 860.62.

B. Paint shall be applied pneumatically with approved equipment.

C. Pavement marking materials shall be applied evenly to the pavement surface to be coated to the thickness specified in MassDOT Specifications Section 860.62.

D. Guidelines and templates shall be employed as necessary to control paint application. Special precautions shall be taken in marking numbers, letters, and symbols. Refer to the Contract Documents for special patterns for numbers, letter, and symbols.

E. Edges of markings shall be sharply outlined.

F. Maximum drying time requirements of the paint manufacturer shall be enforced to prevent undue softening of bitumen, and pickup, displacement or discoloration by vehicle tires.

G. If markings require more drying time than stated by the paint manufacturer, painting operations shall be discontinued until cause of the slow drying is determined and corrected.

3.3 PROTECTION OF MARKINGS

A. Markings shall remain protected in accordance with MassDOT Specifications Section 860.63.

3.4 ACCEPTANCE STANDARDS

A. The following acceptance standards shall be applied to this Contract. These standards are considered superior to typical industry standards. Any portion of the pavement markings that does not come up to these required acceptance standards shall be removed at the direction of the Landscape Architect. Sandblast or otherwise remove unacceptable pavement markings as required by the Landscape Architect and replace with new pavement markings that meet the requirements as specified under this Section, at no additional cost to the Owner.

1. Puddles and thick accretions at the ends of lines of pavement markings.
2. Pavement markings that diverge from alignment.
3. Solid line pavement markings that show kinks, bends, bumps, or other deformities from true alignment.

END OF SECTION

SECTION 32 18 00: RESILIENT SAFETY SURFACING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SUMMARY

B. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to perform all resilient safety surfacing installation and related items as indicated on the Contract Documents and/or as specified in this Section and includes, but is not necessarily limited to, the following:

1. Resilient Safety Surfacing (Poured-in-place surfacing for playground)

1.3 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 03 Section – CAST-IN-PLACE CONCRETE
2. Division 11 Section – PLAY EQUIPMENT
3. Division 31 Section – EARTH MOVING
4. Division 32 Section – ASPHALT PAVING
5. Division 32 Section – PROTECTIVE PLAYGROUND SURFACING

1.4 REFERENCES

A. The following standards shall apply to the work of this Section:

1. ASTM: American Society for Testing and Materials
2. CPSC: U.S. Consumer Product Safety Commission
   Public Playground Safety Handbook
3. ADA: ADA Standards for Accessible Design
4. MAAB: Massachusetts Architectural Access Board
   521 CMR

1.5 SUBMITTALS

A. Material Samples: Following the review of Shop Drawings by Landscape Architect, provide one material sample for each of the items listed below, including final finishing as applicable. Fabrication for the following items shall follow the Landscape Architect's approval of material sample. Any alternate product must be submitted with prior approval packages a minimum of ten (10) days prior to bid date.

1. Poured-in-Place Surfacing: Submit manufacturer's sample (6 inches x 6 inches) of each specified color.
   a. Contractor shall provide three (3) samples of each color or color blend to determine exact blend ratio. Contact Landscape Architect prior to ordering samples for required color blend variations.

B. Submittal packages for resilient safety surfacing shall include but not be limited to:

1. Reference list per all of the requirements of contractor pre-qualifications
2. Certificates stating that materials meet or exceed the specified contract requirements.

3. Written guarantee from manufacturer of the proposed product against all defects in material and/or workmanship.
4. Impact attenuation (per fall height requirements and depth specified), accessibility of surface systems, coefficient of friction, permeability, flammability, toxicity and tensile strength test results from independent approved and certified testing laboratories.
5. Proof of specified insurance requirements
6. MSDS and Product Data Sheets
7. Manufacturer's literature
8. Certificate of Compliance: Submit manufacturer's certificate of compliance indicating materials comply with specified requirements.

C. Furnish independent test results supplied by the manufacturer to the Landscape Architect demonstrating that the surfacing product meets the CPSC/ASTM test procedures and the ADA law for handicap accessibility.

D. Test Results: Poured-in-Place Surfacing

1. Impact Attenuation: ASTM F1292 and ASTM F1292: Impact attenuation test results will be provided to the Owner or Landscape Architect. These test results shall be certified and submitted on the letterhead of an independent testing lab. Impact attenuation test results shall meet or exceed Consumer Product Safety Commission Guidelines for impact attenuation (G-max and Head Injury Criteria "H.I.C"). Both test results must be administered and evaluated under the same test and these results must be shown for three drops at each required temperature: -6° C, 23° C, and 49° C; **yield less than 100 G-Max and less than 800 H.I.C at a minimum 13-ft. fall height.** Testing laboratory must be certified to meet calibration program requirements of MIL-STD-45662A. Additionally, upon request, manufacturer will provide at the installed site impact attenuation testing with the TRIAX 2000 for a fee.
2. Poured-in-place surfacing pre-installation test results shall be provided by the Manufacturer. All lab testing of material needs to be performed over concrete. Testing over aggregate will not be allowed.
3. Impact attenuation testing shall be performed by a National Recreation and Parks Association/National Playground Safety Institute (NRPA/NPSI) Certified Playground Safety Inspector (CPSI) and trained in the proper operation of the Triax test equipment.
4. Accessibility of Surface Systems – ASTM F1951: All playground surfacing products must pass testing to ensure wheelchair access under and around playground equipment as required by the Americans with Disabilities Act.
5. Slip resistance/static coefficient of friction – ASTM Standard F1677: The minimum value 0.20-0.25 is the minimum required to prevent slips for most people walking normally.
6. Water Absorption – ASTM D-570: 0.15 (% by weight)
7. National Fire Protection Association Life Safety Code Class II Rating – ASTM E-648: NFPA Designation no. 253. Critical Radiant Flux watts/cm2 Average 0.37
8. Tensile Properties (Die C) Tensile Strength/Elongation @ Break – ASTM D-412: 2190 PSI – 300%
9. Type 2 surfacing shall be coated with an odorless, colorless, non-leaching, durable, broad-spectrum anti-microbial.
10. Installation shall be provided by a certified installer.

1.6 DELIVERY, STORAGE & HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage:

1. Store materials in accordance with manufacturer's instructions.
2. Playground Safety Surfacing:
   a. Store materials in a dry area at a minimum temperature of 50 degrees F for a minimum of 72 hours before installation.
   b. Protect materials from direct sunlight before installation.
3. Adhesive: Store adhesive in a dry area at a minimum temperature of 50 degrees F.

C. Handling: Protect materials during handling and installation to prevent damage.

1.7 QUALITY ASSURANCE

A. Manufacturer's Qualifications

1. Continuously engaged in manufacturing of resilient playground safety surfacing: similar type to that specified, with a minimum of 10 years successful experience.
2. Furnished a minimum of 1,000,000 square feet of playground safety surfacing of similar type to that specified.

B. Contractor Qualifications

1. Certified by manufacturer for installation of playground safety surfacing.
2. Approved by manufacturer.

C. Insurance Requirements

1. All bidders must carry minimum insurance of $1,000,000 general liability including products and completed operations**.**

1.8 ENVIRONMENTAL REQUIREMENTS

A. Surfacing Temperature: Ensure surface temperature of playground safety surfacing is a minimum of 50 degrees Fahrenheit at time of installation.

B. Air Temperature: Ensure air temperature is a minimum of 40 degrees Fahrenheit for a minimum of 24 hours before and during installation.

C. Material or Air Temperatures: Consult manufacturer's installation instructions for modified installation procedure when air temperatures are above 85 degrees Fahrenheit.

1.9 WARRANTY

A. Materials and Workmanship: Playground safety surfacing shall be warranted for defects in materials and workmanship for 10 years from date of completed installation.

B. Performance: Playground safety surfacing shall be warranted to meet drop height performance requirements of ASTM F1292 for 10 years from date of substantial completion and acceptance by the Owner.

PART 2 – PRODUCTS

2.1 RESILIENT SAFETY SURFACE: POURED-IN-PLACE SURFACING

A. Safety surfacing shall consist of a two-level, exterior grade, poured-in-place, top surface, and shock pad. Base condition is on a granular base for the mound application and on a concrete base when not on the mound.

3. Surfacing colors shall be as selected by Landscape Architect:
   Color 1: 60% Sky Blue and 40% Black
   Color 2: 60% Teal and 40% Black
   a. Colors included are for bidding purposes and final colors will be determined during the play equipment approval process.

B. The resilient surface shall be manufactured by:

1. Surface America of Williamsville, NY
2. Everguard Surfacing of Oyster Bay, NY
3. Or, an approved equal

C. **Installed play surface shall meet or exceed CPSC performance guidelines with respect to critical heights of the in-place play equipment**. The thickness shown in the construction documents is the minimum required. Contractor shall review and submit required heights based on approved play equipment.

D. The shock pad shall be a monolithic poured-in-place cushioned pad, made from a field-mixed blend of recycled styrene butyrene rubber (SBR) and an aromatic polyurethane binder with a finished thickness of 2 inches.

1. Make up of material shall be 16+% urethane (as ratio: 14% urethane divided by 86% rubber). 14% urethane, 86% rubber (based on entire rubber & urethane mix).

E. The top wearing surface shall be a monolithic poured-in-place top surface made from a blend of ethylene propylene diene monomer (EPDM) colored rubber particles measuring 1 to 3 mm in size, with a net weight of 2.5 pounds per square foot and an aliphatic binder. **Contractors must confirm use of aliphatic binders prior to installation of top wearing course.**

1. Make up of material shall 22% urethane (ratio: 18% urethane divided by 82% rubber). 18% urethane, 82% rubber (based on entire rubber & urethane mix).
2. See Contract Drawings for thicknesses.

F. The top wearing surface shall have a tensile strength of 200 pounds per square inch. Elongation at break shall be 145 percent. Meet a Class 1 fire rating. Shore hardness shall be 50-55 and shall meet Tapar Abrasive Test of 0.1.

G. Binders utilizing latex or emulsion type binder will not be accepted.

H. Installed play surface shall meet or exceed CPSC performance guidelines with respect to critical heights of the in-place play equipment. The thickness shown in the construction documents is the minimum required. The resilient surfacing manufacturer shall provide the thickness suitable for the fall height required for the specified play equipment. At 73 degrees Fahrenheit the surface shall meet or exceed 155 G-force reduction and 875 on the HIC shock attenuating scale per ASTM F 1292-93. The contractor is responsible for coordinating with the play equipment manufacturer and resilient safety surfacing manufacturer to provide thicknesses of surfacing that meet the required fall heights.

I. Primer shall be in accordance with the manufacturer's recommendations.

J. Contractor shall supply all binders, tack courses and other materials as required to install the safety surfacing in the method recommended by the manufacturer.

K. Safety surfacing manufacturer must furnish written warranty covering 10 years on materials and one year on labor. Contractor shall furnish Owner with warranty.

L. No pre-manufactured pads or other factory molded products will be accepted. Safety surface shall be completely poured-in-place with a troweled-in-place top wearing surface. Final color shall be uniform with no black fibers from the shock pad below showing through.

2.2 BASE COURSE

A. Material for base course shall be specified, provided, installed, and paid for under the work of the Division 31 SECTION, EARTH MOVING, of this Specification.

PART 3 – EXECUTION

3.1 BASE REQUIREMENTS

A. Reference Division 31 Section, EARTH MOVING.

B. The minimum depth of the crushed stone base is 4 inches. Typical thickness range is 4 inches to 6 inches. Crushed stone base layers thicker than 6 inches are more challenging to achieve the necessary

95% compaction rate throughout the base. Thickness is never to exceed 10 inches.

C. The stone for the base must be crushed so it compacts to a 95% Standard Proctor Compaction (as per A.S.T.M. Test). The stones should be a homogeneous mixture of the following size stones:

Sieve Size	% Passing by Weight
1"	90 - 100
5/8"	50 - 80
1/4"	30 - 50
#4	15 - 35
#8	10 - 30
#30	3 - 5
#200	0 – 3

3. The crushed stone base should be sloped 2% to allow run-off of the excess water that does not percolate through the crushed stone.

C. The crushed stone base shall be thoroughly compacted by using a tamper, roller, or combination of both. This is of critical importance so that settling of the crushed stone base does not happen after installation of the poured-in-place material. If post-installation settling occurs, of course, the poured-in-place system will follow the contour of the settled crushed stone, leaving an aesthetically inferior installation and possible causing cracking in the poured-in-place material because of excess stress where the crushed stone base has settled out.

D. The crushed stone base must be a level plane that is smooth and comparable in look to the sub-surface of an asphalt road prior to the asphalt paving. This requires significant attention to accomplish. String lines must be used to ensure an even plane is constructed.

E. Aggregate base shall be provided and paid for under Division 31 Section, EARTH MOVING.

F. A filter fabric is necessary for crushed stone bases only when tiles are installed. It is not used with poured-in-place systems.

3.2 PREPARATION

A. Scheduling: Surfacing shall be installed after the playground equipment is installed and after the subsurface is ready to receive surfacing. The temperature should be at least 45 degrees and rising during installation of surface.

B. Cleaning: The entire subsurface shall be clean, dry, and free from any foreign and loose material.

3.3 INSTALLATION

A. Do not proceed with playground surfacing installation until all applicable site work, including substrate preparation, fencing, playground equipment installation and other relevant work, has been completed.

B. Thickness: Safety surfacing meets a maximum critical fall height a determined by individual piece of play equipment. Contractor shall verify by product and area of playground and submit to Landscape Architect for approval.

1. Thickness should comply with CPSC and manufacturer's recommendations based on the critical fall height of the play structures. It is anticipated that the critical fall will vary and should be verified once play equipment is approved.

C. Basemat Installation:

1. Using screeds and hand trowels, install the basemat at a consistent density of 29 pounds, 1 ounce per cubic foot (466 kg/m3) to the specified thickness.
2. Allow basemat to cure for sufficient time so that indentations are not left in the basemat from applicator foot traffic or equipment.
3. Do not allow foot traffic or use of the basemat surface until it is sufficiently cured.

D. Primer Application: Using a brush or short nap roller, apply primer to the basemat perimeter and any adjacent vertical barriers such as playground equipment support legs, curbs or slabs that will contact the surfacing system at the rate of 300 ft2/gal (7.5 m2/L).

E. Top Surface Installation:

1. Using a hand trowel, install top surface at a consistent density of 58 pounds, 9 ounces per cubic foot (938 kg/m3) to a nominal thickness of 1/2".
2. Allow top surface to cure for a minimum of 48 hours.
3. At the end of the minimum curing period, verify that the top surface is sufficiently dry and firm to allow foot traffic and use without damage to the surface.
4. Do not allow foot traffic or use of the surface until it is sufficiently cured.

F. Edges: Surface edges shall be flush with edge of adjacent area or tapered to provide safe transition. Surface shall be sloped to drain as indicated on plans.

G. Upon completion, the Contractor shall clean the surface to remove all spills, markings, or other unacceptable conditions, remove all containers, surplus materials and debris and leave the site in a clean and orderly condition.

3.4 CLEANING

A. Remove adhesive spills from playground safety surfacing in accordance with manufacturer's instructions.

B. Clean surfacing in accordance with manufacturer's instructions.

3.5 PROTECTION

A. Protect playground safety surfacing from foot traffic for a minimum of 12 hours after installation.

B. Protect completed surfacing from damage during construction.

3.6 INSPECTION

A. Inspect finished installation for compliance with ADA, MAAB, and CPSC requirements.

B. Impact testing per paragraph 1.5(D) – “Test Results” of this Specification Section.

END OF SECTION

SECTION 32 18 16.13: PROTECTIVE PLAYGROUND SURFACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SUMMARY

A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to perform all resilient safety surfacing installation and related items as indicated on the Contract Documents and/or as specified in this Section and includes, but is not necessarily limited to, the following:

1. Protective Safety Surfacing (Engineered wood fiber)
2. Surfacing wear mat

1.3 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

3. Division 31 Section – EARTH MOVING
4. Division 11 Section – PLAY EQUIPMENT
5. Division 32 Section – RESILIENT PLAYGROUND SURFACING
6. Division 32 Section – SITE IMPROVEMENTS

1.4 REFERENCES

A. The following standards shall apply to the work of this Section:

1. ASTM: American Society for Testing and Materials

ASTM D 2434	Standard Test Method for Permeability of Granular Soils (Constant Head)
ASTM D 2859	Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials
ASTM D 3776	Standard Test Methods for Mass Per Unit Area (Weight) of Fabric
ASTM D 3786	Standard Test Method for Bursting Strength of Textile Fabrics - Diaphragm Bursting Strength Tester Method
ASTM D 4491	Standard Test Methods for Water Permeability of Geotextiles by Permittivity
ASTM D 4533	Standard Test Method for Trapezoid Tearing Strength of Geotextiles
ASTM D 4632	Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
ASTM D 4716	Standard Test Method for Determining the (In plane) Flow rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
ASTM D 4751	Standard Test Method for Determining Apparent Opening Size of a Geotextile
ASTM D 4833	Standard Test Method for Index Puncture Resistance of Geomembranes, and Related Products
ASTM D 5199	Standard Test Method for Measuring the Nominal Thickness of Geosynthetics
ASTM F 1292	Standard Specification for Impact Attenuation of Surfacing Materials within the Use Zone of Playground Equipment
ASTM F3351	Standard Test Method for Impact Testing in a Laboratory at a Specified Test Height
ASTM F 1951	Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment
ASTM F 2075	Standard Specification for Engineered Wood Fiber for Use as a Playground

Safety Surface Under and Around Playground Equipment
16 CFR 1500.44 Method for Determining Extremely Flammable and Flammable Solids

2. CPSC: U.S. Consumer Product Safety Commission
Public Playground Safety Handbook

1.5 SYSTEM DESCRIPTION – LOOSE FILL SYSTEM

A. Engineered Wood Fiber Surfacing: A recreational surface manufactured from 100 percent pre-consumer recovered wood. It is designed to reduce injuries on playgrounds and provide a stable resilient surface for trails. Tested according to ASTM methods to ensure compliance with ADA, ASTM, CPSC, and CSA standards for playground surfacing.

B. Geotextile Fabric: Placed both below and above aggregate drainage material to create a weed barrier and to prevent the aggregate from mixing with the subsurface and the engineered wood fiber.

C. Playground Surfacing Wear mat: Made from recycled foam in a thermal process that does not use chemicals topped with heavy duty vinyl. It is designed to be anchored in place on top of engineered wood fiber playground surfacing to improve accessibility and prevent displacement.

1.6 SUBMITTALS

A. Comply with Division 01 Section, SUBMITTAL PROCEDURES.

B. Product Data: Submit manufacturer's product data, including installation instructions, ASTM F 1292 test results, ASTM F1951 Accessibility test results, ASTM F2075 test results, and IPEMA Certificates of Compliance where applicable.

C. Samples: Submit manufacturer’s samples of each specified material.

D. Maintenance Instructions: Submit manufacturer’s maintenance instructions for playground surfacing.

E. Warranty: Submit manufacturer’s standard warranty.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Member of International Play Equipment Manufacturer’s Association (IPEMA)
2. Sales Representatives trained by National Playground Safety Institute (NPSI)

B. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by surfacing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.

C. Pre-installation Meeting: Convene a pre-installation meeting 2 weeks before start of installation of playground surfacing. Require attendance of parties directly affecting work of this section, including Contractor, Landscape Architect, and installer. Review installation and coordination with other work.

1.8 DELIVERY, STORAGE & HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer. Deliver engineered wood fiber playground surfacing to site in bulk.

B. Storage: Store materials in a clean, dry area in accordance with manufacturer's instructions. Store engineered wood fiber playground surfacing to prevent contamination.

C. Handling: Protect materials during handling and installation to prevent damage. Handle engineered wood fiber playground surfacing to prevent contamination.

1.9 WARRANTY

A. Warranty Covers Playground Surfacing for Following Periods:

1. Engineered Wood Fiber Playground Surfacing: 15-20 years.
2. Bonded engineered wood fiber playground surfacing: 1 year product/ 3 years- impact.
3. Playground surfacing wear mat: 5 years.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Zeager Bros., Inc., of, Middletown, Pennsylvania, or approved equal.

2.2 PLAYGROUND SURFACING

A. Basis of Design: Engineered Wood Fiber Playground Surfacing shall be “Woodcarpet” as manufactured by Zeager Brothers, Inc.

1. Composition: Engineered wood fiber. No chemical treatments or additives.
2. Compliance: Meet or exceed CPSC guidelines for impact attenuation.
3. Recycled Content: 100 percent pre-consumer recovered materials.
4. Dimensions: Per sieve analysis, ASTM F2075 / 4.4: Meets Criteria.
5. Hazardous Metal, ASTM F 2075 / 4.5: Meets Criteria.
6. Tramp Metal, ASTM F 2075 / 4.6: Meets Criteria.
7. Coefficient of Permeability, ASTM D 2434: Greater than 0.6 cm/s.
8. When bonded: Permeability per falling head test, EM1110-2-1906-VII-13: 191.19 gal/min/sq.ft.
9. Moisture Absorption: Maximum of 150 percent by weight.
10. Moisture Content: 25 to 60 percent by weight.
11. Density: 15 to 24 pounds per cubic foot.
12. Impact Attenuation: ASTM F 1292 - Meets criteria and ASTM F3351 for specific test height.
13. IPEMA Certification: 12 inch thickness to 12 feet.
14. Accessibility, ASTM F 1951 - Meets criteria.
15. Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials- D2859: Meets criteria.
16. Flammable, 16 CFR 1500.44, Federal Hazardous Substances Act Title 16, Chapter II, Subchapter C for Rigid and Pliable Solids: Did not ignite.

B. Drainage Fabric

1. Composition: nonwoven geotextile filter fabric of staple fibers that is formed into a random network, needle punched and heat-set for dimensional stability.
2. Recycled content: N/A
3. Size: 5 feet wide x 300 feet long
4. Weight, ASTM D5261 Min. 3.5 ounces per square yard
5. Grab Tensile Strength: ASTM D4632 - 0.45 kN / 57 lbs
6. Grab Tensile Elongation ASTM D4632 - 50%
7. CBR Puncture: ASTM D6241 - .064kN/ 145 lbs
8. UV Resistance: ASTM D4355 - 70% @500 hrs
9. Trapezoidal Tear: ASTM D4533 - 0.13kN / 29lbs
10. Permittivity: ASTM D4491 - 2.20 sec
11. Water Flow Rate: ASTM D4491 - 6112 lpm/m, 150 gpm/ft
12. Apparent Opening size ASTM D4751-0300 mm/50 US Std Sieve.

C. Basis of Design: Playground Surfacing Wear Mat shall be “TuffMat Foam” as manufactured by Zeager Brothers, Inc.

1. Composition: Closed-cell, cross-linked, polyethylene, foam nuggets thermally fused together.
2. Compliance: Meet or exceed CPSC guidelines for impact attenuation.
3. Coating: The top surface of each mat is covered with a layer of heavy dutyvinyl.
4. Recycled Content: 15 percent pre-consumer recovered materials.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine areas to receive playground surfacing. Notify Architect if areas are not acceptable. Do not begin installation until unacceptable conditions have been corrected.

3.2 INSTALLATION

A. WoodCarpet Aggregate System 1.

1. Review project plans and verify that playground equipment use zones, clearances, and reach ranges will comply with ASTM F1487 sections 8, 9, and 10, and with CAN/CSA-Z614 sections 14 and 15.
2. Prepare sub-grade as specified in Section 312000. Ensure that site drainage is routed away from or around the playground area. Grade subsoil to a 2 percent grade toward the drainpipe.
3. Install playground equipment in accordance with manufacturer’s instructions at locations indicated on the drawings.
4. Geotextile Fabric:
   a. Lap seams a minimum of 10 inches or a minimum of 5 inches if a double bead of exterior grade construction adhesive is applied to lap.
   b. Place seams parallel to direction of slides and travel of swings.
5. Install a containment system around the play area edge.
6. Install fabric as described in step 4.
7. Engineered Wood Fiber Playground Surfacing
   a. Place wood fiber surfacing to a minimum depth of 8 inches after compaction for play equipment under 4 feet high and to a minimum depth of 12 inches after compaction for play equipment over 4 feet high.
   b. Use mechanical equipment to uniformly compact and level material.
8. Inspect the playground and verify that playground equipment use zones, clearances, and reach ranges comply with ASTM F1487 sections 8, 9, and 10, and with CAN/CSA-Z614 sections 14 and 15.
9. Prepare sub-grade as specified in Division 31 Section, EARTH MOVING. Ensure that site drainage is routed away from or around the playground area. Grade subsoil to a 2 percent grade toward the drainpipe.
10. Install playground equipment in accordance with manufacturer’s instructions at locations indicated on the drawings.
11. Install a containment system around the play area edge.
12. Install geotextile fabric over subsoil then install resilient foam drainage:
    a. Install panels side by side fabric side up. Allow min. 1/2-inch gap at border to allow for expansion.
    b. Cut around equipment base and border using utility knife or circular saw. Wrap around drainpipe, use plastic cable tie to secure foam to pipe.
13. Engineered Wood Fiber Playground Surfacing:
    a. Place wood fiber surfacing to a minimum depth of 7 inches after compaction for play equipment under 4 feet high and to a minimum depth

of 10 inches after compaction for play equipment over 4 feet high and to a minimum depth of 12 inches for play areas on top of a hard surface (asphalt, concrete, etc.).

b. Use mechanical equipment to uniformly compact and level material.

14. Inspect the playground and verify that playground equipment use zones, clearances, and reach ranges comply with ASTM F1487 sections 8, 9, and 10, and with CAN/CSA-Z614 Sections 14 and 15.

B. Playground Surfacing Wear Mat

1. Install a mat in each kick-out area.
2. Dig a channel around the mat edge down to the base of the engineered wood fiber and slope mat edges down into the channel. When anchoring the mat, install anchors and plastic cable ties to attach mat to anchors. Refill the channel with engineered wood fiber. Anchoring is necessary to keep the mat from shifting or beingremoved.

END SECTION

SECTION 32 21 19: WOOD FENCES & GATES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SUMMARY

A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to furnish and install designated Site Improvements and related items as indicated on the Contract Documents, as specified in this Section, and includes, but is not limited to, the following:

1. Wood post and rail fence
2. Wood utility fence & gate

1.3 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 03 Section – CAST-IN-PLACE CONCRETE
2. Division 32 Section – REINFORCED CONCRETE PAVING
3. Division 32 Section – HEAVY TIMBER VEHICULAR GATE
4. Division 32 Section – TURF & GRASSES

1.4 REFERENCES

A. The following standards shall apply to the work of this Section:

1. Massachusetts Department of Transportation (MassDOT)
   Standard Specifications for Highways and Bridges
2. ASTM: American Society for Testing and Materials
   A153 Zinc Coating (Hot-dip) on Iron and Steel hardware
   A386 Zinc Coating (Hot-dip) on Assembled Steel Products
   A325 High Strength Bolts
3. American Wood Protection Association (AWPA):
   APWA M4 Standard for the Care pf Preservative-Treated Wood Products
   APWA P5 Standard for Waterborne Preservatives
4. American Wood Preservers Bureau (AWPB):
   AWPB Standard C1 through C9

1.5 SUBMITTALS

A. At least thirty (30) days prior to intended use, the Contractor shall provide the following samples and submittals for approval. Do not order materials until Contracting Officer approval of samples, certifications and/or test results has been obtained. Delivered materials shall closely match the approved samples. Samples and Approvals which are not obtained prior to the ordering of materials or the completion of work shall result in possible disapproval of obtained materials or completed work.

B. Shop Drawings

1. Wood post and rail fence
2. Wood utility fence & gate

A. Samples

1. Wood sample

1.6 QUALITY ASSURANCE

A. Environmental Compliance: Comply with State and Local environmental regulations.

1.7 DELIVERY, STORAGE & HANDLING

A. Do not deliver site amenities to the site, until all specified submittals have been submitted to, and approved by, the Engineer.

B. Store products inside, under cover, and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.

1.8 GUARANTEE

A. The Contractor shall furnish and deliver standard written manufacturer's guarantee in Owner's name covering all materials and workmanship under this Section, WOOD FENCES & GATES, in addition to, and not in lieu of, guarantee requirements set forth under Division 01, GENERAL REQUIREMENTS, and other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

B. Supplier shall pay for repairs of any damage to any part of the project caused by defects in his work and for any repair to the materials or equipment caused by replacement. All repairs are to be done to the satisfaction of the Architect.

C. Any part of the work installed under this contract requiring excessive maintenance shall be considered as being defective and shall be replaced by the Supplier during the one year guarantee period at no cost to the Owner.

PART 2 – MATERIALS

2.1 GENERAL INSTALLATION

A. Free-standing site improvement items shall be set plumb and horizontal regardless of the pitch of the finished surrounding grade unless otherwise shown on the Contract Documents.

B. The Contractor shall be responsible for timing the delivery of site improvement items so as to minimize the on-site storage time prior to installation.

C. Contractor shall be responsible for the correct location of site improvement items according to the Contract Drawings. Take particular care to maintain shapes, plumb and level during the pouring of concrete.

D. All Work shall be accurately set to established lines and elevations and rigidly set in place to supporting construction.

2.2 WOOD POST & RAIL FENCE

A. Posts shall be split-sawn black locust.

B. Sawn board rails shall be cedar.

C. Black locust lumber shall be stripped of bark and milled to nominal dimension shown on Contract Drawings.

D. Fasteners shall be hot-dipped galvanized steel.

2.3 WOOD UTILITY FENCE & GATE

A. All lumber shall be band sawn pressure-treated southern yellow pine.

B. Nails, bolts, hangers, gate catches and all other metal components shall be galvanized steel.

C. Concrete for gate post holes shall be minimum 4,000 psi (30 Mpa) 28 day strength air entrained, 3/4 inch aggregate concrete in conformance to requirements of Section M4.02 of the Standard Specifications.

2.4 FASTENERS

A. All hardware shall be fabricated from steel conforming to ASTM A36 requirements. All screws, bolts, nuts, and anchors shall be as indicated on the Drawings. Hardware shall be galvanized in accordance with ASTM A153 requirements.

PART 3 – EXECUTION

3.1 GENERAL

A. Fabricate and install wood guardrail, wood board fence, and wood utility fence and gates as shown on the Contract Documents, and in accordance with approved Shop Drawings.

B. Posts shall be set plumb. All rails and boards shall be set to follow the grade.

C. When meeting existing wood board fence, remove boards to closest in-ground post and reset. No board cuts mid-post shall be accepted.

D. Erect fencing in straight lines between angle points by skilled mechanics experienced in this type of construction. Erect in accordance with the manufacturer's recommendations as approved and with these Specifications.

E. Post holes: Post holes for fence posts shall have a minimum diameter of 12 inches and be a minimum depth of 30 inches below finished grade. Set posts with plumb alignment. Concrete shall be thoroughly worked into post holes so as to leave no voids.

END OF SECTION

SECTION 32 30 00: SITE IMPROVEMENTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SUMMARY

A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to furnish and install designated Site Improvements and related items as indicated on the Contract Documents, as specified in this Section, and includes, but is not limited to, the following:

1. Benches: Hexagonal bench, 6-foot bench, and 8-foot bench
2. Picnic tables
3. Bike racks
4. Lifeguard stand
5. Trailhead signage
6. Interpretive signage
7. Wayfinding signage
8. Check-in stand
9. Picnic pavilion
10. Multi-use porous court surface – Add Alternate #3
11. Boat ramp
12. ADA Non-slip beach mat
13. Precast concrete wheel stops
14. Overlook – Type 1 – Add Alternate #1
15. Overlook – Type 2
16. Footings for Overlook – Type 2
17. Accessibility improvements to spillway
18. Timber crib steps
19. Pad for trash receptacle & recycling bins

1.3 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 03 Section – CAST-IN-PLACE CONCRETE
2. Division 03 Section – REINFORCED CONCRETE FOOTINGS – Add Alternate
3. Division 05 Section – METAL FASTENINGS – Add Alternate
4. Division 05 Section – METAL FABRICATION – Add Alternate
5. Division 05 Section – SITE METAL FURNISHINGS – Add Alternate
6. Division 05 Section – FACTORY-APPLIED COATINGS FOR METAL – Add Alternate
7. Division 06 Section – WOOD TREATMENT – Add Alternate
8. Division 06 Section – HEAVY WOOD CONSTRUCTION – Add Alternate
9. Division 10 Section – INFORMATIONAL SIGNAGE
10. Division 11 Section – PLAY EQUIPMENT
11. Division 26 Section – ELECTRICAL
12. Division 32 Section – ASPHALT PAVING
13. Division 32 Section – REINFORCED CONCRETE PAVING
14. Division 32 Section – STABILIZED CRUSHED GRANITE PAVING

15. Division 32 Section – CHAIN LINK FENCES & GATES
16. Division 32 Section – PLACED BOULDERS

1.4 REFERENCES

A. The following standards shall apply to the work of this Section:

1. Massachusetts Department of Transportation (MassDOT) Specifications Standard Specifications for Highways and Bridges
2. ASTM: American Society for Testing and Materials

1.5 SUBMITTALS

A. Shop Drawings and Manufacturer's Product Literature

1. Benches: Hexagonal bench, 6-foot bench, and 8-foot bench
2. Picnic tables
3. Bike racks
4. Lifeguard chairs
5. Trailhead signage
6. Interpretive signage – Add Alternate
7. Wayfinding signage
8. Check-in stand
9. Picnic pavilion
10. Multi-use porous court surface – Add Alternate
11. Boat ramp
12. ADA Non-slip beach mat
13. Precast concrete wheel stops
14. Overlook – Type 1 – Add Alternate
15. Overlook – Type 2
16. Accessibility improvements to spillway
17. Timber crib steps, including spot grades

B. Samples: Submit samples of all finishes and colors from the manufacturer for the following:

1. Benches: wood and powder-coated finish colors
2. Bike racks: powder-coated finish colors
3. Trailhead signage: wood types & finish; metal roofing finish & colors
4. Multi-use porous court surface – Add Alternate
5. Boat ramp
6. ADA Non-slip beach mat
7. Bar grating for accessibility improvements to spillway

C. Provide manufacturer's warranties for all site improvements items.

1.6 QUALITY ASSURANCE

A. Environmental Compliance: Comply with State and Local environmental regulations.

1.7 DELIVERY, STORAGE & HANDLING

A. Do not deliver site amenities to the site, until all specified submittals have been submitted to, and approved by, the Landscape Architect.

B. Store products inside, under cover, and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.

1.8 GUARANTEE

A. The Contractor shall furnish and deliver standard written manufacturer's guarantee in Owner's name covering all materials and workmanship under this Section, SITE IMPROVEMENTS, in addition to, and not in lieu of, guarantee requirements set forth under Division 01, GENERAL REQUIREMENTS, and other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

B. Supplier shall pay for repairs of any damage to any part of the project caused by defects in his work and for any repair to the materials or equipment caused by replacement. All repairs are to be done to the satisfaction of the Architect.

C. Any part of the work installed under this contract requiring excessive maintenance shall be considered as being defective and shall be replaced by the Supplier during the one year guarantee period at no cost to the Owner.

1.9 TIMING OF IN-RESERVOIR WORK: OVERLOOK – TYPE 1 (Add Alternate #1) & BOAT RAMP

A. The Arlington Reservoir has seasonal water level changes for the swimming season, controlled by the Town DPW. Typical draw-down occurs after August 21 and raising of waters on or before June 15.

B. Installation of Boat Ramp and Overlook – Type 1 shall be conducted in the dry. Contractor responsible for coffee dam and dewatering of Boat Ramp and Overlook – Type 1 shall coordinate schedule as appropriate.

PART 2 – PRODUCTS

2.1 GENERAL INSTALLATION

A. Where anchors, bolts or fasteners are exposed, they shall be configured or secured in such a way as to prevent their casual removal by use of vandal-proof heads or fastenings unless otherwise specified on Drawings.

B. Provision and delivery of all metal inserts, anchor slots, anchors, anchor bolts, fastenings, and other fastening devices, for attachment of trash receptacles, and recycle bins to concrete and masonry, except as otherwise specified under other Sections of this Specification, shall be provided by the manufacturer. Installation of all such fastening devices shall be part of the work of this Section, SITE IMPROVEMENTS.

C. Free-standing site improvement items shall be set plumb and horizontal regardless of the pitch of the finished surrounding grade unless otherwise shown on the Contract Documents.

D. The Contractor shall be responsible for timing the delivery of site improvement items so as to minimize the on-site storage time prior to installation.

E. Contractor shall be responsible for the correct location of site improvement items according to the Contract Drawings. Take particular care to maintain shapes, plumb and level during the pouring of concrete.

F. All Work shall be accurately set to established lines and elevations and rigidly set in place to supporting construction.

2.2 SITE AMENITIES – GENERAL

A. Benches: The basis of design for hexagonal bench, 6-foot bench, and 8-foot bench is Bench 79 as manufactured by DuMor, Inc. of Mifflintown, PA.

1. All benches shall be embedded.

2. Seat slats shall be manufactured from 2” x 4” nominal ipe slats.
3. Supports shall be manufactured from 2” (2 3/8” OD) ASTM A513 schedule 40 steel tubing.
4. All benches shall have arm rests manufactured from 1/4” x 2” ASTM A36 carbon steel flat bar.
5. Powder coating of metal components. Color TBD shall be selected by Landscape Architect.

B. Picnic tables: Basis for Design is Models #72-60I (6 feet long and ipe) and 72-68-1I (wheelchair accessible in ipe) as manufactured by DuMor, Inc. of Mifflintown, PA. Wood shall be ipe.

C. Bike racks: Basis for Design is Model #293 as manufactured by DuMor, Inc. of Mifflintown, PA.

1. Color TBD; to be selected by Landscape Architect.
2. Anchoring shall be direct embedment, S-1, into concrete pad.

2.3 LIFEGUARD CHAIRS

A. Basis for Design is Aquamentor 60-inch Lifeguard Chair a manufactured by Garwood, New Jersey.

1. Lifeguard chair shall be comprised of recycled plastic lumber.
2. Chair shall be 60 inches high. Seat shall be 24 inches wide with 12-inch wide steps.
3. Chairs shall have anti-tip bases, wheels for portability, and umbrella holders.

2.4 TRAILHEAD SIGNAGE

A. Basis of Design is the “Mini Kiosk” as fabricated by TimberHomes Vermont of Verhsire, Vermont.

1. Timber shall be rough-sawn white oak with 1/4-inch chamfer secured with white oak or black locust pegs. Posts shall be black locust 4 inches by 4 inches (nominal).
2. Roof shall have band sawn curve with 5/4 pine roof with roofing metal fastened with screws. Materials shall be metal. Color shall be selected by the Landscape Architect.
3. Signboard shall be tongue-in-groove eastern white cedar; stained (Imperial Grey by Arborcoat). Kiosk shall have signboards and lockable doors on both sides.
4. Door shall be cherry-framed lockable plexiglass door with. The hinged on top and has pin with hole to receive padlock. (Padlock to be provided by Owner).
5. Graphics to be provided by Owner.

2.5 INTERPRETIVE SIGNAGE – Add Alternate #1

A. Basis of Design is “Low Profile Exhibit Base” model number “F-LP-36X24-AL-PF” as fabricated by Pannier Graphics of Gibsonia, Pennsylvania, (800) 544.8428, http://panniergraphics.com; or, approved equal.

1. Interpretive sign base shall be manufactured of aluminum with a 3/16” back plate behind sign panel.
2. Interpretive sign base shall be sized to fit a 12” by 36” by 0.90” thick graphic panel.
3. Color for powder-coating shall be Black.
4. Sign base shall be mounted on wood railing of overlook as shown on Contract Documents.
5. Graphic panel will be provided by Owner.

2.6 WAYFINDING SIGNAGE

A. Basis of Design is “Single Post Frameless #3 Exhibit Base” model number “F-LP-36X24-AL-PF” as fabricated by Pannier Graphics of Gibsonia, Pennsylvania, (800) 544.8428, http://panniergraphics.com; or, approved equal.

1. Wayfinding sign base shall be manufactured of aluminum with a 3/16” back plate behind sign panel.
2. Interpretive sign base shall be sized to fit a 12” by 18” by 0.90” thick graphic panel. Contractor shall be provided with the vector graphics.

3. Color for powder-coating shall be Black.
4. Sign base shall be direct embedded into concrete footing.
5. Signs to be field located.
6. Graphics shall be in accordance with Division 10 Section, INFORMATIONAL SIGNAGE.

2.7 CHECK-IN STAND

A. Basis of Design is the “Pinehurst Mini-Picnic Shelter” as fabricated by Zenecar, LLC of Raleigh, North Carolina.

1. Structure shall be 8 feet square.
2. Manufacture of the structural glued laminated wood components shall conform to the manufacturing requirements of the American Institute of Timber Construction Standards and Standard Specifications for Glued Laminated Timber, AITC 117.
3. The manufacturer and fabricator of the shelter’s laminated wood components and the shelter’s steel connectors shall be one in the same, to assure quality fit of all connections.
4. Quality Control shall be provided in accordance with ANSI/AITC A190.1-latest edition, American National Standard for Wood Products- Structural Glued Laminated Timber, and the American Institute of Timber Construction Inspection Manual AITC-200.
5. Protection: Members shall be individually wrapped.

B. Lumber: Laminating lumber for fabrication of columns, beams, roof decking, fascia, shall be #1 grade kiln-dried, with maximum 15% moisture content, Southern Yellow Pine graded to meet the requirements of Standard Specifications for Structural Glued Laminated Timber, AITC 117. Lumber combination shall be determined by the design requirements for each component and designated on the fabricator’s shop drawings. Lumber for benches and tabletop shall be appearance grade, kiln dried, solid sawn, cedar.

C. Treated Components: All treated components must be treated prior to gluing with CCA (chromate copper arsenate). All treated components with ground contact, must be treated prior to gluing, at 0.6 lbs. per cubic foot with CCA. All treated components not in ground contact, must be treated prior to gluing, at 0.3 lbs. per cubic foot with CCA Waterborne treatment will not be accepted.

D. Adhesives: Adhesives shall be wet-use (waterproof) complying with ANSI/AITC A190.1-latest edition.

E. Columns: Standard shelters to have embedded glued laminated wood columns. Glulam columns to be pressure-treated at .6 lbs. per cubic foot with CCA prior to gluing, in accordance with AITC 109 Standards. Waterborne treatment will not be accepted.

F. Beams: Glulam beams to be fabricated with #1 Grade, kiln-dried, with 15% moisture content, Southern Yellow Pine.

G. Benches and Tabletop: Appearance grade, kiln dries, solid sawn, cedar.

H. Roof Deck: Two-inch (nominal) #1 Grade, single tongue and groove with V-joint bottom face, kiln-dried, to an average of 15% moisture content, Southern Yellow Pine. Galvanized 16d nails shall be provided.

I. Fascia: 2” x 6” fascia, Southern Yellow Pine, #1 SPIB Grade, pressure-treated at .3 lbs. per cubic foot with CCA in accordance with AITC 109 Standards. Galvanized 16d nails shall be provided.

J. Roofing: Class A fire rated fiberglass shingles (25-Year Warranty) with one layer of #30 felt. Standard shelter to have Autumn Brown color shingles. Galvanized roofing nails for attaching felt & shingles shall be provided.

K. Hardware: All steel and hardware for beam and column connections shall be provided. Steel connections to be prime painted with rust inhibitor paint. Hardware to be electrostatic zinc plated.

L. Design: The structural systems are designed to sustain actual dead load in conjunction with 30 PSF live load or 20 PSF wind load, whichever combination is critical.

M. Appearance Grades: AITC Architectural grade. Exposed faces of glulam members to receive one coat of factory-applied clear penetrating sealer.

2.8 PICNIC PAVILION

A. Basis of Design is the Brandywine Shelter as fabricated by EnWood Structures of Raleigh, North Carolina.

1. Structure shall be 15 feet wide by 30 feet long.
2. Manufacture: Manufacture of the structural glued laminated wood components shall conform to the manufacturing requirements of the American Institute of Timber Construction Standards and Standard Specifications for Glued Laminated Timber, AITC 117.
3. Manufacturer's and Fabricator's Certification: Shelter's manufacturer and fabricator shall be a member of, and hold full certification from, The American Institute of Timber Construction (AITC).
4. Manufacturer and Fabricator: The manufacturer and fabricator of the shelter's laminated wood components and the shelter's steel connectors shall be one in the same, to assure quality fit of all connections.
5. Quality Control: Quality Control shall be provided in accordance with ANSI/AITC A190.1-latest edition, American National Standard for Wood Products- Structural Glued Laminated Timber, and the American Institute of Timber Construction Inspection Manual AITC-200.
6. Protection: Members shall be individually wrapped.
7. Design: The structural systems are designed to sustain actual dead load in conjunction with 30 PSF live load or 20 PSF wind load, whichever combination is critical.
8. Appearance Grades: AITC Architectural grade. Exposed faces of glulam members to receive one coat of factory-applied clear penetrating sealer.

B. Lumber: Laminating lumber shall be #1 grade kiln-dried, with maximum 15% moisture content, Southern Yellow Pine graded to meet the requirements of Standard Specifications for Structural Glued Laminated Timber, AITC 117. Lumber combination shall be determined by the design requirements for each component and designated on the fabricator's shop drawings.

C. Treated Components: All treated components must be treated prior to gluing. The treated components, arches, beams and purlins, wall and roof decking, and fascia must be treated, prior to gluing, at .6 lbs. per cubic foot.

D. Adhesives: Adhesives shall be wet-use (waterproof) complying with ANSI/AITC A190.1-latest edition.

E. Arches: Glulam arches to be fabricated with pressure-treated lumber at .6 lbs. per cubic foot, prior to gluing, in accordance with AITC 109 Standards.

F. Beams and Purlins: Glulam beams and purlins to be fabricated with #1 Grade, kiln-dried, with 15% moisture content, Southern Yellow Pine, pressure treated at .6 lbs. per cubic foot, prior to gluing, in accordance with American Wood Preservers Association Standards.

G. Roof Deck: Two-inch (nominal) #1 Grade, end matched, single tongue and groove with V-joint bottom face, kiln-dried, to an average of 15% moisture content, Southern Yellow Pine. Galvanized 16d nails shall be provided.

H. Wall Deck: Two-inch (nominal) #1 Grade, end matched, single tongue and groove with V-joint bottom face, kiln-dried, to an average of 15% moisture content, Southern Yellow Pine, pressure treated at .6 lbs. per cubic foot, in accordance with AITC 109 Standards. Galvanized 16d nails shall be provided.

I. Fascia: 2" x 6" fascia, Southern Yellow Pine, #1 SPIB Grade, pressure-treated in accordance with AITC 109 Standards. Galvanized 16d nails shall be provided.

J. Roofing: Class A fire rated fiberglass shingles (25-Year Warranty) with one layer of #30 felt. Standard shelter to have Autumn Brown color shingles. Galvanized roofing nails for attaching felt & shingles shall be provided.

K. Hardware: All steel and hardware for beam and arch connections shall be provided. Steel connections to be hot dipped galvanized. Hardware to be galvanized.

2.9 MULTI-USE POROUS COURT SURFACE – Add Alternate #3

A. The Basis of Design shall be the Ultra Base Court System as manufactured by Innovative Base Technologies, Inc. of Saint Petersburg, Florida.

1. Approximate court size shall be approximately 30 feet 4 inches by 60 feet 8 inches.
2. Assembled court shall include court panels, geotextile stabilization fabric, edge trim pieces, corner trim pieces, and two (2) ADA-compliant court ramps.
3. Color shall be Willow Green.

B. Court panels shall meet the following criteria:

1. Panels shall be 30 inches by 30 inches by 1-1/4 inches thick, including interlocking tabs. Once installed panels shall be 28 inches by 28 inches.
2. Panels shall have an average weight of 1.86 pounds per square foot.
3. Vertical drainage shall be 424.5 inches per hour.
4. PSI per panel shall be 300 pounds per square inch.
5. Panels, edges, corners, and ramps shall be comprised of polypropylene.

C. Contractor shall furnish and install court panels necessary to complete the required size, plus court edge and corner pieces to complete the panel. Contractor shall also furnish and install two (2) ADA-compliant ramps. Edges, corners, and ramps shall be engineered to securely interlock with the panel system. Edges shall be 28 inches in length.

D. Geotextile stabilization fabric shall be permeable, 8-ounce, non-woven needle-punched fabric.

E. Sand shall be in accordance with Division 31 Section, EARTH MOVING.

2.10 BOAT RAMP: ARTICULATED CONCRETE BLOCK

A. The Basis of Design shall be Cable Concrete “CC55 OC” as manufactured by International Erosion Control Systems, of West Lorne, Ontario; or approved equal. Cable Concrete is an open-void articulated concrete block to be filled with washed granular fill.

1. This system shall be made up of 4 feet x 16 feet and 8 feet x 16 feet mattresses, which are placed side by side and clamped together to provide one homogeneous erosion protection system. The mats are made up of concrete blocks interconnected by integrally woven stainless steel cables, which are poured within each block. The size of the concrete blocks shall be 15.5 inches square at the base and 11.5 inches square at the top face (a truncated pyramid shape). The blocks shall be poured with a round insert in the block pans, to provide open area within the block to release hydrostatic pressures and grow additional vegetation.
2. Weight: 57 pounds/square foot
3. Block height: 8.5 inches
4. Longitudinal cable: 3/16 inches
5. Transverse cable: 5/32 inches
6. Longitudinal rope: 28 mm
7. Transverse rope: 28 mm

B. Concrete: The minimum required concrete strength should be 4000 PSI @ 28 days. Air entrainment of 4% to 7% shall also be added. All ASTM standards will be met in the production of the concrete. The finished concrete product shall consist of a minimum density of 140lbs/sf, in an average of 3 units. No

individual block shall consist of a minimum concrete density lower than 135 lbs/sf.

C. Cables: The cables shall be made of stainless steel aircraft cable of type 302 or 304, depending on the specific use and conditions of the project. The cable shall be of type 1 x 19 construction. Cables shall be integral (poured into) to the concrete block and shall traverse through each block in both longitudinal & lateral directions of the mat system. Polyester rope may be substituted for stainless steel cable in design, but UV degradation protection must be maintained. The rope mats must be covered with rock or topsoil and vegetated. This cover will provide UV degradation protection. A channel with no soil or vegetation cover will not be acceptable for polyester rope.

D. Bedding: Articulated concrete block shall have as a base material: 3/4-inch to 1-inch open graded stone, with no fines (AASHTO #57). Depth shall be a minimum of 6 inches. Granular fill shall be in accordance with Division 31 Section, EARTH MOVING.

E. Geotextile: The geotextile used is to be specified by the governing project engineer. The standard geotextile material used on non-specific projects is an 8-ounce, needle punched non-woven fabric. The geotextile must be place prior to placement of concrete block mats. The geotextile shall be installed according to the geotextile manufacturer's recommendations.

F. Clamps: Sufficient stainless steel wire rope clamps shall be used to secure loops of adjoining Cable Concrete mats. Following manufacturer's instructions for installation of clamps.

G. Open voids shall be filled with granular fill 3/8- to 3/4-inch in size. Granular fill shall be in accordance with Division 31 Section, EARTH MOVING.

2.11 ADA NON-SLIP BEACH MAT

A. The Basis of Design shall be Mobi-Mat Beach Access Surface as manufactured by Deschamps Mats Systems, Inc. of Cedar Grove, New Jersey.

1. Width shall be 5 feet wide. Length shall be as shown on Contract Documents.
2. Color shall be selected by the Landscape Architect.

B. Beach mat shall be three-dimensionally woven polyester filament. Mat shall have stainless steel grommets on the edges for anchoring. Top surface shall be slip resistant.

C. Anchors shall be 3/8-inch bi-chromated steel staples-to be embedded in the sand 18 inches.

2.12 PRECAST CONCRETE WHEEL STOPS

A. Precast concrete wheel stop shall be MassDOT and shall conform to the relevant provisions of Section 700 of the Standard Specifications (703.1) and supplemented as shown on Contract Drawings. Wheel stops shall be furnished by a company or firm specializing in the manufacturer of precast concrete parking appurtenances.

1. Wheel stops shall be 6 feet long by 6 inches high.

B. Anchors to secure wheel stops shall be #4 rebar and shall be a minimum of 14 inches long.

2.13 OVERLOOK – TYPE 2

A. Structural wood as specified herein in Pressure Treated Lumber and in Division 06 Section, HEAVY TIMBER CONSTRUCTION.

B. Decking shall be Ipe as specified herein.

C. Fasteners (nuts, bolts, washers, and related items): unless otherwise specified, hot dipped galvanized steel.

D. Deck fasteners shall be stainless steel Robinson Head deck screws with flat head. Stainless shall be 304 alloy.

E. Mesh: Galvanized steel, 3 inch x 3 inch woven mesh, 0.125 inch diameter wire.

2.14 PRESSURE TREATED LUMBER

A. Pressure treated wood shall be pressure treated southern yellow pine uniform in treatment and appearance, sizes as noted on the Drawings. All wood shall be from a single source.

B. Grade Certification: Each piece of wood shall bear grade mark applicable in accordance with the latest edition of Rules and Southern Pine Inspection Bureau or certified as to grade by a licensed subscriber or SPIB.

1. Grade: Grade shall conform to Southern Pine American Wood Protection Association (AWPA) Standards, latest edition. Grade for all wood shall be UC4A (Suitable for ground contact) and better.
2. Size: Standard dressing in accordance with American Lumber Standard SPR-16-53.
3. All fasteners for pressure treated lumber shall be 316 alloy stainless steel.

2.15 IPE DECKING

A. Decking for Overlooks Type 1 (Add Alternate #1) & 2 shall be Ipe. Decking shall meet the following characteristics:

1. Weight: Specific gravity of 0.85-1.08
2. Air dried density: 66-75 pounds per cubic foot
3. Moisture content: Air dried to approximately 12%
4. Hardness: Janka Hardness rating of 3,680 pounds (ASTM D143)
5. Fire resistance classification: National Fire Protection Agency Class A, Uniform Building Code, Class 1 (ASTM E84)
6. Slip resistance: Must meet ASTM C1028

2.16 FOOTING for OVERLOOK – TYPE 2

A. Basis of Design for Footing for Overlook – Type 2 shall be “Bigfoot” footing form Model BF28. Footing form shall accept 12-inch diameter sonotube. Form footing shall be comprised of polyethylene.

2.17 ACCESSIBILITY IMPROVEMENTS TO SPILLWAY

A. Contractor to provide aluminum bar grating with ADA-compliant spacing of mesh.

1. Basis of Design shall be McNichols Aluminum Bar Grating, press-locked, rectangular bar with close mesh, or approved equal.
2. Bar grating shall have a 3/16-inch rectangular bar with a smooth surface and 55% open area.
3. Spacing between surface bars shall be 1/4-inch maximum to meet ADA Standards for Accessible Design.
4. Thickness shall be determined once existing galvanized treads have been removed.

B. Contractor shall provide and install stainless steel plates to the surface of the concrete walls of the spillway.

1. Plate thickness shall be between 1/4-inch to 1/2-inch based on the existing conditions. Contractor shall verify required thickness to ensure a change in grade no greater than 1/4-inch to meet ADA Standards for Accessible Design.
2. Surface shall be texturized to give it a slip resistance.
3. Length of steel bar shall be 60 inches. Width shall be determined based on existing conditions.

4. All hardware shall be stainless steel.

2.18 TIMBER CRIB STEPS

A. Timber steps, sleepers, and deadmen shall be 6 by 6-inch (nominal) pressure treated timbers, per this section.

B. Steps shall be secured with TLK08 fasteners.

C. Tread layer between timbers shall be stabilized crushed granite pavement, installed, and paid for per Division 32 Section, STABILIZED CRUSHED GRANITE PAVING.

D. Sleepers to be secured with two #4 rebar by 48 inches long each.

E. Base material shall be 3/4-inch washed gravel, installed, and paid for per Division 31 Section, EARTH MOVING.

2.19 PADS & FOOTINGS

A. Concrete footings shall be 4,000 pounds per square inch (30MPa) cast-in-place concrete. Concrete pads shall be 3,000 pounds per square inch (20MPa) cast-in-place concrete.

B. Cast-in-place concrete for pads and footings shall be as specified and paid for under the work of Division 03 Section, CAST-IN-PLACE CONCRETE, of this Specification.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

B. Beginning of installation means acceptance of existing project conditions.

3.2 GENERAL

A. Fabricate and install benches, picnic tables, bike racks, lifeguard chairs, trash receptacles, recycling bins, trailhead signage, wayfinding signage, and wheel stops as shown on the Drawings, per the manufacturer’s instructions and in accordance with approved Shop Drawings.

B. All furnishings shall be set plumb and level.

3.3 MULTI-USE POROUS COURT SURFACE – Add Alternate #3

A. Install porous court surface per the manufacturer’s instructions.

B. After compaction of subbase, install layer of geotextile stabilization fabric. Contractor shall not drive, walk, or lay materials on fabric.

C. Install porous court surface, panels first. Maintain gap of 1/8-inch between panels (under 120 degrees Fahrenheit). Maintain 1/2-inch gap at any fixed objects. Install edges, corners, and ramps. Secure tiles along edges.

D. Once panels are all installed and properly gapped, use heavy roller, a vibratory roller, or a plate compactor to slightly vibrate the panels into the geotextile stabilization fabric. This compaction is essential for ball bounce. Protect panels from scratching or marring by laying a piece of fabric or slip sheet over panels.

3.4 PRE-FABRICATED STRUCTURES: CHECK-IN STAND & PICNIC PAVILION

A. Storage and Erection: The general contractor is responsible for protection of the materials after arrival at destination. If stored temporarily, members should be placed on blocks well off the ground and separated with wood strips so that air can circulate around each member. Cover top and bottom with moisture-resistant paper. Use non-marring slings when handling.

3.5 ADA NON-SLIP BEACH MAT

A. Install beach mat per the manufacturer's instructions. Secure mat along edges to prevent blowing in the wind, against concrete walkway, and extend into water.

3.6 BOAT RAMP: ARTICULATED CONCRETE BLOCK

A. The supplier shall have a technician experienced in the installation of the Cable Concrete System available at the start of an installation where the Landscape Architect or Contractor have not had experience with the product to assist in any special techniques needed to assure a proper installation.

B. The mats shall be laid from the downstream end of project to the upstream end, so the geotextile joints are shingled to direct flow over the joint and to prevent undermining.

C. Intimate contact with the subsurface is critical to the systems performance in the field. The gaps between each mat shall not be greater than 2 inches, preferably 1-inch or the gap must be closed using a grout mixture. The outside edges of the mat shall be entrenched and buried at least one block into the ground. Compacted granular fill or grout may be used to fill the entrenched edges.

D. Any surface application should not be placed prior to the inspection of the systems clamping and anchoring.

3.7 OVERLOOKS – TYPE 1 (Add alternate #1) & 2

A. Edges of decking shall align and be consistent.

B. Place Plank Bridge decking with the "bark side" up to allow water drainage is boards cup. Bark side is a description of the orientation of the growth rings, no bark is allowed on the decking.

C. Spacing between deck boards shall be consistent and be compliant with the American's with Disabilities Act and the Massachusetts Architectural Access Board.

D. Deck screws shall be installed in consistent and straight lines. Screw head shall be flush with top of deck board.

1.8 FOOTING FOR OVERLOOK – TYPE 2

A. Remove excess rings on footing form above the ring diameter required and discard.

B. Attach the required length of construction tube to the footing form with a minimum of four (4) 3/4-inch to 1-inch long #8 wood screws.

C. Remove any excess frayed tube material for ease of application to the footing form.

D. Drill 3/8-inch holes on a 45-degree angle in the footing form as indicated by the markings on the flange area at each rib location to accept a minimum of 12-inch spikes.

E. Place the footing form on undisturbed soil and drive spikes at a 45 degree angle inwards to prevent footing form from rising when concrete is being poured. If the soil is such that the spikes cannot resist the upward pressure caused by the concrete being poured into the footing form then alternative methods such as sandbags or backfill must be used to hold the footing form in place.

F. Footing form and concrete footing shall be installed plumb and level.

1.9 ACCESSIBILITY IMPROVEMENTS TO SPILLWAY

A. Bar grating shall be installed so that bars are perpendicular to the path of travel.

B. Once installed, steel plate and aluminum bar grating shall be flush with no vertical change in grade greater than 1/4-inch to meet ADA Standards for Accessible Design.

C. Stainless steel plate shall be installed so that no warping or bending can cause tripping hazards.

1.10 TIMBER CRIB STEPS

A. Timber crib steps shall be installed per Contract Drawings.

B. Steps shall be installed level horizontally. Length of gravel treads are dependent upon slope and shall be approved in Shop Drawings.

END OF SECTION

SECTION 32 30 02: PLACED BOULDERS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade

1.2 SUMMARY

A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to furnish and install designated placed boulders and related items as indicated on the Contract Documents, as specified in this Section, and includes, but is not limited to, the following:

1. Placed boulders
2. Armored slope/boulder retaining wall

1.3 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 31 Section – EARTH MOVING
2. Division 32 Section – ASPHALT PAVING
3. Division 32 Section – SITE IMPROVEMENTS
4. Division 32 Section – PLANTING
5. Division 32 Section – TURF & GRASSES

1.4 SUBMITTALS

A. Selection

1. Landscape architect shall select boulders from supplier for use on the project. Contractor to arrange an appointment at stone supplier at least 30 days in advance of stone placement.

B. Sample/Mock-up

1. Provide stone samples for verification: shall show color, size, and variety. Submit one or more samples showing full range of variations in appearance characteristics expected in completed Work.
2. Place boulders for mock-up: Prepare mock-ups for review and approval by the Landscape Architect and Owner. Mock-ups shall directly reflect the intended installation as shown in the Contract Documents.

PART 2 – PRODUCTS

2.1 BOULDERS – SOURCE

A. Contractor shall supply full quantity of boulders required on Contract Drawings.

B. On-site stockpiles may be used. Contractor to estimate supply available on-site and provide additional boulders in the size required, and in the general character of on-site stockpile.

2.2 PLACED BOULDER

A. Boulder size range: 18 inches to 36 inches exposed height. Width and depth: 36 inches minimum, unless otherwise indicated on Contract Drawings.

2.3 ARMORED SLOPE/BOULDER RETAINING WALL

A. Voids shall be filled with 1-1/2 inches to 3 inches open graded stone with no fines (AASHTO #2). Aggregate fill shall be supplied and paid for as specified in Division 31 Section, EARTH MOVING.

PART 3 – EXECUTION

3.1 SETTING

A. No stone shall be laid in inclement weather or when the temperature is 36 degrees Fahrenheit, and dropping, nor shall any work be done on rising temperatures until the temperature reaches 32 degrees Fahrenheit. Frozen mortar materials shall not be used.

B. Stone with chips, cracks, stains, or other defects that might be visible in the finished work shall not be used.

3.2 SETTING OF ARMORED SLOPE/BOULDER RETAINING WALL

A. Placed boulders shall be placed on the prepared subgrade and graded to provide the minimum thickness shown on the Plans. Additional crushed stone shall be placed as required to bed each riprap stone into the base layer.

B. Armored slope shall be placed with a minimum volume of voids and with the minimum thickness as shown on the Contract Drawings.

3.3 ADJUST & CLEAN

A. Remove and replace boulders that have been broken, chipped, stained, or otherwise damaged. Remove and replace units which are misaligned or not to grade or do not match adjoining work. Provide new matching units, install as specified and fill joints to eliminate evidence of replacement. Repair defective and unsatisfactory joints as required to provide a neat, uniform appearance.

END OF SECTION

SECTION 32 31 13: CHAIN LINK FENCE & GATES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SUMMARY

A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to furnish and install the fence work of this Section, as indicated on the Contract Documents and as specified herein.

1. 48-inch high Vinyl-coated chain link fence
2. 60-inch high Vinyl-coated chain link fence
3. Vinyl-coated chain link gate(s)
4. Cantilever slide gate

1.3 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 03 Section – CAST-IN-PLACE CONCRETE
2. Division 32 Section – ASPHALT PAVING
3. Division 32 Section – REINFORCED CONCRETE PAVING
4. Division 32 Section – SITE IMPROVEMENTS
5. Division 32 Section – SITE METAL FURNISHINGS

1.4 QUALITY ASSURANCE

A. Prior to installation the fence contractor shall provide the fence manufacturer's notarized certification to the Landscape Architect that the vinyl-coated chain link fabric is warranted by the manufacturer for a minimum of 15 years against rust and corrosion.

B. Fence fabricator qualifications sufficient production capability and 10 years' experience with comparable work.

C. Welding qualifications: Processes/operators in accordance with American Welding Society. Welders passed AWS test in last 12 months.

D. Environmental Compliance: Comply with State and Local environmental regulations.

1.5 REFERENCES

A. The following standards shall apply to the work of this Section.

1. AWS: American Welding Society
   - D1.1 Structural Welding Code
2. ASTM: American Society for Testing and Materials
   - A-90/A90M Standard Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc Alloy Coatings
   - A 123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
   - A 307 Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
   - A392 Standard Specification for Zinc-coated Steel Chain Link Fence Fabric

A491	Standard Specification for Aluminum-coated Steel Chain Link Fence Fabric
A1011/A1011M	Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Allow and High Strength Low-alloy with Improved Formability
A500	Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
A900	Standard Specification for Industrial and Commercial Swing Gates
B-6	Standard Specification for Zinc
B-117	Standard Practice for Operating Salt Spray (Fog) Apparatus
F567	Standard Practice for Installation of Chain-Link Fence
F668	Standard Specification for Poly (Vinyl Chloride) (PVC) and Other Organic Polymer-Coated Steel Chain-Link Fence Fabric
F964	Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Exterior Profiles Used for Fencing
F1043	Standard Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework
F1083	Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures

3. Massachusetts Department of Transportation (MassDOT)
   Specifications — Standard Specifications for Highways and Bridges

1.6 SUBMITTALS

A. Prior to ordering the below listed materials, submit sample to Landscape Architect for approval. Sample shall be representative of designated items. Do not order materials until Landscape Architect's approval has been obtained. Delivered materials shall closely match the approved samples.

B. Submit manufacturer's product data and certification for the following:

1. Chain Link Fence: Each fence fabric type
2. Chain Link Fence: Each size of pipe
3. Chain Link Fence: Each type of hardware and fitting
4. Chain Link Fence: Gates
5. Chain Link Fence: Manufacturer's vinyl coating system
6. Cantilever slide gate system

C. Samples - Samples shall be submitted for approval for all fence materials to be furnished under this Section prior to the start of construction. Three (3) samples, approximately 3" long or 6" square, (of fabric material) post sections and typical accessories shall be submitted for approval. Samples shall also be submitted, in factory-sealed containers, of the cold galvanizing compound and the anchoring cement.

D. Submit complete shop drawings of each type of fence and gate for Landscape Architect's approval.

1. Shop drawings shall show typical materials, elevations, connections, fittings, and details for all elements as well as detailed layout showing all post locations.
2. Submit a complete schedule of all fencing and gates showing all post locations and fabric type locations on the project.

1.7 PRODUCT DELIVERY STORAGE & HANDLING

A. Deliver material in manufacturer's original packaging with all tags and labels intact and legible. Handle and store materials in such a manner as to avoid damage.

PART 2 – MATERIALS

2.1 POSTS, RAILS & BRACES

A. All fence pipe shall be cold-formed steel, schedule 40 pipe conforming to ASTM A-1201, or approved equal.

B. All structural shapes shall be vinyl coated with a minimum 15 mils thick coating of plasticized polyvinyl-chloride applied by fusion method over a thermoset plastic bonding agent. The bond shall exhibit equal or greater strength than cohesive strength of the vinyl. All cut ends shall be coated with vinyl.

1. The color shall be black.

2.2 END, CORNER & PULL POSTS

A. Fences up to and including 5'-0" in height: 2.375-inch O.D. pipe, weighing at least 3.98 lbs. per linear foot with a 2.0 ounces per square foot zinc coating minimum and shall have moisture proof post caps with acorn type design.

B. Line Posts (10'- 0" Maximum Spacing): Fabric up to 5 feet in height: 1.90-inch O.D. pipe, weighing 2.72 pounds per linear foot.

C. All structural shapes shall be vinyl coated with a 10 mil minimum thick coating of plasticized polyvinyl-chloride applied by fusion method over a thermoset plastic bonding agent. The bond shall exhibit equal or greater strength than cohesive strength of the vinyl. All cut ends shall be coated with vinyl.

1. The color shall be black.

2.3 TOP RAIL

A. 1.66" O.D. pipe weighing 2.27 lbs. per linear foot furnished in manufacturer's standard lengths of approximately 21'-0" with outside sleeve type couplings, at least 6" long for each joint - one coupling in each 5 to have expansion spring. Provide means for attaching top rail securely to each corner, pull and end post. Top rail shall form continuous brace from end to end of each run of fence.

B. All structural shapes shall be vinyl coated with 10 mil minimum thick coating of plasticized polyvinyl-chloride applied by fusion method over a thermoset plastic bonding agent. The bond shall exhibit equal or greater strength than cohesive strength of the vinyl. All cut ends shall be coated with vinyl.

1. The color shall be black.

2.4 POST BRACING ASSEMBLY

A. 1.66-inch O.D. pipe weighing 2.27 pounds per linear foot (for horizontal braces). Provide at each corner, pull, and end post for fences 4 feet or higher.

2.5 FENCE FABRIC

A. The fabric shall be vinyl coated steel chain link conforming to ASTM Designation A491-63T in its entirety. A zinc coating of the fabric shall be a minimum of 0.30 ounces per square feet of uncoated wire surface. The weight of zinc coating on the fabric shall be determined in accordance with ASTM A-90. The fabric shall then be vinyl coated with a minimum thickness of 7 mils thick coating of plasticized polyvinyl-chloride applied by fusion method over a thermoset plastic bonding agent. The bond shall exhibit equal or greater strength than cohesive strength of the vinyl. All cut ends shall be coated with vinyl at the factory.

1. The color shall be black.

B. The fabric shall be supplied in the following size: 6 gauge (0.192 inches), two-inch mesh for general uses.

C. All fabric shall be furnished with top and bottom selvage knuckled, both sides.

2.6 FENCE ACCESSORIES

A. All accessories shapes shall be vinyl coated with a 7 mil minimum thick coating of plasticized polyvinyl-chloride applied by fusion method over a thermoset plastic bonding agent. The bond shall exhibit equal or greater strength than cohesive strength of the vinyl. All cut ends shall be coated with vinyl.

1. The color shall be black.

B. Fittings and other appurtenances, including nuts and bolts, shall be aluminum alloy, galvanized pressed steel, malleable or cast steel as specified, epoxy-phenolic primed and coated with matching vinyl (PVC) by the fusion-bond method in accordance with ASTM F668 Class 2b.

C. Post Tops: Pressed steel or malleable iron, designed as weather tight closure cap (for tubular posts). Provide one cap for each post. Where top rail is used, provide tops to permit passage of top rail.

D. Stretcher Bars: One piece lengths equal to full height of fabric with minimum cross section of 3/16-inch by 3 / 4 - inch. Provide one stretcher bar for each end post and two for each corner and pull post.

E. Stretcher Bar Bands: Heavy pressed steel or malleable iron of 1/8 of an inch x 3/4 of an inch minimum cross-section and be of sufficient size to secure stretcher bars to end, corner and pull posts.

D. Rail Clamps: Rail clamps shall be standard clamps (boulevard Clamps) furnished complete with fasteners with ASTM Designation A153.

E. Fabric Bands: Fabric shall be attached using Self-Locking Fabric Bands as manufactured by ADC Manufacturing in Harrison, AZ or an approved equal.

F. Anchoring Cement: Cement for anchoring posts embedded in ledge or concrete shall be “Super POR-rok”, as manufactured by Hallemite (Lehn and Fink Industrial Products Division of Sterling Drugs, Inc.), Mantvale, New Jersey, or approved equal.

1. “Sika Colma-Dur” by the Sika Co.
2. “Five Star Grout” by the Five Star Co.

G. Concrete: Cement Concrete shall conform to the standard specifications of the Department of Public Works Commonwealth of Massachusetts for Class D air entrained Portland Cement Concrete with a 1- to 3-inch slump.

2.7 CHAIN LINK FENCE GATES

A. All materials shall be as specified above.

B. Contractor shall provide two (2) posts each per gate shall be 3 inches O.D.

1. Gate Latch, Industrial hinges and all hardware shall conform to the ASTM standards specified above.

2.8 CANTILEVER SLIDE GATE

A. Basis of Design shall be steel slide gate as fabricated by Hoover Fence Co. of Newton Falls, MA.

1. Steel Cantilever Gates shall be constructed with galvanized round tubing. Top and bottom horizontals rails shall be 2-1/2 inches O.D. (2-3/8 inches actual) tubing in Schedule 40 or HF40 grades. 2 inches O.D. (1-7/8 inches actual) serve as vertical braces, and 1-5/8 inches O.D. diagonal bracing is welded in place to help prevent gate sag.
2. Gate rollers shall be steel or nylon cantilever gate rollers, mounted to the mounting posts, two at top and two at bottom.
    i. All rollers shall have cantilever gate roller covers to protect pinch points.
    ii. Gate shall be 'sandwiched' in-between the top and bottom rollers and slides to open and close.

3. Cantilever gate rollers shall be galvanized chassis to prevent rust. Rollers themselves shall be galvanized steel.

B. Slide gate counterbalance: Counterbalance should be approximately 1/2 the length of the gate opening. Minimum counterbalance should be 4 feet long.

C. Post sizes for 6 feet high gates and shorter:

1. Steel chain link cantilever slide gates require 3 inches O.D. roller posts for widths up to 10 feet opening size.
2. Steel chain link cantilever slide gates require 4-inch O.D. posts up to 20 feet.
3. Steel chain link cantilever slide gates require 6-5/8-inch O.D. posts up to 32 feet.

D. Concrete footers:

1. 18 inches diameter by 42 inches deep is recommended for 3-inch to 4-inch O.D. posts.
2. 24 inches diameter by 42 inches for 6-5/8-inch O.D. posts
3. 30 inches diameter by 48 inches for 8-5/8-inch O.D. posts.
4. Increase bottom diameters 6 inches, creating a bell-shaped hole. The up and down stress with these type gates will work even the largest posts out of the ground. Always consult local building codes or practices prior to beginning any construction project.

PART 3 – EXECUTION

3.1 EXCAVATION

A. Excavation for post footings shall be in firm undisturbed or compacted soil. Excavate the holes to the lines and grades shown on the drawings with a 6-inch minimum clearance between the bottom of the hole and the bottom of the fence post in its final location. Where ledge is encountered, the Contractor shall notify Landscape Architect to determine method of installation.

3.2 POST INSTALLATION

A. Place concrete around posts in a continuous pour, tamp for consolidation. Check each post for vertical and top alignment and hold in position during placement and finishing operation.

1. Tops of footings are to receive a magnesium float finish and pitched as shown on the Contract Documents.
2. Tops of footings in bituminous paved areas shall conform to drawings and terminate 2-1/2 inches below pavement finish grade.

C. A change in direction of the fence line of 30 degrees or more shall be considered corners. Pull (corner) posts shall be used at any abrupt change in grade.

D. Maximum surface area of unbraced fence shall not exceed 1,500 square feet.

E. Terminal posts shall be braced to adjacent posts with horizontal brace rails and diagonal truss rods brought to proper tension so that posts are plumb.

F. There shall be no loose connections or sloppy fits in the fence framework. The fence framework shall withstand all wind and other forces due to the weather.

G. Fabric shall be stretched taut and tied to posts and rails. The fabric shall be installed on the security side of the fence and shall be anchored to the framework so that the fabric remains in tension after pulling force is released. The fabric shall be attached to line posts and rails with stainless steel self-locking metal bands, spaced to line posts at not more than 15-inch intervals and to rails and braces at not more than 24-inch intervals. The fabric shall be securely fastened to all terminal and gate posts with 1/4 inch stretcher bars with heavy No. 11 gauge pressed steel tension bands spaced approximately 12 in. apart. All bands, wires and tension bars shall conform to Federal Specification RR-F-191/4C.

3.3 FENCE ERECTION

All posts shall have continuous horizontal braces at the top and bottom. In addition, all end and corner posts shall be braced in the nearest line post with center brace rails. Outside sleeve type top rail couplings shall be placed a maximum of 12 inches from posts.

3.4 FABRIC

A. All chain link fabric shall be fastened on the outside of the posts unless directed otherwise by the Landscape Architect. The fabric shall be properly stretched and securely fastened to the posts, and between posts the top and bottom of the fabric shall be fastened to the horizontal braces as herein specified and approved by the Landscape Architect.

B. The fabric shall be fastened to end and corner posts with tension bars and stretcher bar bands spaced at 1-foot intervals.

C. All fabric shall be aligned so that the top row of the fabric mesh is tied to the top rail, and so that the bottom of the fabric mesh stands 1-1/2 inches above the finish grade of the turf areas, pavements, or concrete wall grade and that the bottom row of the fabric mesh is tied to the bottom rail.

D. All fabric shall be attached using approved fabric bands. The bands shall be spaced at not more than 15-inch intervals online posts and not more than 15-inch intervals on rails and braces. Bands shall match the fence fabric.

3.5 GATE INSTALLATION

A. The Contractor shall install the gate sections as described herein.

B. The gate shall be fabricated in close conformity to the lines and grades shown on the detail sketches. Welds shall be continuous fillet welds along all exposed joints. Electrodes E60XX and the shielded metal-arc process shall be used. All welding shall conform to the requirements of the latest AWS Specifications.

C. After fabrication is completed, all rough edges shall be buffed to a rounded finish, all oil and grease film shall be removed, and all steel shall be cold galvanized with 1.5 mils thickness coating.

D. Excavation for post footings shall closely follow the lines and grades shown on the drawings, and the concrete shall be mixed and placed to conform to the drawings.

E. The terminal post and the hinge post shall be set plumb to the height called for on the drawings. Attention is drawn to the importance of plumbness and proper height. Proper positioning of the posts is crucial to the free movement of the gate, and the Contractor will be responsible for resetting the posts at no extra charge if the gate does not swing freely or binds in any way.

F. Gate frames shall be 2 inches O.D. schedule 40 standard weight pipe, Wt. 2.72 pounds per lineal foot. Gates shall be fabricated using welded construction. Gates must be properly braced to eliminate any possible sagging condition. Hinges shall be of sufficient strength and design to permit easy and trouble free operation. All gates shall be equipped with a positive type industrial heavy-duty latching device with a means for padlocking.

G. After erection, the Contractor shall brush clean all rust spots, scratches and/or abrasions on the steel surfaces and touch up these spots with one coat of the approved cold galvanizing paint using procedures recommended by the manufacturer.

3.6 CANTILEVER SLIDE GATE

A. Follow manufacturer’s guide to installation.

B. All posts shall be set plumb and level.

END OF SECTION

SECTION 32 84 13: IRRIGATION – Add Alternate

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SUMMARY

A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to install irrigation in turf area of the beach, as indicated on the Contract Documents, as specified.

1. Work included in this section is an Add Alternate.

1.3 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 31 Section – EARTH MOVING
2. Division 32 Section – PLANTING SOILS
3. Division 32 Section – PLANTING
4. Division 32 Section – TURF & GRASSES

1.4 QUALITY ASSURANCE

A. All irrigation materials and components shall be provided and installed in accordance with the Town standards.

1.5 SUBMITTALS

A. The Contractor shall submit Shop Drawings and catalog cuts.

B. Product data including pressure rating, rated capacity, settings, and electrical data of selected models for the following:

1. Valves, including general-duty, underground, automatic control, and valve boxes
2. Sprinklers
3. Drip irrigation tubing and emitters
4. Wiring

C. Wiring diagrams for electrical controllers, valves, and devices.

D. Shop drawings showing irrigation system, including plan layout and locations, types, sizes, capacities, and flow characteristics of irrigation system components. Include valves, piping, sprinklers and devices, accessories, controls, and wiring. Show areas of sprinkler spray and overspray.

1. Shop Drawing shall include sleeve layout for irrigation work, showing sleeve locations and demonstrating coordination with landscape work and finish paving work.

E. Coordination drawings showing piping and major system components. Indicate interface and spatial relationship between piping, system components, adjacent above and below-ground utilities, both existing and proposed for this Project, and proximate structures.

1.6 STANDARDS & DEFINITIONS

A. Pipe sizes used in this Section are nominal pipe size (NPS) in inches. Tube sizes are Standard size in inches.

B. Supply Piping: Piping from water source to connection to irrigation system pressure piping. Piping is under same pressure as water supply. Piping in this category is not included in this Section.

C. Pressure Piping: Piping downstream from supply piping to and including control valves. Piping is under irrigation system pressure during operation, and under static pressure when system is not in operation. Piping in this category includes pump and master valves.

D. Circuit Piping: Piping downstream from control valves to irrigation system sprinklers. Piping is under pressure (less than pressure piping) during system operation.

E. Control Valve: Manual or automatic (electrically operated) valve for control water flow to irrigation system zone.

F. ASTM: American Society for Testing and Materials.

1.7 REFERENCE STANDARDS

A. Materials, equipment, and installation shall conform to the following standards and codes and shall be so labeled or listed:

1. National Fire Protection Association.
2. Underwriters Laboratories, Inc.
3. National Electric Codes.
4. American Water Works Association.
5. Boiler and Pressure Vessel Codes.
6. Federal, State and/or Municipal Codes.
7. Public Safety Codes.
8. U.S. Public Health Service.
9. National Electric Manufacturers Association.
10. American National Standards Institute.
11. American Society of Mechanical Landscape Architects
12. Commercial Standards.
13. Federal Specifications.
14. Cast Iron Soil Pipe Institute.
15. National Sanitation Foundation.
16. Occupational Safety and Health Regulations.

1.8 SYSTEM PERFORMANCE & SCOPE REQUIREMENTS

A. Design and building a complete automatic irrigation system. Irrigation head layout, pipe sizing, zones, etc. has not been completed. The design shall be performed by the Contractor and submitted to the Landscape Architect for review. Head to head coverage is required for all spray and rotor heads. A new controller, backflow preventer shall be included. Water source and electrical source-refer to MEP documents.

B. Components and Installation: Capable of producing piping systems with the following minimum working pressure ratings except where indicated otherwise.

1. Pressure Piping: 200 psig (1035 kPa)
2. Circuit Piping: 125 psig (1035 kPa)

C. The Contractor shall be required to furnish and install all materials necessary to complete the irrigation system in accordance with the best practice and to the full intent of the Drawings and Specifications.

D. The Drawings and Specifications must be interpreted and are intended to complement each other. The Contractor shall furnish and install all parts which may be required by the Drawings and omitted by the Specifications, or vice versa, just as though required by both.

E. Trench excavation, backfilling and bedding materials, together with the testing of the completed installation, shall be included in this work and shall be as specified in Division 31 Section, EARTH MOVING.

F. The work shall be constructed and finished in every respect in a good, workmanlike and substantial manner, to the full intent and meaning of the Drawings and Specifications. All parts necessary for the proper and complete execution of the work, whether the same may have been specifically mentioned or not, or indicated on the Drawings, shall be done, or furnished in a manner corresponding with the rest of the work as if the same were specifically herein described.

1.9 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Verify that irrigation system piping may be installed in compliance with original design and referenced standards.

1.10 SEQUENCING AND SCHEDULING

A. Maintain uninterrupted water service to any public amenities. Arrange for any temporary water shutoff, if required, with Landscape Architect.

B. Notify all municipal departments and/or public utility owners concerned, of the time and location of any work which may affect them. Cooperate and coordinate with them in the protection and/or repairs of any utilities.

C. Provide temporary storage of pipe and other materials, in such manner as to prevent damage, and to maintain them in "new" condition until they are incorporated into the work.

D. Provide temporary support, adequate protection and maintenance of all structures, drains, sewers, and other obstructions encountered. Where grade or alignment is obstructed, the obstruction shall be permanently supported, relocated, removed, or reconstructed as directed by the Landscape Architect.

E. Coordinate with General Contractor to provide sleeves for irrigation water and electrical connections for irrigated areas. Provide Shop Drawings for sleeve layout, demonstrating coordination of irrigation with landscape work and finish paving work.

PART 2 – PRODUCTS

2.1 GENERAL

A. The materials listed below establish a level of quality.

2.2 PIPING - PVC - MAIN LINE PIPING IN LANDSCAPE AREAS

A. All piping for main lines from building to zone control valves 3 inch and smaller, shall be PVC-200, Class-200, Type 1-1120, SDR 21, CS-256-63, 200-psi as manufactured by Cresline, Slone Triangle or approved equal. No substitutions of smaller pipe sizes will be permitted, but substitutions of larger sizes may be approved. All pipe damaged or rejected because of defects shall be removed from the site at the time of said rejections. Sleeves shall be installed for all irrigation pipe under non-soil areas and, where indicated on the Drawings. Minimum pipe sleeve size shall be 3-inch. PVC plastic, minimum Class 160 water pipe shall be used.

B. Fittings for PVC pipe, sizes 3 inch and smaller, shall be Schedule 80 solvent weld PVC fittings in accordance with ASTM D 2467, as manufactured by Dura, Lasco, Spears or approved equal.

C. PVC solvent shall be NSF approved, for Type I and Type II PVC pipe, and Schedule 80 fittings. Cement is to meet ASTM D2564 and FF493 for potable water pipes. PVC solvent cement shall be used in conjunction with the appropriate primer.

D. All nipples to be schedule 80 PVC.

E. Main line piping and wiring shall be within a Schedule 40 PVC pipe sleeve under pavement in park and a Schedule 80 PVC pipe under roads.

2.3 PIPING: POLYETHYLENE - ZONE LINE PIPING IN LANDSCAPE AREAS

A. All piping for zones lines from control valves to spray and rotary irrigation heads shall be polyethylene. Pipe in sizes 1-1/2 inches and below shall be polyethylene (PE-3408) pipe, NSF approved, SDR 15, Type III, Grade 3, Class C conforming to ASTM D2239, with a minimum pressure rating of 100 psi as manufactured by HYCOA, Blueflex, Oil Creek or approved equal.

B. Fittings for polyethylene pipe shall be insert PVC or Nylon type fitting. Fittings shall conform to NSF standards and be attached with two (2) stainless steel clamps on each barb. Fittings shall be per ASTM D2609. Contractor shall provide all proper male adapter x insert fittings and PVC adapter x insert fittings to complete the system. Fittings shall be as manufactured by Sloan, Spears, or Cresline or approved equal. Stainless steel clamps shall be as manufactured by Lox-On, Ideal, Lasco, or approved equal.

C. Zone line piping and wiring shall be within a Schedule 40 PVC pipe sleeve under pavement in park and a Schedule 80 PVC pipe under roads.

2.4 JOINING MATERIALS

A. Solvent Cement: ASTM F 656 primer and ASTM D 2564 solvent cement in color other than orange.

B. Solder: ASTM B 32, Alloys Sn95 and E.

C. Gaskets and Fasteners for Metal and Metal-to-Plastic Flanged Joints: ASME B16.21, nonmetallic, asbestos-free, flat, 1/8 of an inch thickness gaskets and ASME B18.2.1, carbon steel bolts, nuts, and washers.

D. Gaskets for Plastic Flanged Joints: Materials recommended by plastic pipe and fittings manufacturer.

2.5 ELECTRIC CONTROL VALVES: ROTARY & SPRAY HEADS

A. Electric control valve shall in accordance with Town standards.

B. The valve must have an automatic mechanical self-cleaning integral control system and must be slow closing to ensure smooth and shock free operation.

C. The electric control valve shall be equipped with a corrosion proof solenoid constructed of stainless steel and molded in epoxy resin to form one integral unit which is suitable for 24 volt operation.

D. The electric control valve shall be internal diaphragm and disassembly guided by a stainless steel stem in all positions.

E. All electric control valves shall be equipped with a control stem capable of reducing a higher inlet flow to a constant lower flow regardless of supply fluctuations.

F. All electric control valves shall be serviceable from the top without removing the valve body from the system.

G. All electric control valves shall have the capability of manual operation.

2.6 VALVE BOXES

A. Valve boxes shall be fabricated from a durable plastic material resistant to weather, sunlight, and chemical actions of soil. They shall be green in color. The cover shall be capable of sustaining a load of 1,500 psi. Valve box extensions shall be by the same manufacturer as the valve box. All valve boxes shall be as manufactured by Ametek, Carson, Brooks or approved equal. All valve boxes shall have a lockable cover.

B. Cover shall be marked as to contents: Valve, splice, etc.

2.7 SPRINKLER HEADS

A. Rotary Sprinkler 11 feet to 25 feet radius:

1. Rotary Sprinkler Heads for irrigation shall be as manufactured by Hunter equipped with drain check valve, quick snap nozzles, 40-360 adjustable or 360 degree arc and ratcheting riser. Nozzle shall be as necessary to complete the work. Sprinklers shall have a one hundred percent (100%) warranty for two years against defects in workmanship.
2. Radius shall be adjusted from 17 feet to 29 feet as necessary to provide head to head coverage. All irrigation heads shall have a final adjustment in place near project completion in order to maximize correct coverage.
3. Construction: Housing and cover shall be durable, high impact cycolac plastic. Sprinkler shall be fabricated brass, stainless steel and cast bronze. Sprinkler shall close completely when inoperative with a retraction spring of approximately 3 pounds force, and when closed there shall be no top openings to allow entry of foreign matter. All parts shall be replaceable from above ground without removing sprinkler.
4. Pop up heights shall be as follows. Sprinkler heads located in lawn areas shall have a 4 inch pop up height. Sprinkler heads located in ground cover areas shall have a 12-inch pop up height.
   a. Standard Nozzles Automatic Pop-up Nozzles shall have the capability or a 25% reduction in radius throw and shall be:
      i. 27’ Radius 0.80 GPM @ 25 PSI
      ii. 31’ Radius 1.55 GPM @ 30 PSI
      iii. 35’ Radius 2.58 GPM @ 30 PSI
   b. Low Angle Nozzles Automatic Pop-up Nozzles shall have the capability or a 25% reduction in radius throw and shall be:
      i. 23’ Radius 0.75 GPM @ 30 PSI
      ii. 25’ Radius 1.02 GPM @ 30 PSI
      iii. 25’ Radius 2.21 GPM @ 30 PSI

B. Automatic Pop-up Spray Heads:

1. Spray Heads shall be as manufactured by Hunter.
2. Construction: Housing and cover shall be durable, high impact cycolac plastic. Sprinkler shall be fabricated brass, stainless steel and cast bronze. Sprinkler shall close completely when inoperative with a retraction spring of approximately 3 pounds force, and when closed there shall be no top openings to allow entry of foreign matter. All parts shall be replaceable from above ground without removing sprinkler.
3. Automatic Pop-up Spray Nozzles shall be:

a.	6-8’ Radius	1.30 GPM @ 30 PSI	full circle
b.	9’ Radius	2.10 GPM @ 30 PSI	full circle
c.	11’ Radius	3.00 GPM @ 30 PSI	full circle
d.	5’ Bubbler	1.50 GPM @ 30 PSI	full circle

4. Nozzle patterns for quarter, third, half, two thirds, three quarters, and full circles shall be as necessary to complete the work. Nozzle changes which are necessary to make the distribution pattern (precipitation rate) more even shall be considered as an incidental item and part of this work.
5. Shrub areas shall primarily use the 4-inch Rainbird1800 pop-up body. Ground cover areas shall use the 12-inch Rainbird 1800 pop-up body.
6. Irrigation Head Pattern & Coverage: Irrigation heads shall provide coverage for all turf, groundcover, shrub, and tree areas. Spray patterns shall be laid out so as not to wet adjacent pavement areas. All heads shall have 100% (head to head) coverage for 6 feet, 8 feet, 9 feet and 11 feet radius.
7. Operation: The fixed orifice nozzles shall provide fixed flows and areas of coverage at rated pressure requirements in both full-circle and part-circle types. Part-circle nozzles shall water fractional portions of a circle in 10° increments between 60° and 270° as required. Flow discharge of part-circle nozzles shall be directly proportional to the arc covered expressed as a percentage of a full-circle of the same radius, i.e. a half circle 50% of a full circle, etc.; and this ratio shall not be exceeded by more than 15%.

2.8 SPRINKLER RISERS

A. Risers for irrigation Spray heads shall be thick wall poly pipe #850-01 as manufactured by Toro or approved equal (also called "Funny Pipe") shall be used to connect the pop-up sprinklers to the zone lines. Toro's barbed insert x male (3/8 inch x 3/4 inch) ells (2 per sprinkler unit) shall be used. One Lox-On clamp shall be used for each barbed connection. Zone line nipples shall be sized as necessary. 12 inches of thick wall poly pipe will be needed for each unit connection.

B. Risers for irrigation Rotary heads in lawn areas shall be connected to the lateral pipeline by installing a five-elbow deluxe swing joint of PVC fittings and nipples as manufactured by DURA, RAINBIRD, TORO or approved equal. All 1-inch swing joint assemblies for sprinkler heads shall be pre-assembled units manufactured of Schedule 80 PVC material. All PVC swing joints shall be factory-assembled. All PVC swing joint assemblies and sprinklers attached shall be completely backfilled with sand to within 3 inches of final grade.

2.9 WIRING FOR ELECTRIC VALVES

A. Wiring: UL 493, solid copper conductor, insulated cable, suitable for direct burial.

1. Feeder Circuit Cables: Type UF, No. 12 AWG minimum, between building and controllers.
2. Low-Voltage, Branch Circuit Cables: Type UF, No. 14 AWG minimum, between controllers and automatic control valves. Jacket color is other than feeder-circuit-cable jacket color. Furnish cables with jackets of different colors for multiple cable installation in same trench.
3. Splicing Materials: Pressure-sensitive thermoplastic tape and other materials required to make specified connections.
4. An expansion curl should be provided within three feet of each wire connection to a solenoid, and at least every 100 feet of wire length on runs more than 100 feet in length. Provide at least five turns of wire around a rod or pipe one inch or more in diameter.
5. All wiring shall be grounded.

2.10 DRAINAGE BACKFILL

A. Well-drained backfill shall consist of 3/4 of an inch crushed stone, as specified in Division 31 Section, EARTH MOVING, and provided under this Section.

2.11 CONCRETE FOR THRUST BLOCKS

A. Concrete for thrust blocks shall be 4,000 psi, 3/4 of an inch aggregate cement concrete.

PART 3 - EXECUTION

3.1 GENERAL CONSTRUCTION METHODS

A. The workmanship shall be first-class in every respect and neat in appearance. All work shall meet the requirements of the local codes, and other authorities having jurisdiction over the work.

1. For final improvements which are already in place, the irrigation contractor shall core drill or jack for all pipes and wires less than 35 feet in length so that new pavement will not be cut and patched. Existing paved areas in which the subbase and base, or pedestals, and paving are removed shall be replaced with material of equal quality, by the Contractor doing the original work. Irrigation Contractor shall be held responsible for repair work.
2. Planting soil mix encountered within the limits of trench excavation for irrigation mains and branch lines shall be carefully removed to the lines and depths established by the Landscape Architect and stockpiled for subsequent replacement in the trench from which it is excavated. Such removal and replacement of the quantities of loam shall be considered incidental to the cost of the irrigation system and no additional compensation will be allowed. Should planting occur before the installation of the irrigation system, all plants shall be restored to original growth and vitality.
3. All excavation and backfill operations shall conform to the Drawings.
4. The system may be "blown out" for maintenance purposes. Prior to placing pipe, the trench shall be graded and prepared to provide a firm and uniform bearing throughout the entire length of the pipe barrel. During backfill operations the pipe shall be rigidly supported so that no movement of or damage to the pipe or joints will result.
5. All pipe shall be cut straight and true. After cutting, the ends shall be reamed out to the full inside diameter of the pipe.
6. The Contractor shall provide all copper adapter X insert and insert X PVC adapter fittings that may be required as well as other adapter fittings that may be required to complete the system.

7. Foreign material shall be prevented from entering the irrigation system during installation. Immediately prior to assembling, all pipes, valves and fittings shall be cleaned. All unattached ends of pipe, fittings and valves shall be plugged or capped pending attachment of additional pipe or fittings. All lines shall be thoroughly flushed out prior to attachment of terminal fittings.
8. Before any portion of the pipeline is approved, pipe shall be tested in accordance with the requirements herein.
9. All wire required to connect the solenoid valves to the irrigation controller shall be installed in accordance with the requirements specified under this specification. Wire connections shall be made using solderless connectors. The work shall be done as part of this Section.

B. All main line pipe and fittings shall be blocked with an adequately sized thrust block as per ASAE Standard S376.1 and as depicted in the details. Blocking shall be in accordance with pipe and fitting manufacturer's recommendations. Thrust blocks shall be installed against undisturbed soil in all cases. Concrete thrust blocks shall utilize 3000 psi concrete mixture. Bricks, stones, boulders, etc. will not be accepted as thrust blocks or thrust blocking material. Contractor to supply all material needed for thrust blocking.

3.2 PREPARATION

A. Set stakes to identify proposed sprinkler locations. Obtain Landscape Architect’s approval before excavation.

3.3 EARTHWORK

A. Comply with all excavation, trenching, and backfilling requirements specified in Division 31 Section, EARTH MOVING and as required by local building codes.

3.4 PAVING WORK

A. Install piping in sleeves where crossing pavements.

1. Anticipate required sleeving and conduit locations and coordinate with General Contractor installing final improvements.
2. Install piping sleeves by boring or jacking under existing paving, where required.

3.5 JOINT CONSTRUCTION

A. Threaded Joints: Thread pipes with tapered pipe threads according to ASME B1.20.1, apply tape or joint compound, and apply wrench to valve ends into which pipes are being threaded.

B. Copper Tube and Fittings, Soldered Joints: Construct joints according to CDA No. 404/0 Products Handbook "Copper Tube Handbook."

C. Polyvinyl Chloride (PVC) Piping Gasketed Joints: Construct joints between underground AWWA-type, cast-iron valves and NPS PVC pipe; with elastomeric seals that fit pipe diameter and valve ends; and lubricant, according to ASTM D 3139.

D. Polyvinyl Chloride (PVC) Piping Solvent-Cemented Joints: Construct joints according to ASTM D 2672 and ASTM D 2855.

1. Handling of Solvent Cements, Primers, and Cleaners: Comply with procedures in ASTM F 402 for safe handling when joining plastic pipe and fittings with solvent cements.

E. Dissimilar Materials Piping Joints: Construct joints using adapters that are compatible with both piping materials, outside diameters, and system working pressure. Refer to "Piping Systems - Common Requirements" Article for joining dissimilar metal piping.

3.6 PIPING SYSTEMS – COMMON REQUIREMENTS

A. General Locations and Arrangements: Drawings indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, and in

other design considerations. Install piping as indicated, except where deviations to layout are approved on coordination drawings.

B. Install piping at a uniform slope of 6 inches per 100 feet minimum, down to drain points.

C. Install components having pressure rating equal to or greater than system operating pressure.

D. Install piping free of sags and bends.

E. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

F. Install fittings for changes in direction and branch connections.

G. Piping Connections: Except as otherwise indicated make piping connections as specified below.

1. Install unions, in piping 2 inches and smaller, adjacent to each valve and at final connection to each piece of equipment having 2-inch or smaller threaded pipe connection.
2. Install flanges, in piping 2-1/2 inches and larger, adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.
3. Install dielectric fittings to connect piping of dissimilar metals.

3.7 PIPING INSTALLATION

A. Install underground polyvinyl chloride (PVC) plastic pipe according to ASTM D 2774.

B. Lay piping on solid subbase, uniformly sloped without humps or depressions.

1. Slope circuit piping down toward drain valve minimum of 2 inch in 10 feet.
2. Install polyvinyl chloride (PVC) plastic pipe in dry weather when temperature is above 40 deg F. Allow joints to cure at least 24 hours at temperature above 40 deg F before testing, unless otherwise recommended by manufacturer.

C. Drain Pockets: Excavate to sizes indicated. Backfill with crushed stone, drain material to twelve inches below grade. Cover drain material with sheet of ASTM D 226, Type II, asphalt-saturated felt and backfill remainder with excavated material.

D. Minimum Cover: Provide following minimum cover over top of buried piping:

1. Pressure Piping: Minimum of 36 inches below finished grade.
2. Zone Piping: 12 inches.
3. Drain Piping: 12 inches.
4. Sleeves: 18 inches.
5. Main Piping: 18 inches.

E. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed, by tunneling, boring, or jacking.

F. Install piping under sidewalks and paving in sleeves.

3.8 VALVE INSTALLATION

A. Valves: Install underground valves in valve boxes.

B. Valves shall be installed as nearly as possible in the positions indicated on the Drawings consistent with the convenience of operating the hand wheel or wrench. All valves shall be carefully erected and supported in their respective positions free from all distortion and strain or appurtenances during handling and installation. All material shall be carefully inspected for defects in workmanship and material, all debris and foreign material cleaned out of valve openings and seals, all operating mechanisms operated to check their proper functioning, and all nuts and bolts checked for tightness. Valves which do not operate easily or are otherwise defective shall be repaired or replaced at the Contractor's expense.

C. Valves shall not be installed with stems below the horizontal.

D. Valves shall be set plumb and supported adequately in conformance with instructions of the manufacturer.

3.9 ELECTRIC CONTROL VALVES

A. Zone control valves shall be installed as nearly as possible in the positions indicated on the Drawings and in accordance with the manufacturer's recommendations.

B. Control valves in pipelines shall be installed in valve boxes extending from grade to valve body, with a minimum of one foot and six inches cover measured from finish grade to top of valve stem. Valve boxes shall be arranged for easy adjustment and removal.

3.10 SPRINKLER INSTALLATION

A. Sprinklers: Flush circuit piping with full head of water and install sprinklers after hydrostatic test is completed.

1. Install sprinklers at heights indicated.
2. Locate part-circle sprinklers to maintain a minimum distance of 4 inches from walls and 2 inches from other boundaries, unless otherwise indicated.

3.11 BEDDING AND BACKFILL MATERIALS

A. The installation of bedding and backfill materials shall conform to the requirements of Earthwork specification and shall be provided as part of this Section.

3.12 TESTING

A. Prior to the completion of the work, the Contractor will cause the entire irrigation system to be tested in the presence of the Landscape Architect. The test will clearly demonstrate that each and every part of the system functions as specified or intended.

1. Request the presence of the Owner in writing at least forty-eight (48) hours in advance of testing.
2. Testing will be accomplished at the expense of the Contractor and in the presence of the Landscape Architect.
3. Center load piping with small amount of backfill to prevent arching or slipping under pressure.
4. Apply a continuous and static water pressure of 60 psi when welded plastic joints have cured at least twenty-four (24) hours and with the risers capped as follows:

    a. Main lines and submains will be tested for twelve (12) hours.
    b. Lateral lines will be tested for two (2) hours.

5. Repair leaks resulting from tests.

B. Part circle spray patterns will be adjusted as required to provide complete and adequate coverage of the areas to be watered.

C. Automatic and manual features of the irrigation controller will be tested for satisfactory operation. The controller will automatically operate each zone in the irrigation system for not less than one-half hour during which time each remaining zone will be added to the automatic cycle by means of manual control switches. If unsatisfactory performance of the controller develops the condition will be corrected and the testing procedures will be repeated until satisfactory operation is obtained.

3.13 CLEANING AND ADJUSTING

A. Flush dirt and debris from piping before installing sprinklers and other devices. Nozzles & screens shall be removed, cleaned, and reinstalled in heads not functioning properly.

B. Adjust automatic control valves to provide flow rate of rated operating pressure required for each sprinkler circuit.

C. Adjust settings of controllers and automatic control valves.

3.24 GUARANTEE

A. The Irrigation Subcontractor will give the Owner a written guarantee to make good any and all faults and defects in the irrigation system due to defective or improper materials or workmanship that may appear within one year from the date of final acceptance by the Landscape Architect and he/she will make all changes within the guarantee period which are required to put the system in proper condition and operation, without cost to the Owner.

END OF SECTION

SECTION 32 90 00: PLANTING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SUMMARY

A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to perform all planting work and related items as indicated on the Contract Documents and as specified in this Section and includes, but is not limited to, the following:

1. Planting trees, shrubs, perennials, bulb, and groundcovers
2. Planting bed preparation
3. Planting maintenance
4. One-year guarantee period for all plants
5. Providing and placing backfill mix

1.3 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 31 Section – EARTH MOVING
2. Division 32 Section – PLANTING SOIL
3. Division 32 Section – TURF & GRASSES
4. Division 32 Section – IRRIGATION – ADD ALTERNATE

1.4 REFERENCES

A. The following standards shall apply to the work of this Section.

1. Michael Dirr's *Manual of Woody Landscape Plants* (latest revision 2009), or Michael Dirr's *Encyclopedia of Trees and Shrubs* (2011)
2. Tree and Shrub Transplanting Manual, E.B. Himelick, 1991, International Society of Arboriculture
3. American National Standards Institute (ANSI):
   A300 Tree Care Industry Association (TCIA)
   Z60.1 American Standard for Nursery Stock, latest edition, published by American Nursery & Landscape Association, (ANLA)

1.5 SUBMITTALS

A. Submit proof of landscape contractor's experience to the Landscape Architect in accordance with QUALITY ASSURANCE paragraph of this Section, PLANTING.

B. At least 30 days prior to ordering materials, the Contractor shall submit to the Landscape Architect representative samples, certifications, manufacturer's product data and certified test results for materials as specified below. No materials shall be ordered or delivered until the required submittals have been reviewed and approved by the Landscape Architect. Delivered materials shall closely match the approved samples. Approval shall not constitute final acceptance. The Landscape Architect reserves the right to reject, on or after delivery, any material which does not meet these Specifications.

C. Material Sampling and Testing:
1. Material Sampling and Testing of Loam Borrow from Off-Site Sources shall be specified, performed, and paid for under the work of the Division 32 Section, PLANTING SOIL, of this

Specification. Testing of the off-site loam borrow shall occur in place after the loam has been spread and represents a second testing of the off-site loam borrow. The first sampling and testing shall have occurred prior to delivery of the loam as specified, performed, and paid for under the work of the Division 32 Section, PLANTING SOIL, of this Specification. Additional sampling and testing of delivered and stockpiled loam or delivered and spread loam to verify that it meets the test results submitted for approval under the Division 32 Section, PLANTING SOIL, shall not be abrogated by the language of this Division 32 Section, PLANTING.

2. Material Sampling and Testing of On-Site Loam: On-site loam shall be sampled and tested as specified, performed, and paid for under the Division 32 Section, PLANTING SOIL, of this Specification.
3. Planting Mulch: Submit a one cubic foot sample.
4. Anti-desiccant: Submit manufacturer's product data.
5. Peat: Submit a one cubic foot sample and manufacturer's certification of contents.
6. Tree Staking System: Submit manufacturer's product data of system.
7. Soil Additives: Submit manufacturer’s product data for all soil additives needed to amend a specific soil in order to meet the requirements of this Section, PLANTING.

1.6 EXAMINATION OF CONDITIONS

A. All areas to be planted shall be inspected by the Contractor before starting work and any defects such as incorrect grading or inadequate drainage shall be reported to the Landscape Architect prior to beginning this work.

B. The Contractor shall be solely responsible for judging the full extent of work requirements involved, including but not limited to the potential need for storing and maintaining plants temporarily and/or re-handling plants prior to final installation.

C. All plants are the full responsibility of the Contractor between the time of digging at the nursery and final acceptance.

1.7 QUALITY ASSURANCE

A. Qualification of Landscape Contractor: The work of this Section, PLANTING, shall be performed by a landscape contracting firm which has successfully installed work of a similar quality, schedule requirement, and construction detailing with a minimum of five years’ experience. Proof of this experience shall be submitted per SUBMITTALS paragraph of this Section, PLANTING.

PART 2 – PRODUCTS

2.1 LOAM BORROW

A. Loam borrow for planting shall be specified, provided, installed and paid for under the work of the Division 32 Section, PLANTING SOIL, of this Specification.

2.2 SOIL ADDITIVES

A. Soil additives shall be specified, provided, installed, and paid for under Section, PLANTING SOIL, of this Specification.

B. All trees, shrubs, groundcovers, and perennials shown to be planted in areas with compacted soils that are not otherwise noted to be de-compacted shall be scarified to the depth noted on the planting details in the Contract Drawings prior to planting and planting soil and amendments added.

2.3 GRADES AND STANDARDS OF PLANTS

A. The Contractor shall furnish all plants shown on the Contract Documents, as specified, and in quantities listed on the PLANT SCHEDULE. No substitutions will be permitted, without written approval by the Landscape Architect. All plants shall be nursery grown unless specifically authorized to be collected as noted on the PLANT SCHEDULE.

B. All plants shall be typical of their species or variety and shall have a normal habit of growth and be legibly tagged with the proper name. Only plant stock grown within Hardiness Zones 1 through 6b, as established by the USDA Plant Hardiness Zone Map, latest edition, will be accepted.

C. Plants shall be in accordance with ASNS Standards of the American Nursery & Landscape Association except as noted in this Section, PLANTING. Botanical plant names shall be in accordance with plant designations included in Dirr's *Manual of Woody Landscape Plants*.

D. If, at any time during the performance of the Contract, any plant shows signs of graft incompatibility, as determined by the Landscape Architect, then the tree or shrub and all other similarly grafted plants of the same Genus/Species/Variety shall be rejected and removed from the site. Visual symptoms of graft incompatibility as cause for rejection include:

1. Development of over-growths by rootstock or scion resulting in the development of shoulders or inverted shoulders.
2. Suckering of the rootstock combined with poor growth or dieback of scion.
3. Any mechanical weakness between scion and rootstock.
4. Any marked difference in bark pattern and structure between scion and rootstock.

E. All deciduous trees shall meet the following standards:

1. Trees shall have a single, straight trunk, well formed, and sturdy. No part of the trunk shall be conspicuously crooked as compared with normal trees of the same variety.
2. Trees with multiple leaders shall conform to all standards noted in this Section, PLANTING for single leader trees and shall be accepted only as noted on the PLANT SCHEDULE.
3. All pruning wounds shall show vigorous bark on all edges at the time of harvest. Trees shall be free from all signs of pest and disease damage. The trunk shall be free from sun scald, frost cracks, and wounds resulting from abrasions, fire, animal damage, or other causes.
4. Pruning scars within the crown of any tree shall be clean cut and shall leave no protrusion beyond the branch collar.
5. All trees shall have healthy, vigorous leaves or needles of normal size, color, shape, and texture for the particular species and variety.
6. Deciduous shade trees and deciduous flowering trees shall have fall color typical for their species and variety.
7. Unless otherwise indicated on the PLANT SCHEDULE, the height and spread of deciduous shade trees shall be the minimum requirements.
8. Take caliper measurements for deciduous trees 6 inches above ground level up to and including 4 inches caliper size and 12 inches above ground for larger sizes.
9. No deciduous tree shall be pruned after the Landscape Architect has tagged the plant in the nursery except as directed by the Landscape Architect.
10. Unless otherwise noted on the PLANT SCHEDULE, shade trees for use in paved areas shall have no branches lower than 6 feet 6 inches from finish grade and no higher than 7 feet 6 inches from finish grade. Flowering trees for use in areas away from pedestrian traffic shall have the first branch of their crowns no higher than 4 feet from finish grade.
11. Branching of all deciduous trees shall be best quality representatives of the species, cultivar or variety with lateral branching around the entire trunk to form a symmetrical tree for 80 percent to 100 percent of the tree's outer perimeter. All branches on deciduous trees shall meet the trunk at angles no less than 30 degrees and no greater than 90 degrees from the vertical.

F. Evergreen trees shall meet the following standards:

1. The height of the evergreen trees (measured from the trunk flair at the natural ground line of the tree to the midpoint of the terminal leader) shall be not less than the minimum size designated on the PLANT SCHEDULE.
2. No trees with double-leaders or twin-heads will be permitted.
3. Evergreen trees shall be of specified height with spread in proportion to height, as designated in ASNS Standards, and shall be well-branched to the ground.
4. All pruning wounds shall show vigorous bark on all edges at the time of harvest.
5. Terminal and top whorl buds of all evergreen trees shall be in healthy and whole condition at the time of harvest.
6. No evergreen tree shall be pruned after the Landscape Architect has tagged the tree in the nursery except as directed by the Landscape Architect.

7. All trees shall have healthy, vigorous leaves or needles of normal size, color, shape, and texture for the particular species and variety.

G. All shrubs shall meet the following standards:

1. All shrubs shall be healthy and vigorous plants which are very well shaped, heavily branched, densely foliated, and true to form for the variety.
2. Canes or Trunk(s) and Branches:
   a. Well-formed and sturdy.
   b. Branching shall be uniformly distributed close to the ground.
   c. Scars shall be free of rot and not exceed one-quarter the diameter of the wood beneath in greatest dimension unless completely healed (except pruning scars).
   d. Pruning scars shall be clean cut and shall leave little or no protrusion from the trunk or branch.
   e. Graft unions shall be completely healed.
   f. No suckers or water sprouts.
   g. Contain no dead wood.
   h. Free of cracks, splits, or cambium peeling.
3. No shrub with pest or mechanical damage will be accepted.
4. Shrubs shall show no signs of frost or winter damage to the foliage. Foliage shall not be in a state of drought stress. Leaves or needles shall show no signs of wilt or desiccation due to weather stress at any season of the year.

H. All groundcover plants and vines shall meet the following standards:

1. Groundcover plants and vines shall be of size, pot size, age, and condition listed in the PLANT SCHEDULE. When indicated on the PLANT SCHEDULE, the number of runners and the lengths of the runners of vines shall be minimums.
2. Plants shall be healthy, free of insects, and diseases.

I. All bulbs shall meet the following standards:

1. Top size
2. Fresh, firm and from current year crop
3. Bone meal shall be natural bone meal with approximate 6-12-0 N-P-K fertilizer properties.

J. All perennials shall meet the following standards:

1. Perennials shall be listed in the PLANT SCHEDULE.
2. Perennials shall be healthy and well cared for, with no evidence of insects or diseases present. Insect-ridden or diseased plants shall be rejected. Plants shall have a deep green foliage and dense, compact growth. Perennials shall have multi-stemmed bases and shall be two year potted stock minimum, one year in cutting bench and one year in pots.

2.4 ROOT SYSTEMS FOR ALL PLANTS

A. Each plant shall have an extensive, symmetrically balanced fibrous root system. Any root ball which shows signs of asymmetry, girdling, injury, or damage to the root system shall be rejected.

B. Curling or spiraling of the roots along the walls of rigid containers will not be accepted. Curling, spiraling or girdling roots within balled and burlapped material will not be accepted.

C. All parts of the fibrous root system of all plants shall be moist and fresh with a white color when washed of soil. When the plant is removed from the container, the visible root mass shall be healthy with white root tips. The root systems of all plants shall be free of disease, insect pests, eggs, or larvae.

D. All trees which are not grown in containers must be moved with the root systems as solid units with balls of earth firmly wrapped with untreated 8 ounce natural, biodegradable fabric burlap, firmly laced with stout, natural biodegradable cord or twine. The base of the tree trunks shall be wrapped with a protective burlap layer, surrounded by a cardboard trunk protector, and loosely tied with twine.

E. The diameter and depth of the balls of earth must encompass the fibrous and root feeding system necessary for the healthy recovery of the plant. Minimum root ball diameters and depths shall be in accordance with ASNS standards.

F. No plants shall be loose in the container.

G. Container grown plants which have roots growing out of the container will be rejected.

2.5 PLANTING SOIL MIX

A. Planting soil mix shall be an approved loam borrow specified, provided, installed, and paid for under the Division 32 Section, PLANTING SOIL, of this Specification and that has been pH adjusted according to particular planting applications and improved through the addition of organic matter as directed below. Planting loam shall conform to the following pH levels:

1. Planting soil mix for general planting of non-acid loving plants shall have a true pH value of 6.0 to 6.5. Planting soil mix shall be amended by the Contractor at his own expense to the proper pH range by mixing with dolomitic limestone as specified, provided, installed, and paid for under the Division 32 Section, PLANTING SOIL.
2. The amount of either sulfur or limestone required to adjust the planting soil mix to the proper pH range shall be approved by the Landscape Architect on the basis of soil tests as specified, provided, installed and paid for under the Division 32 Section, PLANTING SOIL, of this Specification.
3. In those areas indicated on the Contract Documents, augment planting soil mix with 10 percent gypsum. Thoroughly premix gypsum into planting soil mix prior to commencing the planting operations. Gypsum shall be specified, provided, installed, and paid for under the Division 32 Section, PLANTING SOIL, of this Specification.

2.6 MULCH

A. Bark Mulch: Mulch shall be high quality, double-ground, premium bark mulch of 70 percent hemlock bark with the balance spruce and pine bark. Mulch shall have been aged for a minimum of six months and not longer than two years. Bark mulch shall be shredded to a uniform size; free of dirt, debris and foreign matter; with pieces no thicker than one-quarter inch. Mulch must be free of stringy material or chunks over 3 inches in size and shall not contain, in the judgment of the Landscape Architect, an excess of fine particles. Submit sample for the Landscape Architect’s approval.

2.7 WATER

A. The Contractor shall be responsible to furnish his own supply of water to the site at no extra cost. If possible, the Owner shall furnish the Contractor upon request with an adequate source and supply of water at no charge. However, if the Owner's water supply is not available or not functioning, the Contractor shall be responsible to furnish adequate supplies at his own cost. All work injured or damaged due to the lack of water, or the use of too much water, shall be the Contractor's responsibility to correct. Water shall be free from impurities injurious to vegetation.

B. Watering bags shall be installed around each deciduous, evergreen, and ornamental tree. If trees are staked, the watering bag shall be installed around one of the stakes so as to prevent the trunk of the tree from being damaged by wet conditions and to encourage root growth. Watering bags shall be capable of releasing 20 gallons of water over a 24 hour period.

1. Contractor shall remove the water bags at Final Completion or remain for future removal at the Owner’s discretion.

2.8 ANTI-DESICCANTS

A. Anti-desiccants shall be emulsions or other materials which will provide a protective film over plant surfaces permeable enough to permit transpiration and specifically manufactured for that purpose. Manufacturer of anti-desiccant shall be subject to the Landscape Architect's approval and shall be used only after approval by the Landscape Architect. Anti-desiccant shall be delivered in containers of the manufacturer and shall be mixed and applied according to the manufacturer's instructions.

PART 3 – EXECUTION

3.1 PLANTING

A. Furnishing and planting of plant material shall include, but shall not be limited to, the digging of planting pits and plant beds, amendment of loam as required to produce planting soil mix, provision of soil additives required to adjust for pH requirements of specific plants, furnishing the plants as specified as well as the labor of planting, fertilizing, and maintenance.

B. Prior to spreading of loam, subgrades shall have been tested to determine if they are too compact to drain water as specified, performed, and paid for under the work of Division 32 Section, PLANTING SOIL, of this Specification.

C. As noted on plans and as directed by the Landscape Architect, Contractor shall air spade tree and shrub planting beds prior to adding new topsoil, or soil amendments. See Division 32 Section, SOIL RESTORATION for additional information.

D. The Contractor shall locate plant material sources and ensure that plants are shipped in timely fashion for installation.

E. Contractor shall locate all existing underground utilities that are within 10 feet of the proposed planting pits and notify the Landscape Architect of any conflicts prior to digging plant pits.

F. Seasons for Planting:

1. Spring:
   Deciduous materials - March 21 through May 1;
   Evergreen materials - April 15 through June 1.

2. Fall:
   Deciduous materials - October 1 through December 1;
   Evergreen materials - August 15 through October 15.

   ** Bulbs can only be planted in the fall.

G. Plant Material Inspection:

1. At a minimum of 21 days after the Notice to Proceed, the Contractor shall identify the supplying nursery or nurseries for approval. At least one month prior to the expected planting date, the Contractor shall request that the Landscape Architect provide a representative to select and tag stock to be planted under this Section, PLANTING. The Contractor shall pay for the transportation, subsistence, and overnight accommodations, if necessary, for the Landscape Architect's representative during the period of time required to select and tag the plant material.
2. The Contractor shall be responsible to certify the availability of quality plants in specified sizes from his/her sources of supply prior to requesting that the Landscape Architect make plant source inspections. In the event that plants at the inspection location are found to be unavailable or of insufficient size, the Contractor shall be liable to reimburse the Owner for all costs of the Landscape Architect's hourly services which are incurred during unproductive inspection trips.
3. Unless specifically designated otherwise, a representative of the Contractor shall accompany the Landscape Architect on all plant material selection field trips.
4. All trees for the project shall be individually tagged for approval with the Landscape Architect's seals, and no trees shall be accepted for delivery to the site without such seals.
5. Plants to be inspected shall be in locations and conditions that allow direct and un-obscured inspection by the Landscape Architect. Harvested trees held in storage shall not have branches tied up. Harvested trees shall not have trunks obscured by burlap, cardboard trunk protection, or other devices that would otherwise obscure inspection. In the event that branches are tied up, trunks are obscured by burlap or cardboard trunk protection, or root flares hidden by burlap and twine and the Landscape Architect cannot inspect root flares, trunks or branching habit, the Contractor shall bear all responsibility and costs associated with tree rejection at a later date during the course of the Contract.

6. Inspection and approval of plants at the source shall not impair the right of subsequent inspection and rejection upon delivery to the site, or during the progress of the work if the Landscape Architect finds that plants do not meet the requirements of the PLANT SCHEDULE or this Contract, have declined noticeably due to handling abuse, lack of maintenance, or other causes. Cost of replacements, as required, shall be borne by the Contractor.
7. The City Arborist reserves the right to reject any plant material once delivered to the site.

H. Placement of Loam for planting soil shall be specified, performed, and paid for under the work of Section, PLANTING SOIL, of this Specification. Obtain Landscape Architects written approval of work of rough grading and finish grading prior to starting the work of planting.

I. Planting

1. Notify the Landscape Architect three working days prior to the proposed arrival of plant material on the site. If not planted within 24 hours of delivery to the site, all plants shall be maintained in an on-site nursery. Container grown shrubs stored on site shall be shaded from direct sunlight at all times and shall not be stored directly on paved surfaces. All plants delivered to the site and not planted within 24 hours of delivery shall have their root balls covered with mulch and shall be watered on a daily basis such that root balls are kept moist throughout.
2. Locations for all plants and outlines for planting areas shall be staked on the ground by the Contractor for approval by the Landscape Architect before any plant pits or plant beds are dug. Notify the Landscape Architect no less than 3 days prior to the desired date of inspection of staking to schedule site visit.
3. Circular plant pits shall not be required provided that the minimum dimension between the edge of the pit and the face of the rootball is not less than required by this Section, PLANTING.
4. All plant pits dug with a machine shall have the sides of the holes scraped with hand shovels to prevent glazing or compaction of the sides of the hole. Remove and stockpile excavated loam for reuse as backfill for plant pit. All subsoil excavated from the bottoms of planting pits shall be removed from the site.
5. Plant pits shall be dug to the dimensions shown on the Contract Documents.
   a. Plant pits for trees shall be a minimum three times greater in diameter than the diameter of the root ball. Place root ball directly on subgrade. Slope sides of tree pits at a 45 degree angle.
   b. Plant pits for trees and shrubs shall be dug to the depth of the rootball to be planted.
   c. Remove all soil from around the root flare of the stem of the plant and from the top of the rootball to determine the true depth of the rootball. All plants that have been planted and have root flares that are buried will be rejected.
6. All plant roots and earth balls must be damp and thoroughly protected from sun and wind from the beginning of the digging operation, during transportation, and at the site until the final planting.
7. Remove container plants from containers prior to planting.
8. Trees shall be placed in the center of plant pits, plumb, with the crown of their roots exposed and located above the surrounding finish grade.
9. Prior to completion of planting installations, remove rope and cut wire baskets from the top 1/3 of the root balls. Pull burlap away from the trunk or stem of the plant and cut burlap from the top one-third of the root balls.
10. Planting soil shall be backfilled with approved planting soil to the full depth of the planting pit or bed. Eliminate air pockets and compact the soil by flooding the tree pit or plant bed within 2 hours of planting installation. After water has drained from the planting pit or bed and planting backfill has dried enough additional planting soil shall be spread in pit or bed to bring the finished surface of the planting pit or bed to grades shown on the Contract Documents. A saucer shall be formed around each plant at a depth of 3 inches for trees.
11. Fertilizer shall be spread over the plant saucer or plant bed between the saucer and the edge of the rootball. Till the fertilizer into the soil to a depth of four inches prior to the placement of the planting mulch. Fertilizer shall be provided, spread, and paid for under the Section, PLANTING SOIL, of this Specification. Do not mulch until placement of the fertilizer has been verified by the Landscape Architect. Fertilizer application rates shall be as determined by soil testing, analysis, and testing laboratory recommendations specified, performed, and paid for under the Section, PLANTING SOIL, of this Specification.

J. All plants shall be watered immediately following planting as necessary to thoroughly moisten rootball and plant pit loam and thereafter shall be inspected frequently for watering needs and watered, as

required, to provide adequate moisture in the planting pit. The Contractor shall inspect tree pits 24 hours after initial watering to confirm that they are draining properly. If surface water or excessively saturated plant pit soils exist, the Contractor shall immediately notify the Landscape Architect. The Landscape Architect will recommend remedial measures based upon site conditions.

K. Keeping Trees Plumb

1. Contractor shall keep trees plumb and upright at all times.

L. Mulch material shall be placed over entire saucer areas of individual trees and shrubs and over the entire area of planting beds to a depth of 3 inches after settlement, not later than one week after planting. Do not apply mulch prior to the first watering of plant materials. Do not apply mulch prior to placement of surface applied fertilizer and verification of placement by the Landscape Architect.

1. Mulch shall not touch the trunks of trees. No mulch shall be placed within 2 to 3 inches of trunks.

M. The trunks of all deciduous trees over 1-1/2 inches in diameter shall be wrapped by the Contractor immediately after the inspection of the trees by the Landscape Architect. Wrapping shall extend from the ground line to the height of the second branches or to the height directed. The specified wrapping shall be wound spirally, starting from the base and overlapping 1-1/2 inches in order to shed water. Wrapping shall be securely taped to prevent loosening and unraveling. If trees are planted in springtime, do not apply any tree wrapping. If deciduous trees are planted in the autumn, wrap the trees and then remove wrapping the following spring.

1. Trees delivered to the site wrapped for protection shall be unwrapped at the site for inspection of the trunk by the Contractor and Landscape Architect.

N. Pruning

1. As directed by the Landscape Architect, each plant shall be pruned in accordance with the workmanship requirements of "Pruning Standards" for Class I, fine pruning, to preserve the natural character of the plant.
2. Tree pruning, as required, shall be undertaken to the full height of affected trees.
3. All dead wood or suckers and all broken or badly bruised branches shall be removed. Never cut a leader.

O. If planting is done after lawn preparation or installation, proper protection of lawn areas shall be provided. Any damage resulting from planting operations shall be repaired immediately at no cost to the Owner. Repair work shall be as specified and installed under the work of Section, TURF & GRASSES, of this Specification and paid for under this Section, PLANTING.

P. Absolutely no debris may be left on the site. Repair any damage to site as directed by the Landscape Architect, at no additional cost.

3.2 MAINTENANCE

A. Maintenance shall begin immediately after each plant is planted and shall continue for a minimum 90-day Monitoring Period within the growing season and until Final Acceptance.

1. The growing season is from April 1 to November 1.

B. Maintenance shall consist of keeping the plants in a healthy growing condition and shall include but is not limited to watering, weeding, cultivating, pruning, re-mulching, tightening, and repairing of guys, straightening of trees to a plumb position, removal of dead material, resetting plants to proper grades or upright position, and maintaining the planting saucer.

1. Plants shall be inspected for watering needs at least twice each week and watered to promote plant growth and vitality. The following watering rates assume that the soil is free draining. If the on-site conditions do not ensure a free draining soil, then notify the Landscape Architect in writing of this condition. Watering rates in free draining soils are presented here as guidelines to

ensure that the top six inches of plant bed soil remains moist at all times. Actual watering rates may vary depending upon soil conditions. Guideline rates shall be as follows:

Type of Plant/Size	Weekly Watering Rate
Deciduous Trees:	
1 - 1-1/2 in. caliper	40 gallons
1-1/2 - 2 in. caliper	54 gallons
2 - 2-1/2 in. caliper	61 gallons
2-1/2 - 3 in. caliper	70 gallons
3 - 3-1/2 in. caliper	80 gallons
Evergreen Trees:	
1 - 2 ft. height	25 gallons
2 - 3 ft. height	30 gallons
3 - 4 ft. height	35 gallons
5 - 6 ft. height	40 gallons
6 - 7 ft. height	45 gallons
7 - 8 ft. height	50 gallons
Shrubs:	
Up to 2 ft. height	10 gallons
2 - 4 ft. height	20 gallons
4 - 6 ft. height	30 gallons
Perennials	5 gallons

a. Water shall be applied by 1 inch diameter hose with an attached metering gauge.

2. For trees, apply water into the watering bag.
3. Stakes shall be kept plumb and neat in appearance. Guys, wires and anchoring cables shall be tightened and repaired weekly.
4. Individual plant pits shall be kept free of weeds, and mulch shall be replaced as required to maintain the specified layer of mulch. Individual pits shall be neat in appearance and maintained to the designed layout.
5. Plants that die during the maintenance period shall be removed and replaced by the Contractor within one week of notification and replaced during that growing season, unless directed otherwise by the Landscape Architect.
6. Spraying of insecticides or herbicides shall be done by State-licensed professionals. Spraying for insects, pests and diseases shall conform to the National Arborist Association Standards under the section entitled "Standards for Pesticide Application Operations", as currently adopted and as approved by the Landscape Architect. All insecticides, pesticides, and herbicides shall be EPA-approved and shall conform to the requirements of the Commonwealth of Massachusetts.
7. Work of pruning, fertilizing, spraying, and similar activities shall be undertaken only by Certified Arborists and licensed chemical applicators, as pertinent to the work being performed.

C. During the maintenance period, any decline in the condition of plantings shall require the Contractor to take immediate action to identify potential problems and undertake corrective measures. If required, the Contractor shall engage professional arborists and/or horticulturalists to inspect plant materials and to identify problems and recommend corrective procedures. The Landscape Architect shall be immediately advised of such actions. Inspection and recommendation reports shall be submitted to the Landscape Architect.

D. Contractor is responsible for watering the entire park for the duration of construction.

3.3 ACCEPTANCE

A. Upon completion of all planting work, the Contractor shall request in writing that the Landscape Architect formally inspect the planting work.

B. If plant materials and workmanship are acceptable, the Landscape Architect will issue a written Certificate of Conditional Acceptance to the Contractor.

C. Following the issuance of the Certificate of Conditional Acceptance to the Contractor, the Contractor shall maintain the plants for a minimum 90 day Monitoring Period. At the end of the Monitoring Period, the plant material will be inspected by the Landscape Architect to determine whether or not all planting work has been performed to the requirements of this Section, PLANTING.

D. Acceptance Standards at end of the Monitoring Period: If plant material is reviewed when it is in full leaf, leaves shall be plump with water with a shape indicative of the species and shall be free of insect, pest and disease damage. Twigs shall have living cambium for their full length. Twigs and branches shall have a full bud set for their full length, including terminal buds. Trunks and branches shall be free of frost cracks; sun scald; damage due to insects, pests, and disease; structural defects; and damage resulting from machinery or tools. Plant material inspected and reviewed when the plants are not in full leaf shall have twigs, branches and trunks meeting the above requirements. All plants regardless of the season of review shall have a minimum of 75 percent healthy, balanced branching structure with a healthy terminal leader(s) with viable terminal bud(s).

E. If any number of plants do not meet these Acceptance Standards at the time of inspection, or if in the Landscape Architect's opinion, workmanship is unacceptable, written notice will be given by the Landscape Architect to the Contractor in the form of a punch list, which itemizes necessary planting replacements and/or other deficiencies to be remedied. The Contractor's responsibility for maintenance of all plants shall be extended until replacements are made or other deficiencies are corrected. All plants that do not meet these Acceptance Standards shall be removed from the project within seven days of receipt of the punch list. Replacements shall conform in all respects to the Specifications for new plants and shall be planted in the same manner.

F. Following the correction of all Punch List deficiencies, the Contractor shall request in writing that the Landscape Architect formally inspect the planting work. If plant materials and workmanship are acceptable, the Landscape Architect will issue a written Certificate of Final Acceptance to the Contractor.

3.4 GUARANTEE

A. The date of the Certificate of Final Acceptance shall establish the commencement of the required one-year guarantee and establishment period for planting work.

B. During the guarantee period, Contractor shall replace dead/damaged plants at their expense.

C. At the end of the guarantee and establishment period, a final inspection will be held to determine whether any plant material replacements are required. Each plant shall be plumb, shall have a character that is natural for its species as determined by the Landscape Architect, and shall conform to the Acceptance Standards described in this Section, PLANTING. Plants found to be unacceptable shall be removed promptly from the site and replaced according to this Section, PLANTING. A final inspection will be made after the replacement plants have lived through one year.

D. At the end of the one-year guarantee and establishment period, remove all tree stakes, guys, or anchors installed on trees during the course of the work of this contract.

E. All replacements shall be plants of the same kind and size specified in the PLANT SCHEDULE. The cost shall be borne by the Contractor, except for possible replacements due to vandalism or neglect on the part of others.

END OF SECTION

SECTION 32 91 13: PLANTING SOIL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SUMMARY

A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to supply and place planting soil as indicated on the Contract Documents and as specified. Supplying and placement of planting soil shall include, but not be limited to:

1. Sampling and testing of loam borrow.
2. Modifying, screening, placing, spreading, and grading of loam borrow.
3. Providing all other sampling, testing, supplying, placing, spreading, and grading of planting soil as required by this Section.

1.3 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 31 Section – EARTH MOVING
2. Division 32 Section – PLANTING
3. Division 32 Section – TURF & GRASSES

1.4 REFERENCES

A. American Society for Testing and Materials (ASTM):
D 75 Practice for Sampling Aggregates
D 422 Test Method for Particle-Size Analysis of Soil
D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3)
D1557 Moisture-Density Relations of Soil and Soil-Aggregate Mixtures using 10-lb Rammer and 18-in. Drop

B. AOAC: Association of Official Agricultural Chemists.

1.5 SUBMITTALS

A. At least 30 days prior to ordering materials, the Contractor shall submit to the Landscape Architect representative samples, certifications, manufacturer's product data and certified test results for materials as specified below for approval in conformance with the requirements of Section, SUBMITTALS, of this Specification. No materials shall be ordered or delivered until the required submittals have been reviewed and approved by the Landscape Architect. Delivered materials shall closely match the approved samples. Approval shall not constitute final acceptance. The Landscape Architect reserves the right to reject, on or after delivery, any material that does not meet these Specifications.

1. Loam Borrow: The Contractor shall provide a one cubic foot representative sample for testing. All stockpile sampling shall be per ASTM D 75 and Appendixes for securing samples from stockpiles.

Testing will be at the Contractor's expense. Contractor shall deliver all samples to testing laboratories via overnight courier and shall have the testing report sent directly to the Landscape Architect. Perform all tests for gradation, organic content, soil chemistry and pH by

UMASS Soil and Plant Tissue Laboratory, West Experiment Station, North Pleasant Street, University of Massachusetts (UMass), Amherst, MA 01003, (413) 545-2311.

Testing reports shall be dated within 30 days of submission to the Landscape Architect. Testing reports beyond 30 days old will be rejected and new testing reports mandated.

Testing reports shall include the following tests and recommendations. Contractor shall deliver samples to testing laboratories and shall have the testing report sent directly to the Landscape Architect from the Soil and plant Tissue Laboratory. Testing reports shall include the following tests and recommendations.

a. Mechanical gradation (sieve analysis) shall be performed and compared to the USDA Soil Classification System. Sieve analysis shall be by combined hydrometer and wet sieving using sodium hexametaphosphate as a dispersant in compliance with ASTM D 422 after destruction of organic matter by H_2O_2. To facilitate review and approval of sieve analysis, provide a computer generated gradation curve from UMass Soil & Plant Tissue Laboratory.
b. Percent of organics shall be determined by the loss on ignition of oven-dried samples. Test samples minus #10 material shall be oven-dried to a constant weight at a temperature of 450 degrees Fahrenheit (752 degrees Centigrade).
c. Chemical analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, extractable Aluminum, Lead, Zinc, Cadmium, Copper, Soluble Salts, and pH and buffer pH. A Conductivity Meter shall be used to measure Soluble Salts in 1:2 soil/water (v/v). Except where otherwise noted, nutrient tests shall be for available nutrients.
d. Soil analysis tests shall show recommendations for soil additives to correct soil deficiencies as necessary, and for additives necessary to accomplish lawn and planting work as specified.

2. Peat Moss: Submit a one cubic foot sample and supplier's certification of contents.
3. Limestone: Submit supplier's certification that the limestone being supplied conforms to these Specifications.
4. Acidulant: Submit supplier’s certification that the acidulant being supplied conforms to these Specifications.
5. Fertilizer:
   a. Submit product data of planting fertilizer and certificates showing composition and analysis. Submit fertilization rates for fertilizer product based upon soil testing, analysis, and recommendations as specified, performed, and paid for under in this Section, PLANTING SOIL.
   b. Submit the purchasing receipt showing the total quantity purchased for the project prior to installation.
6. Gypsum: Submit manufacturer's product data and 2 pound sample.
7. All additives needed to amend a specific soil in order to meet these specifications.

1.6 EXAMINATION OF CONDITIONS

A. All areas of the existing site where topsoil is to sampled for testing shall be inspected by the Contractor before starting work and any issues that might inhibit or prevent the sampling operation shall be reported to the Landscape Architect prior to beginning this work.

B. The Contractor and any sub-Contractor responsible for the execution of the Work of this Section, PLANTING SOIL, shall review and confirm in writing that the subsoil elevations have been brought to the proper subgrade elevations prior to proceeding with the spreading of the loam borrow.

PART 2 – PRODUCTS

2.1 LOAM

A. Loam borrow shall be one of the following loamy sands and sandy loams; “loamy sand”, “loamy fine sand”, “loamy very fine sand”, or “coarse sandy loam”: determined by mechanical analysis (ASTM D 422) and based on the "USDA Classification System" and as defined in this Section. It shall be of uniform composition, without admixture of subsoil. It shall be free of stones greater than 0.75 inches lumps, plants and their roots, debris and other extraneous matter as determined by the Landscape Architect.

Planting soil for lawn areas shall have the following grain size distribution for material passing the #10 sieve:

Sieve Size	% Passing by Weight
2.0 mm	100
1.0 mm	82 – 100
0.5 mm	65 – 87
0.25 mm	49 – 72
0.10 mm	30 – 45
0.05 mm	22 – 32
0.002 mm	2 – 5

1. Maximum size shall be one and one quarter inches largest dimension. The maximum retained on the #10 sieve shall be 25% by weight of the total sample.
2. The ratio of the particle size for 80% passing (D_{80}) to the particle size for 30% passing (D_{30}) shall be 6.0 or less. ($D_{80}/D_{30} < 6.0$).
3. In addition to the foregoing, all loam borrow to be used for loaming shall be mechanically screened processed loam borrow that passes a 3/4 inch by 6 inch screen size.

B. Organic content and pH for specific planting use shall be as follows:

1. Top 18 inches of areas planted with tree and shrub as described in the Section 32 90 00, PLANTING, of this Specification:
   a. pH: 5.5 through 6.5 for non-acid loving plants
   b. pH: 4.5 through 5.5 for *Ericaceae* and other acid-loving plants
   c. Organic Content 4.0 - 6.0 percent as determined by the loss on ignition of oven-dried samples passing #10 sieve (Muffle furnace temperature: 450 +/- 10 degrees C for 8 hours)
2. Loam borrow shall be pH adjusted for particular planting applications and shall be adjusted prior to delivery to the Project sites as recommended by UMass Soil & Plant Tissue Laboratory test results.
   a. When pH of loam borrow is equal to or greater than 7 use aluminum sulfate to adjust pH downward to required levels.
   b. When pH of loam borrow is less than 7 use either sulfur or ferrous sulfate to adjust pH downward to required levels.
   c. When pH of loam borrow must be raised to the required levels use limestone.
   d. Regardless of amendment Contractor chooses to use, Contractor, not the Owner, shall be responsible for obtaining specified pH by planting time.

C. All loam borrow proposed for use shall be tested for conformance to the specifications. Soil additives shall be used to counteract soil deficiencies as recommended by the soil analysis and as supplements for lawn construction as specified herein.

D. The Landscape Architect reserves the right to reject on or after delivery to the project site any material which does not, in his opinion, meet these specifications.

PART 3 – EXECUTION

3.1 FILLING AND COMPACTION

A. Subsoil or ordinary borrow shall have been excavated and filled as required by the Contract Documents and specified and paid for under the Division 31 Section, EARTH MOVING, of this Specification. Do not damage the work previously installed. Maintain all required angles of repose of materials adjacent to the loam as shown on the Contract Documents. Do not over excavate compacted subgrades of adjacent pavement or structures during loaming operations.

B. Confirm that the subgrade is at the proper elevation and that no further earthwork is required to bring the subgrade to proper elevations. Subgrade elevations shall slope parallel to the finished grade and or toward the subsurface drain lines as shown on the Contract Documents.

C. Clear the subgrade of all construction debris, trash, rubble, and any foreign material. In the event that fuels, oils, concrete washout or other material harmful to plants have been spilled into the subgrade material, excavate the soil sufficiently to remove the harmful material. Such construction debris, trash,

rubble, and foreign material shall be removed from the site and disposed of in a legal manner. Fill any over excavation with approved fill and compact to the required subgrade compaction levels.

D. Do not proceed with the installation of loam borrow until all utility work in the area has been installed.

E. Protect adjacent walls, walks and utilities from damage or staining by the loam borrow. Use 0.5-inch plywood and or plastic sheeting as directed to cover existing concrete, metal and masonry work and other items as directed during the progress of the work. Clean up all trash and any soil or dirt spilled on any paved surface at the end of each working day.

3.2 FINE GRADING

A. Place loam in two lifts. Place the first lift to a depth of 2 inches and harrow or till the loam into the underlying subsoil to a depth of 2 inches, creating a blended interface of loam and subsoil approximately 4 inches deep. Spread the second lift of loam to a minimum depth of 4 inches or greater as shown on the Contract Documents.

B. No loam borrow shall be handled, planted in any way if it is in a wet or frozen condition. A moist loam borrow is desirable.

C. Soil additives shall be spread and thoroughly incorporated into the layer of loam borrow by harrowing or other methods reviewed by the Landscape Architect. The following soil additives shall be incorporated:

1. Ground limestone or acidulant as required by soil analysis to achieve the required Ph.
2. Fertilizer at the rate and of analysis recommended by the soil analysis
3. Other soil amendments as required by soil analysis.

D. Sufficient grade stakes shall be set for checking the finished grades. Stakes must be set in the bottom of swales and at the top of slopes. Deviation from indicated elevations that are greater than one-tenth of a foot shall not be permitted. Connect contours and spot elevations with an even slope. Finish grades shall be smooth and continuous with no abrupt changes at the top or bottom of slopes.

E. During the compaction process, all depressions caused by settlement or rolling shall be filled with additional loam borrow and the surface shall be regraded and rolled until presenting a smooth and even finish corresponding to the required grades.

F. The Contractor shall install loam borrow in successive horizontal lifts no thicker than 6 in turf areas and 12 inches in plant bed areas to the desired compaction as described herein. The Contractor shall install the soil at a higher level to anticipate any reduction of loam borrow volume due to compaction, settling, erosion, decomposition, and other similar processes during the warranty period. The Landscape Architect will ensure that the full depths of loam borrow for lawn and plant beds are obtained by digging holes in the loam borrow at the same frequency as for compaction testing.

1. Compact loam to the required density as specified herein.
2. Maximum dry density for topsoil and loam shall be determined in accordance with ASTM D698. The following percentages of minimum to maximum dry densities shall be achieved for fill materials or prepared subgrades.
   a. In seeded areas and plant beds: 80 to 85%
3. The surface area of each lift hall shall be scarified by raking prior to placing the next lift.

G. Select equipment and otherwise phase the installation of the loam borrow to ensure that wheeled equipment does not travel over subsoil, placed fills or ordinary borrow or already installed soil.

H. Disturbed areas outside the limit of lawn work shall be graded smooth and spread with a minimum of 6 inches of loam borrow to the finished grade.

I. Annual planting beds shall be graded smooth and spread with a minimum of 12 inches of loam borrow to the finished grade.

3.3 ACCEPTANCE

A. Confirm that the final grade of the loam borrow is at the proper finish grade elevations. Adjust grade as required to meet the contours and spot elevations noted on the Plans. Request the presence of the

Landscape Architect to inspect final grade. Do not proceed with the remaining work of this Contract until the Landscape Architect has given his/her written approval of the final grade.

END OF SECTION

SECTION 32 92 19: TURF & GRASSES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SUMMARY

A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to perform all lawn installation and fine grading work and related items as indicated on the Contract Documents and/or as specified in this Section and includes, but is not necessarily limited to, the following:

1. Turf seed mix
2. Conservation seed mix
3. Sod – Add Alternate #5
4. Top dressing & over-seeding
5. Maintenance & protection
6. Turf area protection fencing

1.3 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 32 Section – PLANTING
2. Division 32 Section – PLANTING SOILS
3. Division 32 Section – IRRIGATION – Add Alternate #4

1.4 REFERENCES

A. Not Applicable

1.5 SUBMITTALS

A. Submit proof of landscape contractor's experience to the Landscape Architect in accordance with Quality Assurance paragraph of this Section.

B At least 30 days prior to intended use, the Contractor shall provide the following samples and submittals for approval in conformance with the requirements of Section, Submittals. Do not order materials until Landscape Architect’s approval of samples, certifications or test results has been obtained. Delivered materials shall closely match the approved samples. Acceptance shall not constitute final acceptance. The Landscape Architect reserves the right to reject on or after delivery any material that does not meet these Specifications.

1. Material Sampling and Testing of Loam Borrow from Off-Site Sources shall be specified, performed, and paid for under Section, Planting Soils, of this Specification.
2. Fertilizer:
   a. Submit product literature of seeding fertilizer and certificates showing composition and analysis.
   b. Submit the purchasing receipt showing the total quantity purchased for the project prior to installation.
3. Seed: Submit a manufacturer's Certificate of Compliance to the Specifications with each shipment of each type of seed. These certificates shall include the guaranteed percentages of

purity, weed content and germination of the seed, and also the net weight and date of shipment. No seed may be sown until the Contractor has submitted the certificates.

4. Hydroseeding: Prior to the start of hydroseeding, submit a certified statement for approval as to the number of pounds of materials to be used per 100 gallons of water.
5. Wood Cellulose Fiber Mulch: Submit copies of manufacturer's literature and one material sample.
6. Limestone: Submit supplier's certification that the limestone being supplied conforms to these Specifications.
7. All additives needed to amend a specific soil in order to meet these specifications.

1.6 EXAMINATION OF CONDITIONS

A. All areas to be improved shall be inspected by the Contractor before starting work and any defects such as incorrect grading, or drainage problems shall be reported to the Landscape Architect prior to beginning this work. The commencement of work by the Contractor shall indicate his acceptance of the areas to be improved, and he shall assume full responsibility for the work of this Section, Seeding.

B. The Contractor shall be solely responsible for judging the full extent of work requirements involved.

1.7 QUALITY ASSURANCE

A. Qualification of Landscape Contractor: The work of this Section, Seeding, shall be performed by a landscape contracting firm which has successfully installed work of a similar quality, schedule requirement, and construction detailing with a minimum of five years' experience. Proof of this experience shall be submitted per Submittals paragraph of this Section, Seeding.

B. Qualification of Foreman or Crew Leader: All work of seeding shall be supervised by a foreman or crew leader who is a certified landscape professional or a certified horticulturist.

1. Certification shall be current. Proof of certification shall be submitted per Submittals paragraph of this Section, Seeding.

PART 2 – PRODUCTS

2.1 LOAM

A. Loam borrow shall be specified, provided, installed, and paid for under the work of the Division 32 Section, PLANTING SOILS, of this Specification.

2.2 SOIL ADDITIVES

A. Soil additives shall be specified, and provided under Section, Planting Soils

2.3 TURF SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with Association of Official Seed Analysts' "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.

B. Seed mixture shall be fresh, clean, new crop seed. Grass shall be of the previous year's crop and in no case shall the weed seed content exceed 0.25% by weight. The seed shall be furnished and delivered in the proportion specified below in new, clean, sealed and properly labeled containers.

All seed shall comply with State and Federal seed laws. Submit manufacturer's Certificates of Compliance. Seed that has become wet, moldy, or otherwise damaged shall not be acceptable. Chewings fescue, hard fescue, tall fescue, and ryegrass shall contain *Acromonium* endophytes. Seed containing endophyte must be kept cool and dry at all times; do not stockpile in the sun.

C. Seed Mixture Composition for General Turf Conditions without Irrigation:

Common Name	Germination by Weight	Purity Minimum	Proportion Minimum
Creeping Red Fescue, or Chewings Fescue	50%	85%	95%
Kentucky Bluegrass	25%	85%	90%
Perennial Ryegrass	25%	90%	90%

1. Bluegrass and rye grass varieties shall be within the top 50 percent and 25 percent respectively, of varieties tested in National Turfgrass Evaluation Program, or currently recommended as low maintenance varieties by University of Massachusetts or the University of Rhode Island.
2. Seeding rate shall be 6 pounds per 1,000 square feet.

2.4 CONSERVATION SEED MIXES

A. The Contractor shall provide Conservation Seed as designated on the Contract Drawings.

B. Type 1: Native Perennial Restoration Seed Mix for Invasive Management Revegetation Areas for sunny areas.

1. The Basis of Design for Type 2 Conservation Seed Mix shall be “Native Steel Slope Mix with Annual Ryegrass” as manufactured by Ernst Seeds, or Meadville, Pennsylvania. Approved equals may be submitted for evaluation, but must be the following specifications:

a. Seed Mixture Composition:

Botanical name	Common name	Percentage
Sorghastrum nutans, 'Tomahawk'	Indiangrass, ‘Tomahawk’	31.1%
Lolium multiflorum	Annual Ryegrass	20.0%
Andropogon gerardii, 'Niagara'	Big Bluestem, ‘Niagara’	14.0%
Elymus virginicus, 'Madison'	Virginia Wildrye, ‘Madison’	10.0%
Elymus canadensis	Canada Wildrye	7.0%
Agrostis perennans, Albany Pine Bush	Autumn Bentgrass	4.0%
Panicum virgatum, 'Shawnee'	Switchgrass, ‘Shawnee’	4.0%
Panicum clandestinum Tioga	Deertongue	3.0%
Echinacea purpurea	Purple Coneflower	1.5%
Chamaecrista fasciculata	Partridge Pea	1.3%
Heliopsis helianthoides	Oxeye Sunflower	1.2%
Coreopsis lanceolata	Lanceleaf Coreopsis	1.0%
Rudbeckia hirta	Blackeyed Susan	1.0%
Monarda fistulosa, Fort Indiantown Gap	Wild Bergamot	0.3%
Asclepias syriaca	Common Milkweed	0.2%
Solidago nemoralis	Gray Goldenrod	0.2%
Aster laevis	Smooth Blue Aster	0.1%
Aster novae-angliae	New England Aster	0.1%

b. Seeding rate shall be 60 pounds per acre/1.5 pounds per 1,000 square feet.

2. Conservation seed mix shall be spread with a nurse crop.
3. The nurse crop shall be comprised of the following:

a. If planted in spring: *Secale cereal* (grain rye) at a rate of 30 pounds per acre
b. If planted in fall: *Avena sativa* (grain oats) at a rate of 30 pounds per acre

C. Type 2: Native Perennial Restoration Seed Mix for Invasive Management Revegetation Areas for partially shaded areas.

1. The Basis of Design for Type 2 Conservation Seed Mix shall be “Partially Shaded Area Roadside Mix” as manufactured by Ernst Seeds, or Meadville, Pennsylvania. Approved equals may be submitted for evaluation, but must be the following specifications:

a. Seed Mixture Composition:

Botanical name	Common name	Percentage
Schizachyrium scoparium, Fort Indiantown Gap	Little Bluestem	51.5%
Elymus virginicus, 'Madison'	Virginia Wildrye, 'Madison'	20.0%
Elymus hystrix	Bottlebrush Grass	6.5%
Echinacea purpurea	Purple Coneflower	6.0%
Chamaecrista fasciculata	Partridge Pea	3.5%
Rudbeckia hirta	Blackeyed Susan	3.0%
Heliopsis helianthoides	Oxeye Sunflower	2.0%
Tradescantia ohiensis	Ohio Spiderwort	0.8%
Aster macrophyllus	Bigleaf Aster	0.7%
Aster prenanthoides	Zigzag Aster	0.7%
Liatris spicata	Marsh Blazing Star	0.7%
Pycnanthemum tenuifolium	Narrowleaf Mountainmint	0.7%
Zizia aurea	Golden Alexanders	0.7%
Baptisia australis	Blue False Indigo	0.5%
Anemone virginiana	Thimbleweed	0.4%
Geum canadense	White Avens	0.4%
Monarda fistulosa, Fort Indiantown Gap	Wild Bergamot, Fort Indiantown Gap	0.4%
Penstemon digitalis	Tall White Beardtongue	0.4%
Asclepias tuberosa	Butterfly Milkweed	0.3%
Solidago nemoralis	Gray Goldenrod	0.3%
Agrostis perennans, Albany Pine Bush	Autumn Bentgrass, Albany Pine Bush	0.2%
Asclepias syriaca	Common Milkweed	0.1%
Eupatorium rugosum	White Snakeroot	0.1%
Solidago odora	Licorice Scented Goldenrod	0.1%

b. Seeding rate shall be 20 pounds per acre/0.5 pounds per 1,000 square feet.

2. Conservation seed mix shall be spread with a nurse crop.
3. The nurse crop shall be comprised of the following:

a. If planted in spring: *Secale cereal* (grain rye) at a rate of 30 pounds per acre
b. If planted in fall: *Avena sativa* (grain oats) at a rate of 30 pounds per acre

D. Type 3: Native Restoration Seed Mix for bank stabilization and revegetation.

1. The Basis of Design for Type 3 Conservation Seed Mix shall be "New England Erosion Control/Restoration Mix for Detention Basins and Moist Sites" as manufactured by New England Wetland Plants of Amherst, Massachusetts. Approved equals may be submitted for evaluation, but must be the following specifications:

a. Seed Mixture Composition:

Botanical name	Common name
Agrostis perennans	Upland bentgrass
Andropogon gerardii	Big bluestem
Aster/Symphyotrichum novae-angliae	New England aster
Bidens frondosa	Beggar ticks
Elymus riparius	Riverbank wild rye
Eupatorium/Eutrochium maculatum	Spotted Joe Pye weed
Eupatorium perfoliatum	Boneset
Festuca rubra	Red fescue
Juncus effuses	Soft rush
Panicum virgatum	Switch grass

Schizachyrium scoparium	Little bluestem
Scirpus cyperinus	Wool grass
Vernonia noveboracensis	New York ironweed

b. Seeding rate shall be 35 pounds per acre, or 1,250 square feet per pound

E. Immediately after plant installation, all conservation seeding shall be protected with a barrier, as specified in Division 32 Section, PLANTING.

2.5 SOD – Add Alternate #5

A. Sod for areas of the beach nursery grown sod grown locally (Within New England) from the following seed mixtures of a turf-type tall fescue blend, and in accordance with percentages as specified:

Common Name	Percentage of Sod	Germination by Weight
Montana Tall Fescue	20%	92%
Future Tall Fescue	20%	91%
Thunderbolt Tall Fescue	19%	87%
Toltec Tall Fescue	15%	92%
Pivot Kentucky Bluegrass	10%	85%
Deep Blue Kentucky Bluegrass	10%	85%
Frontier Perennial Ryegrass	5%	90%
Inert matter	<2%	

1. Sod is available as “Black Beauty Sod” from SodCo, Slocum, Rhode Island

A. Sod shall be machine cut from an established sod farm specializing in the production and harvesting of top quality, grass turf products. Sod shall be machine cut at a uniform soil thickness of 3/4-inch +/- 1/4 inch, at the time of cutting. Measurement for thickness shall exclude top growth and thatch. Individual pieces of sod shall be cut to the supplier's standard width and length. Maximum allowable deviation from standard widths and lengths shall be 5 percent. Broken pads and torn or uneven ends will not be acceptable. Sod shall be at least one year old from time of original seeding.

D. Sod shall be free of grass species other than those specified in this Section, TURF & GRASSES. Sod shall be free of weeds.

E. Sod shall be furnished and installed in rectangular sod strips measuring 12 inches or 16 inches in width and from 4 feet to 6 feet in length, stored in rolls with the grass top side inverted so that the topsoil is to the exterior.

F. Sod shall be harvested, delivered, and installed within a period of 36 hours. Soil on sod pads shall be kept moist at all times.

G. Stakes: Stakes for pegging the sod shall be sound hardwood approximately one inch by 2 inches and of sufficient length to penetrate the mat, the seed bed and to a minimum depth of 2 inches of subsoil. Stakes shall be free from insects and fungi and capable of remaining in the ground at least 2 years.

H. Sod delivered to the construction site which does not conform to the requirements of this Section, TURF & GRASSES, will be rejected by the Landscape Architect and shall be removed from the site by the Contractor at no additional cost to the Owner. Sod found to contain unacceptable levels of unspecified grass species or weed species at any time up to and including Final Acceptance will be rejected by the Landscape Architect. Contractor shall remove such sod from the site at no additional cost to the Owner. Contractor shall replace unacceptable sod with new, approved sod at no additional cost to the Owner. The Landscape Architect shall be the sole judge of what constitutes acceptable or unacceptable levels of unspecified grass species or weed species.

2.6 FERTILIZERS

A. Fertilizer shall be a commercial product complying with the State and United States fertilizer laws. Deliver to the site in the original unopened containers that shall bear the manufacturer's certificate of

compliance covering analysis. Fertilizer shall contain not less than the percentages of weight of ingredients as recommended by the soil analysis specified, performed, and paid for under the Section, PLANTING SOILS of this Specification.

B. Phosphorus shall be superphosphate or triple superphosphate.

2.7 LIMESTONE

A. Ground limestone for adjustment of loam borrow pH shall contain not less than 85 percent of total carbonates and shall be ground to such fineness that 40 percent will pass through 100 mesh sieve and 95 percent will pass through a 20 mesh sieve. Contractor shall be aware of loam borrow pH and the amount of lime needed to adjust pH to specification in accordance with testing lab recommendations.

2.8 WOOD CELLULOSE FIBER MULCH

A. Mulch to cover hydroseeded areas with slopes less than 3 to one shall be fiber processed from whole wood chips and clean recycled newsprint in a 1:1 proportion manufactured specifically for standard hydraulic mulching equipment. Fiber shall not be produced from recycled material such as sawdust, paper, or cardboard.

B. Moisture content shall not exceed 10 percent, plus or minus 3 percent as defined by the pulp and paper industry standards. Fiber shall have a water holding capacity of not less than 900 grams water per 100 grams fiber.

C. The mulch shall be of such character that the fiber will be dispersed into a uniform slurry when mixed with water. It shall be nontoxic to plant life or animal life.

D. The mulch shall contain a non-petroleum based organic tackifier and a green dye to allow for easy visual metering during application but shall be non-injurious to plant growth.

2.9 HERBICIDES, CHEMICALS & INSECTICIDES

A. Provide chemicals and insecticides as needed for fungus or pest control. All chemicals and insecticides shall be approved by the Massachusetts Department of Food and Agriculture for the intended uses and application rates.

B. Provide post emergent crab grass control throughout the maintenance period to ensure a germinated and mown lawn free of crab grass.

2.10 WATER

A. The Contractor shall be responsible to furnish his own supply of water to the site at no extra cost. If possible, the Owner shall furnish the Contractor upon request with an adequate source and supply of water at no charge. However, if the Owner's water supply is not available or not functioning, the Contractor shall be responsible to furnish adequate supplies at his own cost. All work injured or damaged due to the lack of water, or the use of too much water, shall be the Contractor's responsibility to correct. Water shall be free from impurities injurious to vegetation.

B. Contractor shall keep log of watering schedule and volume applied. Log shall be signed by Foreman and submitted to Landscape Architect.

2.11 TURF AREA PROTECTION FENCING

A. Tree protection fencing shall be one of the following, at the Contractor’s option.

1. Polypropylene barricade fencing manufactured by Forestry Suppliers (formerly Ben Meadows Co.), 3589 Broad Street, Atlanta, GA. Stakes for fencing shall be 2-inch x 4-inch wood posts, driven a minimum of 3 feet into the ground. Posts shall be spaced 8 feet maximum.
2. Plastic polymer safety fence, Model BX2050 Safety Grid, manufactured by the Tensar Corporation, Morrow, GA, or approved equal. Color shall be high visibility orange. Stakes for fencing shall be 2-inch x 4-inch wood posts, driven a minimum of 3 feet into the ground. Posts shall be spaced 8 feet on center maximum.

3. Unless otherwise indicated, height of fencing shall be 4 feet.

PART 3 – EXECUTION

3.1 FILLING & COMPACTION

A. Filling and compaction of loam shall be specified, performed, and paid for under the work of the Division 32 Section, PLANTING SOILS, of this Specification.

3.2 FINE GRADING

A. Fine grading shall be specified, performed, and paid for under the work of the Division 32 Section, PLANTING SOILS, of this Specification.

3.3 SEEDING

A. Contractor shall obtain Landscape Architect's written approval of fine grading and bed preparation before doing any seeding.

B. Limit of grading and earthwork shall be limit of seeding unless otherwise indicated on the Contract Documents. All areas disturbed outside the limit of seeding shall be prepared and seeded as specified herein at no additional cost.

C. The season for seeding shall be from April 1 to June 1 and from August 15 to September 30. The actual planting of seed shall be done, however, only during periods within this season which are normal for such work as determined by weather conditions and by accepted practice in this locality. To prevent loss of soil via water and wind erosion and to prevent the flow of sediment, fertilizer, and pesticides onto roadways, sidewalks, and into catch basins, seed loam areas within 5 Days of spreading the loam.

D. Seed only when the bed is in a friable condition, not muddy or hard.

E. Seeding shall be by Hydroseeding Method specified as follows:

1. Prior to the start of work, furnish a certified statement as to the number of pounds of materials to be used per 100 gallons of water. This statement shall also specify the number of square feet of hydroseeding that can be covered with the quantity of solution in the hydro-seeder.
2. Hydroseed with wood cellulose fiber mulch at a rate of 46 pounds per 1,000 square feet or 2000 pounds per acre.
3. For the hydroseeding process, a mobile tank with a capacity of at least 500 gallons shall be filled with water and the mixture noted above in the specified proportions. The resulting slurry shall be thoroughly mixed by means of positive agitation in the tank. Apply the slurry by a centrifugal pump using the hose application techniques from the mobile tank. Only hose application shall be permitted. At no time shall the mobile tank or tank truck be allowed onto the prepared hydroseed beds. The hose shall be equipped with a nozzle of a proper design to ensure even distribution of the hydroseeding slurry over the area to be hydroseeded and shall be operated by a person thoroughly familiar with this type of seeding operation.
4. Contractor shall obtain Landscape Architect's written approval of fine grading and bed preparation before doing any hydroseeding.
5. Limit of grading and earthwork shall be limit of hydroseeding unless otherwise indicated on the Contract Documents. All areas disturbed outside the limit of hydroseeding shall be hydroseeded.
6. Seed only when the bed is in a friable condition, not muddy or hard. Construction methods shall conform to hydraulic method requirements specified in the Standard Specification.
7. Hydroseeding shall be a two-step process.
    a. Step one shall consist of spreading 100 percent of the required seed uniformly over the prepared loam bed so that the seed comes into direct contact with the soil. To mark the progress of the hydroseeding operation the Contractor may add 10 percent of the wood cellulose fiber mulch to the slurry.
    b. Step two shall consist of a separate application of wood cellulose fiber mulch immediately following the first step of hydroseeding noted above. Apply the wood cellulose fiber mulch at a rate of 2,000 pounds per acre.

3.4 LAYING SOD – Add Alternate #5

A. A. The season for laying sod shall be from April 1 to June 1 and from August 15 to October 1. The actual installation shall be done, however, only during periods within this season that are normal for such work as determined by weather conditions and by accepted practice in this locality. At his/her option, and on his/her own responsibility, the Contractor may proceed under unseasonable conditions without additional compensation, but subject to Landscape Architect's approval of time and methods.

B. Immediately prior to laying sod operations, the loam bed shall be lightly scratched with a fine toothed harrow or hand rake to provide a slightly roughened surface to accept the sodding application.

C. The soil on which the sod is laid shall be reasonably moist and shall be watered, if necessary. The sod shall be laid smoothly, edge to edge, and where continuous or solid sodding is called for on the plans sod shall be laid with the longest dimension parallel to the contours. The laying sod shall start at the base of slopes and progress upwards in continuous parallel rows. Vertical joints between sods shall be staggered. Immediately after laying sod, press the sod firmly into contact with the soil bed by tamping, rolling, or by other approved methods so as to eliminate all air pockets. Provide true and even surfaces, ensure knitting, and protect all exposed sod edges, but without displacement of the sod or deformation of the sod surface.

D. In all swales, and on all slopes steeper than or equal to three to one (3:1) and elsewhere as specified or as directed by the Landscape Architect, sods shall be held in place by stakes. Stakes shall be untreated wood one inch by two inches by twelve inches long. Staking shall be done immediately after tamping. At least one stake shall be driven through each sod to be pegged and the stakes shall be not more than two feet apart. Stakes shall have their flat sides against the slope and be driven flush.

3.5 TURF MAINTENANCE

A. Maintenance shall begin immediately after any area is seeded and shall continue for a 90 day active growing period for seeded areas past Final Acceptance: the completion of all lawn construction work, and until final acceptance of the project.

1. In the event that seeding operations are completed too late in the autumn for adequate germination and growth of grass, then maintenance shall continue into the following spring for the minimum 60 Day period. In addition, install blankets or netting to prevent loam degradation and movement over the winter. Submit product literature and samples to the Landscape Architect for review. Blankets and netting shall be placed in a timely manner at no additional cost to the Owner.
2. Contractor shall be responsible for the timely care and maintenance of the existing turf areas in the park from receipt of Notice to Proceed until Final Completion. Maintenance shall include mowing (turf shall not be allowed to grow longer than 4 inches).

B. Maintenance shall include reseeding, mowing, watering, weeding, fertilizing a minimum of two times in addition to the fertilizer incorporated by harrowing into the spread loam, and resetting and straightening of protective barriers. Turf area maintenance shall also include chemical treatments as required for fungus and/or pest control.

C. During the maintenance period, any decline in the condition of seeded areas shall require immediate action to identify potential problems and to undertake corrective measures.

D. Watering shall be done in a manner that will provide uniform coverage, prevent erosion due to application of excessive quantities over small areas, and prevent damage to the finished surface by the watering equipment.

1. The Contractor shall provide all labor and arrange for all watering necessary to establish an acceptable turfgrass stand. In the absence of adequate rainfall, watering shall be performed daily or as often as necessary to maintain moist soil to a depth of at least 2 inches for seeded areas. Begin watering immediately after seeding.
2. Watering shall be done in a manner that will provide uniform coverage, prevent erosion due to application of excessive quantities over small areas, and prevent damage to the finished

surface by the watering equipment. The Contractor shall furnish sufficient watering equipment to apply water to the required soil depths each 8-hour period.

E. Protection

1. Turfgrass areas shall be protected by a 4-foot high fence constructed with steel stakes set 18 inches in the ground at 10 foot intervals.
2. Barriers must be raised immediately after turf establishment and shall be maintained until Acceptance.

F. After the grass in seeded areas has germinated, reseed all areas and parts of areas that fail to show a uniform stand of grass. Reseed such areas and parts of areas repeatedly until all areas are covered with a satisfactory growth of grass with no less than 20 grass shoots per square inch and 2,880 grass shoots per square foot. Reseeding together with necessary grading, fertilizing, and trimming shall be done at the Contractor’s expense.

G. Fertilizing: The first application of fertilizer is specified, provided, performed, and paid for under the Section, Planting Soils.

3.6 APPLYING LIMESTONE

A. The Contractor shall return to the site at the beginning of the next seeding season and spread limestone across all turfgrass areas installed under this Contract. The work of liming the fields shall be as specified under Section, Planting Soils, of this Specification, and performed and paid for under this Section, TURF & GRASSES. Limestone shall be spread at rates determined by the soil tests specified, performed, and paid for under Section, Planting Soils.

3.7 ACCEPTANCE

A. Acceptance of seeded turf shall be in advance of contract Final Completion. If additional time is required for turf establishment, the Contractor shall notify the Landscape Architect in writing at least 60 days in advance of Final Completion.

B. Following the minimum required maintenance periods for turfgrass establishment, the Contractor shall request the Landscape Architect in writing for a formal inspection of the completed work. Request for inspection shall be received by the Landscape Architect at least 10 days before anticipated date of inspection.

C. Acceptance Requirements

1. At the end of the maintenance period, seeded areas shall have a close stand of grass as defined above with no weeds present and no bare spots greater than 3 inches in diameter over greater than 5 percent of the overall seeded area. At least 90 percent of the grass established shall be permanent grass species. If seeded areas are deficient, the Contractor's responsibility for maintenance of all seeded areas shall be extended until deficiencies are corrected. Seeded areas to be corrected shall be prepared and reseeded in accordance with the requirements of this Section, TURF & GRASSES.
2. Sodded areas shall be in vigorous growing condition with no discolored, dead or otherwise unacceptable areas. Sod will have knit firmly to the loam subgrade and no weeds shall be present.
3. At the time of acceptance, the Contractor shall remove temporary barriers used to protect turfgrass areas.

D. Furnish full and complete written instructions for maintenance of the seeded areas to the Owner at the time of acceptance in conformance with Submittals requirements.

E. Landscape Architect’s inspection shall determine whether maintenance shall continue in any part.

3.8 CLEAN UP

F. Absolutely no debris may be left on the site. Excavated material shall be removed as directed. Repair any damage to site or structures to restore them to their original condition, as directed by the Landscape Architect, at no cost to the Owner.

G. Clean wheels of vehicles before leaving site.

END OF SECTION

SECTION 33 49 00

STORMWATER STRUCTURES

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes

1. Provide storm drainage catch basins, inverts and castings in accordance with this Section and applicable reference standards listed in Article 1.03.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and payment requirements: per Division 01 General Requirements.

1.03 REFERENCES

A. Reference Standards

1. ASTM International (ASTM)

a. ASTM A615 Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

b. ASTM C139 Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes

c. ASTM C478 Standard Specification for Circular Precast Reinforced Concrete Manhole Sections

d. ASTM C923 Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals

e. ASTM C990 Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

2. MassDOT Standard Specifications and Supplements, and Construction Details

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination, Sequencing, and Scheduling: per Division 01 General Requirements.

1.05 SUBMITTALS

A. Submit in accordance with the Division 01 General Requirements.

B. Product Data

1. Manufacturer's descriptive data, technical literature, catalog cuts, and installation instructions

2. Dimensional data for each structure

3. Product data for joint sealants, catch basins, inverts, risers, frames, grates and frost barriers.

C. Shop Drawings

1. Catch basins and precast concrete items showing components to be used, elevations of top of precast sections, base and intermediate levels and pipe inverts, rim elevation, location of pipe penetrations, and cutouts.

D. Certification by engineer licensed in the Commonwealth of Massachusetts certifying precast structures, including anti-flotation slabs (whether provided separately or as a monolithic unit), have been designed to withstand all forces including soil, traffic and hydrostatic loads in accordance with applicable Laws, Regulations, rules and codes.

E. Design Data for precast structures including anti-flotation slabs.

F. Qualification Statements.

G. Source and Field Quality Control Submittals.

1. Leakage test reports for each structure

2. Record as-built structure information neatly in a permanently bound notebook including location and rim elevations of precast concrete structures and locations and invert elevations of pipe penetrations. Provide Engineer access to records. Submit copies to Engineer on a weekly basis.

H. Closeout and Maintenance Material Submittals: per Division 01 General Requirements.

1. Location and rim elevations of precast concrete structures.

2. Locations and invert elevations of pipe penetrations.

1.06 QUALITY ASSURANCE

A. Provide in accordance with Division 01 General Requirements.

B. Qualifications: per Division 01 General Requirements and as follows for structure design.

1. Licensed engineer in the Commonwealth of Massachusetts with 5 years' minimum experience in design of similar structures.

C. Storm drainage structures will be inspected upon delivery for quality. Components which do not conform to specification requirements will be rejected and shall be removed immediately from the site by the Contractor. Furnish labor and facilities necessary to assist the Engineer in inspecting the material.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Provide in accordance with Division 01 General Requirements.

B. Packing, Shipping, Handling, and Unloading

1. Handle and place concrete units in accordance with manufacturer's written rigging instructions.

2. Provide slings, straps, and other devices for handling and support of catch basin sections during lifting, installing, and final positioning using lifting holes.

1.08 SITE CONDITIONS

A. Existing Conditions: per Division 01 General Requirements.

PART 2 – PRODUCTS

2.01 CASTINGS

A. Catch Basin/Drain Inlet Grate: In accordance with Section 201 and 220 of the MassDOT Standard Specifications and Supplements. Provide MassDOT standard frame and grate in accordance with M8.03.0. Structure castings shall be iron castings, Class No. 30 for gray iron castings. Grates shall be 24" square, ADA & High Heel Compliant (drop inlet grate style). Opening dimensions shall not exceed 1/2" in one direction. Long dimension of openings shall be placed perpendicular to the dominant direction of travel.

B. Source Quality Control: in accordance with Division 01 General Requirements.

2.02 CATCH BASINS

A. Precast structures: ASTM C478 and as shown on Drawings, capable of supporting H-20 loading.

B. Provide in accordance with MassDOT Standard Specifications and Supplements Section 201 and MassDOT Construction Details.

C. Precast concrete base and first riser: monolithic.

1. Include crystalline waterproofing additive in concrete prior to casting of riser section.

D. Precast bases and top slabs: same construction as precast riser sections of dimensions shown on Drawings.

E. Anti-floatation slab: ASTM C139 precast monolithic base unit or cast-in-place, based on manufacturer's recommendation and as approved.

F. Wall Thickness

1. 4-foot diameter catch basin: minimum 5-inch thick wall sections.

G. Embed cast openings for pipe and materials in structure wall during manufacture.

H. Cone sections: precast sections of similar manufacture with varying heights to meet construction requirements.

I. Lift holes: maximum 2 cast or drilled in any section, with suitable rubber or concrete stopper or other approved device for plugging holes.

J. Clearly mark date of manufacture and name or trademark of manufacturer on inside of riser structure.

K. Factory applied coating: UV resistant, black bituminous damp proofing, AASHTO M81 or M82 cutback asphalt, or AASHTO M140 asphalt emulsion. Coat exterior surface of precast manhole, catch basin bases and walls at 5 gallons per 100 square feet minimum per coat.

L. All-weather joint sealant: butyl rubber material in flexible rope form, and ASTM C990 Section 6.2.1. Field seal joints between precast sections with watertight, shiplap-type seal.

2.03 PIPE CONNECTIONS (CATCH BASINS)

A. Compression type connector: ASTM C923 single rubber gasket constructed solely of synthetic or natural rubber.

B. Boot type connector: ASTM C923 rubber gasket or boot with metal expansion ring and double metal take-up clamps.

2.04 SOURCE QUALITY CONTROL

A. Provide in accordance with Division 01 General Requirements

PART 3 – EXECUTION

3.01 INSTALLATION

A. Provide in accordance with Sections 201 and 220 of the MassDOT Standard Specifications and Supplements and the Drawings.

B. Set catch basin frames to finished lines and grades as specified.

C. Set castings in bituminous concrete collars and underlay with cement concrete.

1. Place so bottom of structure is plumb and pipe inverts are at proper elevations. Position tops of structures flush with finished grade.

2. Locate each structure and set accurate templates to required line and grade as shown on Drawings. Remove structures incorrectly and improperly located, oriented or aligned, and rebuild.

3. Establish sufficient length of proposed curb or edge of pavement adjacent to structure prior to construction of drain inlet and catch basin to ensure structure is correctly located and oriented.

4. Place foundation course on firm soil of uniform bearing. If soil below foundation course is classified as unsuitable, remove and replace with crushed stone as specified in Section 31 00 00.

5. Seal joints between precast sections with all-weather joint sealant as specified prior to backfill or completion of manhole, if above grade.

D. Touch up damp proofing in field prior to backfilling.

E. Refill excavated area with gravel and set casting into concrete collar. Engineer will determine new elevation of structure.

F. Remodeling: as specified in Drawings or as directed.

1. Provide remodeling of cone of structure where line or grade requires a change greater than 6 inches at existing drainage structures or where noted on Drawings.

2. Refill excavated area with gravel and set casting into concrete collar and overlay with 4-inch thick bituminous concrete top course when structures are in roadway. Engineer will determine new elevation of structure.

G. Frames

1. Set to final grade 1/2-inch below pavement grade as shown on Drawings. Provide adequate temporary covers to prevent accidental entry until final placement of frame and cover.

2. Use 2 rings of 1-inch diameter butyl rubber sealant between frame and chimney joints. Provide downward force to frame to compress joint, provide a watertight seal and prevent future settlement. Point compressed joint with butyl rubber caulk sealant.

3. Set manhole frames and covers to final grade only after pavement base course has been applied.

H. Seal drain pipe connections to catch basin structures with mortar in accordance with MassDOT M4.02.15.

I. Inverts: as indicated on Drawings.

J. Replace steps out of plumb and not to correct horizontal placement.

K. Use material removed from excavation for catch basins that remain after backfilling finished structure wherever possible within location. Remove and legally dispose of material if not needed or unsuitable.

L. Backfill structures with controlled density fill when installed with less than 18 inches of horizontal clearance from adjacent structures and pipe as directed.

M. Do not pave over any utility appurtenances or structures unless specifically directed.

N. Remove and replace defective castings with new castings as directed. Repair or replace damaged castings.

3.02 REPAIRS

A. Repair leaks after determining cause. Perform earthwork required for repairs if manhole has already been backfilled.

1. Perform repairs by approved methods to bring leakage within allowable rate.

B. Perform repairs using approved methods and materials. Remove and replace or reconstruct if necessary.

3.03 FIELD QUALITY CONTROL

A. Provide in accordance with Division 01 General Requirements.

B. Site/Field Tests and Inspections

1. General: Tests shall be observed by Engineer. Manholes must be complete for final test acceptance except for shelf and invert brickwork. Plug pipes and other openings in the structure walls prior to test. The Contractor shall test precast concrete manholes soon as

they are installed, and before backfilling, to demonstrate that the work conforms to these specifications.

2. Exfiltration Test:

   a. Plug pipes into and out of manhole and secure plugs.

   b. Fill manhole with water to bottom of flat slab.

   c. Allow a period of time for absorption (determined by Contractor).

   d. Refill to bottom of flat slab.

   e. Determine volume of leakage in an 8-hour (minimum) test period and calculate rate.

   f. Acceptable leakage rate: Not more than 1 gallon per vertical foot of manhole section per 24 hours.

3.04 REPAIRS

A. Determine causes of leaks and repair them. Engineer shall reject any manhole with an exfiltration rate exceeding 3 gallons per vertical foot per 24-hours. If exfiltration is less than 3 gallons per vertical foot per 24-hours but more than 1 gallon per vertical foot per 24-hours, repairs may be made by approved methods as directed by the Engineer to bring the leakage within the allowable rate of one gallon per vertical foot per 24-hours. If repairs fail to reduce the leakage rate to less than one gallon per vertical foot per 24-hours after exfiltration test repairs, Engineer shall reject the manhole.

B. Perform repairs using methods and materials approved by Engineer. Remove and replace or reconstruct if necessary.

3.05 INSPECTION

A. Make manhole accessible for inspection by Engineer prior to backfilling. Failure to notify the Engineer prior to backfilling may result in rejection of payment.

3.06 CLOSEOUT ACTIVITIES

A. Provide in accordance with Division 01 General Requirements.

END OF SECTION

SECTION 34 71 10: VEHICULAR GATE

PART 1 – GENERAL

1.1 REFERENCES AND STANDARDS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SCOPE OF WORK

A. The work of this Section consists of furnishing and installing all site improvements and related items as indicated on the Contract Documents and/or as specified herein and includes, but is not limited to the following:

1. 20-foot, double-leaf vehicular gate

1.3 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 03 Section – CAST-IN-PLACE CONCRETE
2. Division 32 Section – ASPHALT PAVING
3. Division 32 Section – SITE IMPROVEMENTS

1.4 REFERENCES

A. Unless otherwise specified or indicated, materials and workmanship shall conform to the latest edition of the following standards, codes, specifications, requirements and regulations:

1. American Society for Testing and Materials (ASTM):
   A36 Structural Steel
   A53 Pipe, Steel, Black and Hot-dipped, Zinc-coated
   A153 Zinc Coating (Hot-dip) on Iron and Steel hardware
   A386 Zinc Coating (Hot-dip) on Assembled Steel Products
   A325 High Strength Bolts
2. American Wood Protection Association (AWPA):
   APWA M4 Standard for the Care pf Preservative-Treated Wood Products
   APWA P5 Standard for Waterborne Preservatives
3. American Wood Preservers Bureau (AWPB):
   AWPB Standard C1 through C9

1.5 SUBMITTALS

A. At least thirty (30) days prior to intended use, the Contractor shall provide the following samples and submittals for approval. Do not order materials until Contracting Officer approval of samples, certifications and/or test results has been obtained. Delivered materials shall closely match the approved samples. Samples and Approvals which are not obtained prior to the ordering of materials or the completion of work shall result in possible disapproval of obtained materials or completed work.

B. Shop Drawings

1. Submit detailed Shop Drawings for each item required to be fabricated or installed under this Section. Include plans, sections and details as required to show all materials, layout, dimensions, jointing and connections for all items required. Shop drawings required are as follows:
   a. Vehicular gate

1.6 DELIVERY, STORAGE & HANDLING

A. Deliver and store work under this Section in a manner to prevent wracking or stress of components, and to prevent mechanical damage or damage by the elements.

B. Items which become rusted or damaged because of non-compliance with these conditions will be rejected and shall be replaced without additional cost to the Government.

C. Do not use frozen materials or materials mixed or coated with ice or frost. Do not use salt to thaw ice in anchor holes or slots. Do not lower the freezing point of mortar by use of admixtures or anti-freeze agents, and do not use calcium chloride in mortar or grout.

D. Deliver work to the site in sufficient time to avoid delay in job progress and at such times as to permit proper coordination of the various parts.

PART 2 – PRODUCTS

2.1 HEAVY TIMBER VEHICULAR GATE

A. Basis of Design: Basis of Design for the heavy timber vehicular gate is the 20-foot, double-leaf as fabricated by Ryther-Purdy Lumber Company of Old Saybrook, Connecticut, (860) 388-4405, http://www.rytherpurdy.com/

B. Gate systems shall be manufactured from solid, rough sawn, #1 common Western Red Cedar.

C. Single leaf systems shall consist of a 4-piece unit: Support post, gate leaf, hitch post, and hitchbak post (wooden catch post).

D. Support post measures 10-inch by 10-inch by 8-inch (nominal) with top edges chamfered 1-inch at 45º angle.

E. Gate leaf shall consist of an 8-inch by 8-inch vertical member and 5-inch by 6-inch horizontal/diagonal member.

F. Hitch posts shall measure 8-inch by 8-inch by 8-in with top edges chamfered 1-inch at 45º angle.

G. Hinge and latch assemblies shall be constructed of electrically welded steel, hot-dip galvanized after fabrication.

H. Contractor shall provide a 6-inch by 6-inch by 8-foot hitchback post.

I. All fasteners shall be hot dip galvanized.

J. Stain finish shall be specified; Clear natural or dark brown Woodlife® preservative or approved equal.

PART 3 – EXECUTION

3.1 VEHICULAR GATE

A. Fabricate and install gate as shown on Contract Drawings, and in accordance with approved Shop Drawings.

B. Horizontal rail of vehicular gate shall be set level. Gate shall swing freely and meet the locking post in alignment.

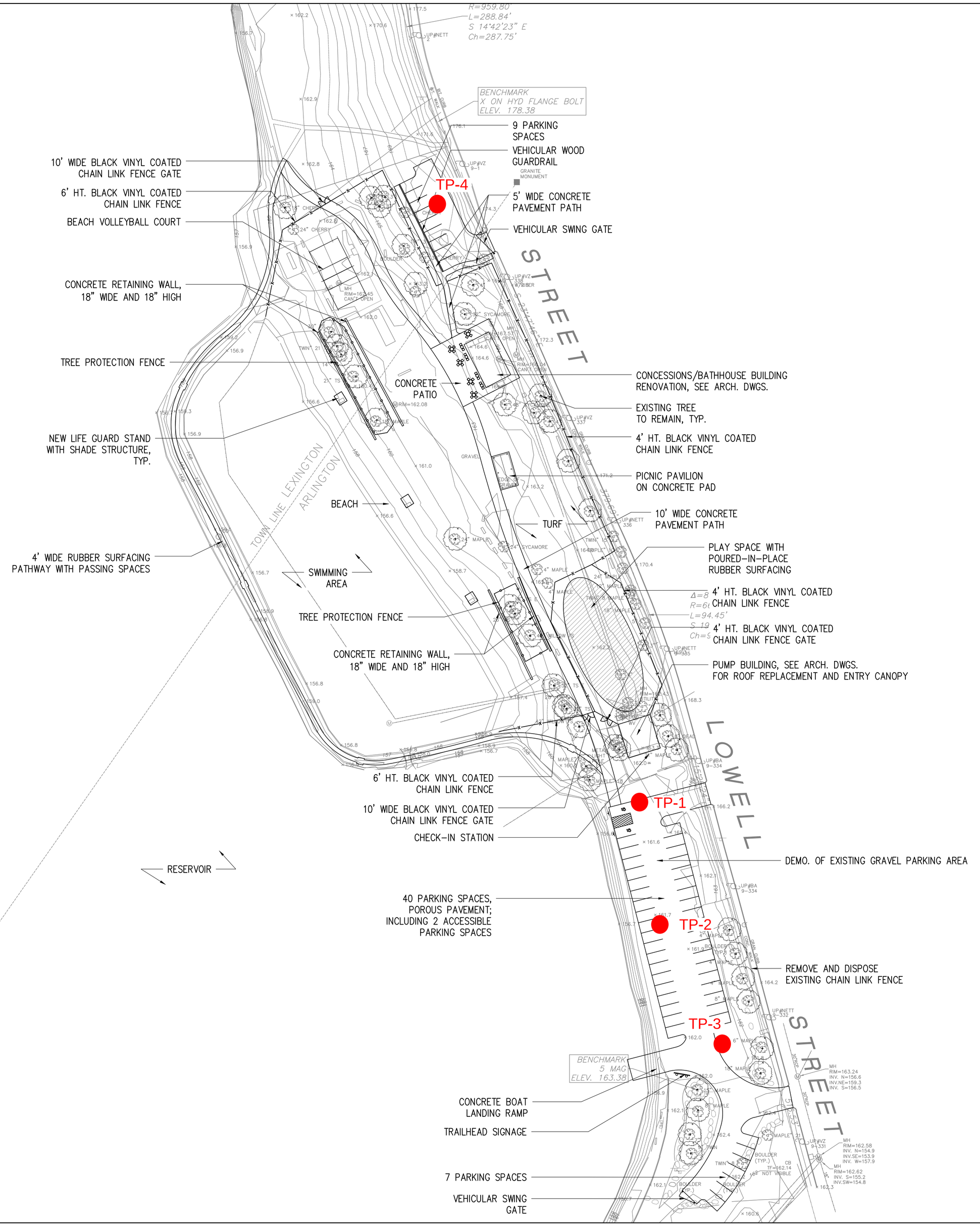
END OF SECTION

APPENDICES

Appendix A: Town of Arlington Conservation Commission Order of Conditions – To be submitted via Addendum

Appendix B: Town of Lexington Conservation Commission Order of Conditions – To be submitted via Addendum

Appendix C: Soil Logs & Test Pit Diagram, dated August 6, 2020



ARLINGTON RESERVOIR - PHASE 2

ARLINGTON, MASSACHUSETTS

TOWN OF ARLINGTON

NO.	REVISION	DATE

kzla
Kyle Zick Landscape Architecture, Inc.
36 Bromfield Street Suite 202 617 451-1018 Tel
Boston, MA 02108 www.kylezick.com

SCHEMATIC DESIGN SET

Job Number:	
Project: ARLINGTON RES.	
Drawn By: MD	Checked By: KZ
Date: JUNE 30, 2020	
Scale: 1"=50'-0"	
Drawing Title:	

ENLARGEMENT PLAN

LX

Commonwealth of Massachusetts
City/Town of Arlington

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Town of Arlington
Owner Name

210 Lowell Street
Street Address

Map/Lot #

Arlington
City

MA
State

02474
Zip Code

B. Site Information

1. (Check one) ☐ New Construction ☐ Upgrade ☐ Repair Test pits for drainage purposes

2. Soil Survey Available? ☒ Yes ☐ No If yes: Web Soil Survey (Source) 253B (Soil Map Unit)

Hinckley Loamy Sand
Soil Name

Soil Limitations

Sandy and gravelly glaciofluvial deposits
Soil Parent material

Landform

3. Surficial Geological Report Available? ☒ Yes ☐ No If yes: MassGIS Oliver (Year Published/Source) Map Unit

Sand and gravel / till and bedrock
Description of Geologic Map Unit:

4. Flood Rate Insurance Map Within a regulatory floodway? ☐ Yes ☒ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☐ Yes ☒ No If yes, MassGIS Wetland Data Layer: Wetland Type

7. Current Water Resource Conditions (USGS): 08/06/20 (Month/Day/ Year) Range: ☐ Above Normal ☒ Normal ☐ Below Normal

8. Other references reviewed:

Commonwealth of Massachusetts
City/Town of Arlington

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-1 (Hole #) | 08/06/20 (Date) | 7:30 AM (Time) | 70*, sunny (Weather) | _____ (Latitude) | _____ (Longitude:)

1. Land Use: Parking lot (e.g., woodland, agricultural field, vacant lot, etc.) | None (Vegetation) | Many large boulders (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-2 (Slope (%))

Description of Location: See attached sketch

2. Soil Parent Material: Till | _____ (Landform) | _____ (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >25 feet | Drainage Way N/A feet | Wetlands >25 feet | Property Line >10 feet | Drinking Water Well N/A feet | Other _____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 68" Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-27	Fill										
27-38	A	Sandy Loam	10YR3/2						Massive	Friable	
38-44	B	Sandy Loam	10YR3/4						Massive	Friable	
44-84	C	Sandy Loam	10YR5/2	44"	High and Low Chroma	>2	2	10	Massive	Friable	

Additional Notes:

Commonwealth of Massachusetts
City/Town of Arlington

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-2 (Hole #) | 08/06/20 (Date) | 7:45 AM (Time) | 70*, sunny (Weather) | _____ (Latitude) | _____ (Longitude:)

1. Land Use: Parking lot (e.g., woodland, agricultural field, vacant lot, etc.) | None (Vegetation) | Many large boulders (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-2 (Slope (%))

Description of Location: See attached sketch

2. Soil Parent Material: Till | _____ (Landform) | _____ (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >25 feet | Drainage Way N/A feet | Wetlands >25 feet | Property Line >10 feet | Drinking Water Well N/A feet | Other _____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: _____ Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-16	Fill										
16-30	A	Sandy Loam	10YR3/2						Massive	Friable	
30-43	B	Sandy Loam	10YR6/6	30"	High and Low Chroma	>2			Massive	Friable	
43-60	C	Sandy Loam	10YR5/3				2	10	Massive	Friable	

Additional Notes:

Commonwealth of Massachusetts
City/Town of Arlington

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-3 (Hole #) | 08/06/20 (Date) | 8:00 AM (Time) | 70*, sunny (Weather) | _____ (Latitude) | _____ (Longitude:)

1. Land Use: Parking lot (e.g., woodland, agricultural field, vacant lot, etc.) | None (Vegetation) | Many large boulders (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-2 (Slope (%))

Description of Location: See attached sketch

2. Soil Parent Material: Till | _____ (Landform) | _____ (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >25 feet | Drainage Way N/A feet | Wetlands >25 feet | Property Line >10 feet | Drinking Water Well N/A feet | Other _____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: _____ Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-9	Fill										
9-25	B	Sandy Loam	10YR6/6						Massive	Friable	
25-55	C	Sandy Loam	10YR5/3	32"	High and Low Chroma	>2	2	10	Massive	Friable	

Additional Notes:

Commonwealth of Massachusetts
City/Town of Arlington

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-4 (Hole #) | 08/06/20 (Date) | 8:30 AM (Time) | 70*, sunny (Weather) | _____ (Latitude) | _____ (Longitude:)

1. Land Use: Parking lot (e.g., woodland, agricultural field, vacant lot, etc.) | None (Vegetation) | Many large boulders (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-2 (Slope (%))

Description of Location: See attached sketch

2. Soil Parent Material: Till | _____ (Landform) | _____ (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >25 feet | Drainage Way N/A feet | Wetlands >25 feet | Property Line >10 feet | Drinking Water Well N/A feet | Other _____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: _____ Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-12	Fill										
12-61	C	Sandy Loam	10YR5/3	24"	High and Low Chroma	>2	2	10	Massive	Friable	

Additional Notes:

Commonwealth of Massachusetts
City/Town of Arlington

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Signature of Soil Evaluator	Date: 08/06/20
William Hall, P.E., S.E. 13592	06/31/21
Typed or Printed Name of Soil Evaluator / License #	Expiration Date of License
Leyna Tobey - Woodard & Curran	N/A
Name of Approving Authority Witness	Approving Authority

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Field Diagrams: Use this area for field diagrams:

See attached sketch