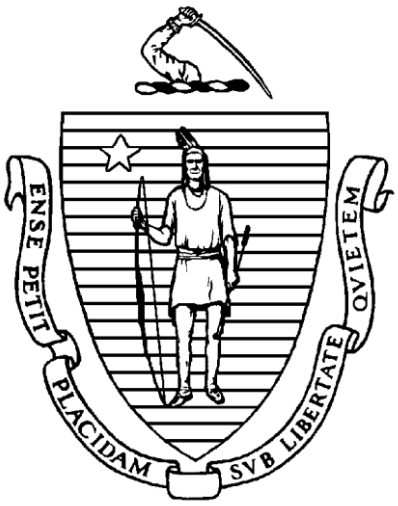


Department of Conservation and Recreation

PART I

INSTRUCTIONS TO BIDDERS

CONTRACTS FOR PUBLIC WORKS PROJECTS
AND
FOR BUILDING PROJECTS ESTIMATED TO
COST MORE THAN $25,000 BUT NOT MORE THAN $100,000
SUBJECT TO THE PROVISIONS OF M.G.L. CH. 30 SEC. 39M

NOTICE TO CONTRACTORS – M.G.L. C. 30, sec. 39M CONSTRUCTION
ADVERTISEMENT OF INVITATION FOR BIDS
COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF CONSERVATION AND RECREATION
10 PARK PLAZA, SUITE 6620, BOSTON, MA 02116
PHONE: 617-626-1250
www.mass.gov/dcr

Contract No. P25-3605-C6A
Title: Memorial Drive – Phase III
Location: Cambridge, Massachusetts

GENERAL BID proposals shall be submitted on a form furnished by the Department and will be received until **12:00 PM on Thursday, June 5, 2025** through DCR's E-bid room at www.bidexpress.com/businesses/36765/home.

Individual sets of contract documents will only be available on DCR's E-bid room at www.bidexpress.com/businesses/36765/home.

If any addenda are issued throughout the open period for this project, DCR will distribute these addenda via Bid Express, which will also email identified prospective at the time plans and specifications are issued.

A pre-bidding site walk/conference for prospective bidders will be held at 10:00 AM on Thursday, May 22, 2025, at the Cambridge Boat Club, 2 Gerrys Landing Road, Cambridge, MA 02138. All questions from prospective bidders following the pre-bidding site walk must be received by DCR no later than Wednesday, May 28, 2025.

The work to be performed consists of but is not necessarily limited to the following: numerous parkway and parkland improvements along an approximate one-mile segment of the Memorial Drive Parkway from the Eliot Bridge to the Anderson Memorial Bridge at JFK Street.

The estimated project cost is **$ 13,400,000**

The work is to be accomplished within **878** calendar days of a notice to proceed. Liquidated damages in the amount of **$1,000** per day will be assessed if the work has not been completed in accordance with the provisions of the contract within the time specified (as extended by any authorized extension of time granted in accordance with the contract provisions).

Bidders must be pre-qualified by the Massachusetts Dept. of Transportation (MassDOT) Highway Division in HIGHWAY-CONSTRUCTION to bid on the above project. An award will not be made to a Contractor who is not pre-qualified by MassDOT prior to the opening of Proposals.

The Proposed contract includes a requirement of 6% for MBE (Minority Business Enterprise) 10% for WBE (Women Business Enterprise) and 3% VOBE requirement (Veteran-Owned Business Enterprise).

The applicable local minority workforce utilization percentage is a minimum goal of 15.3%. The applicable local women workforce utilization percentage is a minimum goal of 6.9%.

Each bid must be accompanied by a bid deposit, in the form of a bid bond, cash, certified check, or a treasurer's or cashier's check issued by a responsible bank or trust company, payable to the Department of Conservation and Recreation in the amount of 5% of the bid.

Each bid must be submitted through DCR's E-Bid room at www.bidexpress.com/businesses/36765/home. Please ensure that your bid is complete and marked as responsive when submitting through DCR's Bid room. Any bids found to be incomplete and/or marked unresponsive will be rejected by DCR and will not be considered when awarding the project.

Bids are subject to the provisions of M.G.L. Ch. 30, Sect. 39F, G, H and M inclusive. Wages are subject to minimum wage rates as per M.G.L. Ch. 149, sections 26 to 27D inclusive. The Department reserves the right to waive any informalities in or to reject any and all bids if it be in the public interest to do so.

Brian M. Arrigo, Commissioner
Massachusetts Department of Conservation and Recreation

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF CONSERVATION AND RECREATION

PART I
INSTRUCTIONS TO BIDDERS

CONTRACTS FOR PUBLIC WORKS PROJECTS
SUBJECT TO THE PROVISIONS OF M.G.L. C. 30. SEC. 39M

Awarding Authority:
Department of Conservation and Recreation
10 Park Plaza, Suite 6620,
Boston, MA 02116
Telephone: 617-626-1250

DCR Contract No.: P25-3605-C6A
Title: Memorial Drive – Phase III
Project Scope: The scope of work includes, but is not necessarily limited to the following: installation of erosion and sediment control measures; establishment of temporary traffic controls; clearing and grubbing; excavation (including temporary earth support system, if selected by the Contractor); installation of a proposed shared use path and stabilized aggregate walking path (including amenities); mill & overlay and limited full depth reconstruction of the Memorial Drive parkway; installation of three (3) traffic signal locations and two (2) pedestrian signal locations; installation of a new, ornamental DCR street lighting system; modifications to the existing drainage system, including BMPs; new parkland trees and plantings; and other incidental work necessary to complete the proposed project.

Deadline for filing general bids is 12:00 P.M. on Thursday, June 5, 2025.

The minimum wage rate and truck rate requirements for this Contract are located www.bidexpress.com/businesses/36765/home.

Bid forms for this Contract are located @ www.bidexpress.com/businesses/36765/home.

The Minority, Women & Veterans Business Enterprise participation for this Contract are to be found in the Notice to Contractors section (Part I - Page 2/3).

The time for completion of the Work is specified in Article 2 of the Department of Conservation and Recreation - Contractor Agreement. Liquidated damages for failure to complete on time are as stated in Article 8 of the Department of Conservation and Recreation - Contractor Agreement.

As used herein, capitalized terms shall have the meaning assigned to them in the General Conditions of the Contract and the Department of Conservation and Recreation - Contractor Agreement unless the context clearly indicates otherwise.

SECTION 1 - BIDDER'S REPRESENTATION

1.1 Each bidder (hereinafter sometimes referred to as "Bidder") by making a bid (hereinafter sometimes referred to as "Bid") represents and warrants that Bidder has visited and examined the Site and the Contract Documents; that Bidder is familiar with the local conditions under which the Work is to be performed; that Bidder has correlated personal observations with the requirements of the Contract Documents; and that where the Contract Documents require, in any part of the Work, a given result to be produced, the Contract Documents are adequate and that Bidder will produce the required result within the Bid price and that the Bid is made in accordance therewith.

1.2 FAILURE TO EXAMINE THE CONTRACT DOCUMENTS AND THE SITE WILL NOT RELIEVE ANY BIDDER FROM ANY OBLIGATION UNDER THE BID AS SUBMITTED. NEITHER THE COMMONWEALTH NOR THE DESIGNER WILL BE RESPONSIBLE FOR ERRORS, OMISSIONS AND/OR CHARGES FOR EXTRA WORK ARISING FROM BIDDER'S FAILURE TO FAMILIARIZE ITSELF WITH THE CONTRACT DOCUMENTS OR EXISTING CONDITIONS.

1.3 Pre-Bidding Conference

A. If applicable, a pre-bidding conference for prospective bidders will be held at the date, time and location as specified in the Notice to Contractors section (Part I – page 2/3).

B. At the conference, the project will be discussed in general. It is desirable that all prospective bidders attend. The Contract, Specifications, Drawings, and any other aspects of this project will be explained in response to questions by those attending. For interpretations of questions requiring legal, administrative, or engineering decision, prospective bidders shall comply with Section 3 herein.

SECTION 2 - GENERAL BIDDERS - QUALIFICATION

2.1 Every Bidder must submit the following documents, as required:

Special certification may be required as required by the Department on a contract-specific basis.

Refer to the Notice to Contractors for the specific qualification requirements of this contract.

SECTION 3 - REQUESTS FOR INTERPRETATION

3.1 Interpretation

A. The Plans and Specifications and other Contract Documents are to be considered together and are intended to be mutually complementary, so that any work shown on the Plans though not specified in the Specifications, and any work specified in the Specifications though not shown on the Plans, is to be executed by the Contractor as a part of this Contract.

B. All things that in the opinion of the Awarding Authority may be reasonably inferred from the Plans, Specifications and other Contract Documents are to be executed by the Contractor. The Awarding Authority shall determine whether the detail Plans conform to the general Plans and Contract Documents.

C. The tables of contents, titles, headings and marginal notes or sub-scripts contained herein are solely to facilitate references, are not intended to be construed as provisions of the Contract, and in no way affect the interpretation of the provisions to which they refer.

D. Where reference is made in the Contract Documents to publications, standards, or codes issued by associations or societies, such reference shall be interpreted to mean the current edition of such publications, standards, or codes, including revisions in effect on the date of the Advertisement, notwithstanding any reference to a particular date. The foregoing sentence shall not apply to the dates, if any, specified with respect to insurance policy endorsement forms.

E. In case of any conflict among the Contract Documents, unless the context clearly otherwise requires, the Contract Documents shall be construed according to the following priorities:

First Priority:	Contract Modifications
Second Priority:	Department of Conservation and Recreation - Contractor Agreement
Third Priority:	General Conditions of the Contract
Fourth Priority:	Drawings - Schedules take precedence over enlarged detail Drawings and enlarged Detail Drawings take precedence over reduced scale Drawings; figured dimensions shall prevail over scale.
Fifth Priority:	Specifications

3.2 Any questions by prospective Bidders concerning interpretation of the Contract Documents must be submitted in writing to the Awarding Authority and should be in its possession at least five working days before the date set for the receipt of Bids. The Awarding Authority will post to Bid Express any addenda or written interpretations that it deems necessary to Bidders who have taken out plans at the address given by them before the date set for the receipt of affected Bids. Bidders may not rely upon oral communications or interpretations from the Awarding Authority or the Designer, and the Awarding Authority shall not be bound by them.

Written Questions shall be submitted to:

Attn: Dan Driscoll, Project Manager
Department of Conservation and Recreation
Bureau of Transportation, Infrastructure and Construction
10 Park Plaza, Suite 6620
Boston, MA 02116

Email: dan.driscoll@mass.gov

3.3 It is the sole responsibility of the Bidder to ascertain the existence of any addenda issued by the Awarding Authority, all addendums are posted on Bid Express- www.bidexpress.com/businesses/36765/home. Copies of addenda will be made available for inspection at the locations listed in the Advertisement where the Contract Documents are on file.

3.4 Wherever in the Contract Documents reference is made to Massachusetts General Laws, it shall be construed to include all amendments thereto effective as of the date of the issuance of the invitation to bid on the proposed work.

SECTION 4 - PREPARATION OF BIDS; ALTERNATES

4.1 Bids shall be submitted through the DCR E-Bid room at www.bidexpress.com/businesses/36765/home?agency=true.

4.2 All Bids submitted thru Bid Express must be deemed responsive by Bid Express to be considered

4.3 Where so indicated on the Bid Form, sums shall be expressed in both words and numerals. Where there is a discrepancy between the Bid sum expressed in words and the Bid sum expressed in figures, the Bid sum expressed in words shall control unless the intention of the Bidder clearly is otherwise as determined by the Awarding Authority in its sole discretion.

4.4 Each Bidder shall acknowledge all required alternates in Section C on the Bid Express by entering the dollar amount of addition or subtraction necessitated by the alternate(s).

4.5 If an alternate includes work within the Bidder's scope of work and does not involve a change in the cost of the Bid, the Bidder shall so indicate by writing "No Change" or "N/C" or "0" in the space provided for that alternate.

4.6 The lowest Bidder will be determined based on the sum of the base Bid and the accepted alternates.

4.7 Each bid must be accompanied by a bid deposit, payable to the Department of Conservation and Recreation in the amount of 5% of the bid. Bid Bonds must be submitted electronically, please ensure your company and your bonding agent's company register with one of the Bid Bond agencies affiliated with Bid Express: If you

need additional assistance, please call the Bid Express Customer Support Team at 888-352-2439, available Monday - Friday from 7:00am – 8:00pm (EST). You can also email the team at support@bidexpress.com

4.8 The amount of such bid deposit shall be **5% five per cent** of the value of the Bid.

SECTION 5 - SUBMISSION OF BIDS

5.1 Each bid, **including the bid deposit,** shall be submitted via DCR's Bid room at www.bidexpress.com/businesses/36765/home?agency=true

5.2 All Bids must be received by the Awarding Authority no later than the applicable date and time specified on page 1 of these Instructions to Bidders. Any Bid not received by the applicable deadline will not be accepted.

SECTION 6 - WITHDRAWAL OF BIDS; REJECTION OF BIDS

6.1 Any Bid may be withdrawn prior to the specified deadline for the receipt of Bids provided that the withdrawal shall be made by a written request signed by a person having the authority to bind the Bidder. The written request must be hand delivered or otherwise delivered to Robert Boncore, Director of Contracts and Procurement, at 10 Park Plaza, Suite 6620, Boston, MA 02116 or through email at Robert.Boncore@Mass.Gov, and must be received on or before the date and time appointed as the deadline for the receipt of Bids.

6.2 A Bidder may withdraw its Bid without penalty at any time up to the time of Award as defined below in subsection 9.1 only upon demonstrating to the satisfaction of the Awarding Authority that a death or disability has occurred, or a bona fide clerical error or mechanical error of a substantial nature was made during the preparation of the bid. Failure to demonstrate conclusively that a bona fide clerical error or mechanical error of a substantial nature was made may result in forfeiture of the Bid deposit

6.3 The Awarding Authority reserves the right to waive any informality in or to reject any and all Bids if it is in the public interest to do so. Without limiting the foregoing, the Awarding Authority reserves the right to reject unit prices which it deems unduly high or unduly low as unbalanced.

SECTION 7 – INSURANCE

7.1 Insurance Generally

A. The Contractor shall take out and maintain the insurance coverages listed in this Section with respect to the operations as well as the completed operations of this Contract. The insurance requirements stipulated shall cover all damage to property, whether above or below ground, and shall apply to all the Work to be performed under this Contract. This insurance shall be provided at the Contractor's expense and shall be in full force and effect for the full term of the Contract or for such longer period as this Article requires.

B. All policies shall be written on an occurrence basis and be issued by companies authorized to write that type of insurance under the laws of the Commonwealth and rated in Best's Insurance Guide (or any successor thereto or replacement thereof) as having a general policy holder rating of "A" or better and a financial rating of at least "9" or otherwise acceptable to the DCR.

C. The Contractor shall submit two originals of each certificate of insurance, acceptable to the DCR, simultaneously with the execution of this Contract. Certificates shall include:

"**Notwithstanding any policy terms or endorsements: DCR Contract Number /Project Name & DCR is an additional insured as to all policies of insurance, with the exception of workmen's compensation. In addition, none of the above-referenced insurance coverages shall be cancelled, terminated, or materially modified in any way unless and until 10 (Ten) days advance written notice is given to the DCR. The contractor has paid all premiums.**

The Contractor shall submit updated certificates prior to the expiration of any of the policies referenced in the certificates so that the DCR shall at all times possess certificates indicating current coverage. Certificates shall indicate contractual liability coverage, and the Contractor's Protective Liability coverage is in force. Certificates shall include specific acknowledgment that the coverage set forth in this Section 7 are included in the policies.

7.2 Types and Amounts of Insurance

Contractor's Commercial General Liability

Bodily Injury &	500,000.00 each occurrence
Property Damage	1,000,000.00 general aggregate, per project

This policy shall include coverage relating to explosion, collapse, and underground property damage if blasting operations constitute part of the Work to be performed under this Contract.

If the Contract work includes work to be performed within fifty feet of a railroad, any exclusion for liability assumed under contract for work within fifty feet of a railroad shall be deleted.

Vehicle Liability

The Contractor shall provide the following minimum coverage with respect to the operations of any employee, including coverage for owned, non-owned, and hired vehicles:

Combined Single Limit: 1,000,000.00

Worker's Compensation

The Contractor shall provide the following coverage in accordance with M.G.L. c. 149, sec. 34A and M.G.L. c. 152 as amended, unless a higher coverage is specified below:

Part One	Provide Statutory Minimum
Employer's Liability	$500,000.00 each accident
Part Two	$500,000.00 disease per employee
	$500,000.00 disease policy aggregate

SECTION 8 – MBE, WBE AND VOBE PARTICIPATION

8.1 The apparent low Bidder's compliance with the requirements of this Section 8 is a prerequisite for receiving the Award of the Contract. The MBE, WBE and VOBE participation for this Contract are as set forth on the first page of these Instructions to Bidders

8.2. The Awarding Authority reserves the right to reduce or waive the MBE or WBE participation established for this Contract upon written request made by a Bidder. Requests to reduce or waive the MBE,WBE & VOBE participation for this Contract should be received by the Awarding Authority no later than Ten (10) working days before the date set for the receipt of general Bids. **THE AWARDING AUTHORITY RESERVES THE RIGHT TO REJECT ANY REQUEST TO REDUCE OR WAIVE THE MBE,WBE & VOBE REQUIREMENTS FOR THIS CONTRACT THAT IS RECEIVED AFTER THESE DEADLINES**. Such written request must demonstrate to the satisfaction of the Awarding Authority that it is not feasible for a non-MBE or non-WBE general Bidder to meet the percentage established for this Contract based upon any or all of the following: (i) actual MBE,WBE & VOBE availability, (ii) the geographic location of the project to the extent related to MBE,WBE & VOBE availability, (iii) the scope of the work, (iv) the percentage of work available for subcontracting to MBE,WBE & VOBEs and/or (v) other relevant factors, including a **documented** inability by the prospective Bidder to obtain commitments from MBE,WBE & VOBE subcontractors sufficient to meet the MBE,WBE & VOBE requirements after having made a diligent, good faith effort to do so. All the foregoing documentation shall accompany the Bidder's request for a reduction or waiver of the MBE,WBE & VOBE participation requirements. Such documentation shall include, at a minimum, the following:

-- A list of all items of work under the Contract that the Bidder made available for subcontracting to MBE,WBE & VOBEs. The Bidder shall identify all items of work that the Bidder did not make so available and shall state the reasons for not making such work available for subcontracting to MBE,WBE & VOBEs. The Bidder shall also demonstrate that, where commercially reasonable, subcontracts were divided into units capable of being performed by MBE,WBE & VOBEs.

-- Evidence that the Bidder sent written notices soliciting Bids or proposals to perform the items of work made available by the Bidder for subcontracting to all MBE,WBE & VOBEs qualified to perform such work. The Bidder shall identify (if) each solicited, and (ii) each MBE,WBE & VOBE listed in the Massachusetts Supplier Diversity Office ("SDO" formerly "SOMWBA") directory under the applicable trade category that was not solicited and reasons, therefore. The Bidder shall also state the dates that notices were mailed and provide a copy of the written notice(s) sent.

-- Evidence that the Bidder made reasonable efforts to follow up the written notices sent to MBE,WBE & VOBEs with telephone calls or personal visits to determine with certainty whether the MBE,WBE & VOBEs were interested in performing the work. Phone logs or other documentation must be submitted.

-- A statement of the response received from each solicited, including the reason for rejecting any MBE,WBE & VOBE who submitted a bid or proposal.

-- Evidence of efforts made to assist MBE,WBE & VOBEs that needed assistance in obtaining bonding or insurance, or lines of credit with suppliers if the inability of MBE,WBE & VOBEs to obtain bonding, insurance, or lines of credit is the reason given for the Bidder's inability to meet the requirements.

The Bidder may also submit any other information supporting its request for a waiver or reduction in the MBE,WBE & VOBE participation, including without limitation evidence that the Bidder placed advertisements in appropriate media and trade association publications announcing the Bidder's interest in obtaining bids or proposals from MBE,WBE & VOBEs, and/or sent written notification to MBE,WBE & VOBE economic development assistance agencies, trade groups and other organizations notifying them of the Contract and the work to be subcontracted by the Bidder to MBE,WBE & VOBEs. The Bidder shall also submit any other information requested by the Awarding Authority to show that the Bidder has taken all actions that could be expected to achieve the MBE,WBE & VOBE participation.

8.3 Any reduction or waiver of the MBE,WBE & VOBE participation for this Contract will be made by written addendum via Bid Express to all persons who have taken out plans for the project.

8.4 No later than five (5) working days after the opening of Bids, the apparent low Bidder shall submit the following documents to the Awarding Authority's Contract Officer listed in subsection 5.1: (i) a completed Schedule for Participation by Minority/Women Business Enterprises ("Schedule for Participation") in the form provided by the Awarding Authority showing participation in amounts equal to or exceeding the MBE,WBE & VOBE requirements for this Contract, (ii) a completed Letter of Intent in the form provided by the Awarding Authority for each MBE,WBE & VOBE listed in the Schedule for Participation, and (iii) a current SDO certification letter for each MBE,WBE & VOBE listed in the Schedule of MBE,WBE & VOBE Participation showing that the MBE,WBE & VOBE is certified in the area of work for which it is listed on the Letter of Intent.

8.5 Each Letter of Intent shall identify and describe the work to be performed by the named (the “MBE,WBE & VOBE Work”) with enough specificity to permit the Awarding Authority to identify the items of contract work that the MBE,WBE & VOBE will perform for participation credit. The Awarding Authority reserves the right to reject any Letter of Intent if the price to be paid for the MBE,WBE & VOBE Work does not bear a reasonable relationship to the value of such work under the Contract as determined by the Awarding Authority.

8.6 Within five (5) working days after receipt of the Schedule For MBE,WBE & VOBE Participation, Letters of Intent, and SDO certification letters, the Awarding Authority shall review and either approve or disapprove the apparent low Bidder’s submissions. If the apparent low Bidder has not submitted an appropriate Schedule For MBE,WBE & VOBE and appropriate Letters of Intent and SDO certification letters establishing that the MBE,WBE & VOBE participation for the project will be met, the apparent low Bidder may be considered ineligible for Award of the Contract and the Awarding Authority will Award the Contract to the second lowest Bidder, subject to said Bidder’s compliance with these conditions.

8.7 The Contractor is required to submit to the Awarding Authority signed subcontracts with all subcontractors prior to the commencement of work to be performed under these contracts, and/or a purchase order or invoice from each material supplier and/or manufacturer listed on the Schedule For MBE,WBE & VOBE Participation of the issuance of the Notice to Proceed by the Awarding Authority.

SECTION 9 - CONTRACT AWARD

9.1 "Award" means the determination, selection, and notification of the lowest, responsible, and eligible Bidder by the Awarding Authority.

9.2 The Contract will be awarded to the lowest responsible and eligible Bidder as determined by the Awarding Authority. Bidders will be required to hold firm their respective bids for thirty (30) days, Saturdays, Sundays, and legal holidays excluded, after the opening of the Bids.

9.3 As used herein, the term "lowest responsible and eligible Bidder" shall mean the Bidder whose Bid is the lowest of those Bidders who, in the Awarding Authority's opinion, are ready, willing and able to comply with all requirements of the Contract Documents and demonstrably possess the skill, ability, and integrity necessary for the faithful performance of the Work, based on the determination of past performance and financial soundness under M.G.L. c. 30, sec. 39M, (ii) the rules, regulations, orders, guidelines and policies promulgated from time to time by the Commissioner of the Department of Conservation and Recreation and (iii) any other relevant criteria that the Awarding Authority may prescribe.

9.4 The Bid price shall be the price set forth in paragaraph C of the Bid Form.

9.5 Should the Contract Documents require submission of special data to accompany the Bid, the Awarding Authority reserves the right to rule the Bidder's failure to submit such data an informality and to receive said data subsequently within a reasonable time as set by the Awarding Authority, provided that no such ruling shall result in an unfair advantage to the Bidder.

9.6 Should the Contract Documents require submission of special data to accompany the Bid, the Awarding Authority reserves the right to rule the Bidder's failure to submit such data an informality and to receive said data subsequently within a reasonable time as set by the Awarding Authority, provided that no such ruling shall result in an unfair advantage to the Bidder. **In addition,** the Department reserves the right to waive minor defects in documents or time limits

SECTION 10 - EXECUTION OF CONTRACTS

10.1 Upon receipt of the Award, the Bidder awarded the Contract shall submit two (2) properly executed originals of each of the following documents prior to execution of the Contract by the Awarding Authority. All such documents shall be in the form prescribed by the Awarding Authority and received within five working days from receipt of the Award.

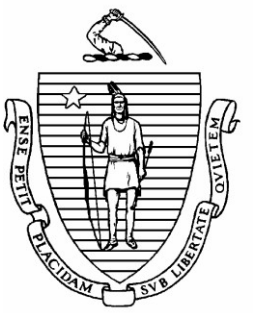
-Department of Conservation and Recreation-Contractor Agreement
-Certificate of Corporate Vote
-Joint Venture Authorization (if appropriate)
-Performance and Payment Bonds with power of attorney
-Certificates of Insurance evidencing coverages in amounts required by the Contract Documents.
-Any other documents that the Awarding Authority may require in connection with the Contractor's execution of the Contract.

10.2 Please note that no part of the Contractor's work may be subcontracted without the prior written approval of the Awarding Authority. The Contractor must complete a minimum of 51% of the scope of this contract by his own work force. If the Contractor desires to subcontract any part of the Work, the Contractor must promptly forward to the Awarding Authority a list in duplicate designating the work to be performed and the name of each proposed subcontractor. Approved subcontractors are eligible for direct payments under M.G.L. 30, sec. 39F, as amended. Material suppliers not involving site labor need not be submitted for approval.

SECTION 11 - RETURN OF BID DEPOSITS

11.1 All Bid deposits of Bidders, except those of the three (3) lowest responsible and eligible general Bidders, shall be returned within five days, Saturdays, Sundays, and legal holidays excluded, after the opening of the Bids. The Bid deposits of the three (3) lowest responsible and eligible Bidders shall be returned upon the execution and delivery of the Contract, or if no award is made; except that, if any Bidder fails to perform its agreement to execute the Contract and furnish performance and payment bonds as stated in its Bid, then said Bidder's Bid deposit shall become the property of the Commonwealth as liquidated damages; provided that the amount of the Bid deposit that becomes the property of the Commonwealth shall not exceed the difference between the Contractor's Bid price and the Bid price of the next lowest responsible and eligible Bidder; and provided further that, in the case of death, disability, bona fide clerical or mechanical error of a substantial nature, or other similar unforeseen circumstances affecting the Bidder, such Bidder's Bid deposit shall be returned.

11.2 In addition to the provisions for the return of Bid deposits as provided above, upon receipt of a Bid Bond in an amount not less than the amount of the required Bid deposit, the Awarding Authority shall return any Bid deposit of a Bidder forthwith after the public opening of Bids.



COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF CONSERVATION & RECREATION
STANDARD CONSTRUCTION CONTRACT
For Projects Subject to M.G.L. c. 149 or M.G.L. c. 30, sec. 39M

PART II

DEPARTMENT OF CONSERVATION AND RECREATION - CONTRACTOR AGREEMENT

Awarding Authority: The Massachusetts Department of Conservation and Recreation

Department Code: DCR

This agreement ("Contract") is made by and between the Commonwealth of Massachusetts acting by and through the Awarding Authority identified above with a principal place of business at 10 Park Plaza, Suite 6620, Boston, MA 02116, and hereinafter called the "Contractor".

Terms used in this Department of Conservation and Recreation - Contractor Agreement, which are defined in the General Conditions of the Contract shall have the meanings designated therein.

The Awarding Authority and the Contractor agree as follows:

Article 1. Scope of Work. The Work under this Contract is defined as all work required by the Contract Documents for the construction of Contract No: P2 in accordance with and as described in the Plans and Specifications prepared by and as modified by Addenda () included herein.

Article 2. Time for Completion. The Contractor shall commence the Work under this Contract on the date specified in the written "Notice to Proceed," and shall within _Days after such date, bring the Work to Substantial Completion and to the point at which a Certificate of Agency Use and Occupancy may be issued, and shall bring the Work to Final Acceptance within 10 days after the date specified for Substantial Completion.

Article 3. Contract Price. The Awarding Authority shall pay the Contractor, in current funds, for the performance of the Work, subject to additions and deductions by Approved Change Order(s), the Contract Price of _Dollars and Zero Cents ($ .00).The Unit Prices, if any, approved by the Awarding Authority are those included in the Contractor's General Bid. The following Alternates have been accepted, and their costs are included in the Contract Price:

Article 4. Approved Subcontractors. The filed Subcontractors listed in the Contractor's General Bid submitted by the Contractor have been approved for the performance of the specified portions of the Work subject to the Commonwealth's verification that they have complied with state corporation and partnership registration laws. No other filed Subcontractors and no non-filed Subcontractors shall be used for these or any other portions of the Work without the prior written approval of the Awarding Authority.

Article 5. Certifications. Pursuant to M.G.L. c. 62C, sec. 49A, the individual signing this Contract on behalf of the Contractor hereby certifies, under the penalties of perjury, that to the best of his or her knowledge and belief the Contractor has complied with all applicable state and federal tax laws. The individual signing this Contract on behalf of the Contractor further certifies under penalties of perjury that the Contractor is not presently debarred from doing public construction work in the Commonwealth under the provisions of M.G.L. c. 29, sec. 29F, or any other applicable debarment provisions of any other chapter of the General Laws or any rule or regulation promulgated thereunder and is not presently debarred from doing public construction work by any agency of the United States.

Article 6. The Contract Documents: The following documents form the Contract, are incorporated by reference herein, and are referred to as the "Contract Documents:"
-The Instructions to Bidders
-The General Bid submitted by the Contractor
-This Department of Conservation and Recreation – Contractor Agreement
-The General Conditions of the Contract
-The Special Conditions [Note: the term “Special Conditions" may also refer to Division 1 of the Specifications.]
-The Plans and Specifications, including Addenda identified in Article 1 above
-All Approved Change Orders issued after execution of this Department of Conservation and Recreation - Contractor Agreement

Article 7. Minority Business Enterprise, Women Business Enterprise and Veteran-Owned Business Enterprises Participation requirements and Minority/Women and Veteran-Owned Business Enterprises Workforce Utilization Percentages: The applicable requirements, if any, for minority business enterprise and women business enterprise participation, as well as those for minority and women workforce utilization percentages established for this Contract are to be found at the Notice to Contractors for this project, at Part I – Instructions to Bidders, and are incorporated by reference herein.

Article 8. Liquidated Damages. For the purposes of Article VI of the General Conditions of the Contract, liquidated damages for delay are to be found at the Notice to Contractors for this project at Part I – Instructions to Bidders and are incorporated by reference herein.

Article 9. Insurance Requirements. The insurance requirements are set forth in the Instructions to Bidders and are incorporated herein.

In witness whereof, the parties hereto have caused this instrument to be executed in duplicate under seal as of the date set forth above.

Forms Used During Contract Award and Execution

PAYMENT BOND
PERFORMANCE BOND
CERTIFICATE OF CORPORATE VOTE OF AUTHORITY
CERTIFICATE OF COMPLIANCE WITH STATE TAX LAWS AND WITH UNEMPLOYMENT COMPENSATION CONTRIBUTION REQUIREMENTS
CERTIFICATE OF LIABILITY INSURANCE
A. SEE PART I, SECTION 7 – ARTICLE 7.1 C.
B. ADDING IN THE DESCRIPTION **DCR AS ADDITIONAL INSURED**.
SCHEDULE FOR WOMEN AND MINORITY BUSINESS ENTERPRISE
LETTER OF INTENT – MINORITY AND WOMEN BUSINESS PARTICIPATION
SCHEDULE FOR VETERAN-OWNED BUSINESS ENTERPRISE
LETTER OF INTENT – VETERAN-OWNED BUSINESS ENTERPRISE
EXECUTIVE ORDER 546 – CONTRACTOR CERTIFICATION - VOBE POLICY OF THE COMMONWEALTH
EXECUTIVE ORDER 481 – CONTRACTOR CERTIFICATION - UNDOCUMENTED WORKERS POLICY OF THE COMMONWEALTH
EQUAL EMPLOYMENT OPPORTUNITY COMPLIANCE FORM
IF APPLICABLE FORM OF SUBCONTRACTOR(S)

IN WITNESS WHEREOF, said Contractor has caused these presents to be signed in its name and its behalf under seal by its officers, duly authorized to do so, and the said Commonwealth has executed these presents by the Commissioner of said Department, or its authorized agent, as prescribed by law, who shall not incur any personal liability by reason of the execution of these presents or of anything herein contained, and who hereby certifies under penalties of perjury that all applicable provisions of M.G.L. c. 149, sec. 44J, have been complied with.

(Executed in duplicate under Seal)

CONTRACTOR:

By:_____SIGNATURE & SEAL

Name: _____

Title: _____

Date: _____

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF CONSERVATION AND RECREATION

By: _____

Name: Brian M. Arrigo

Title: Commissioner

Date: _____

PAYMENT BOND

BOND No._____

Know all men by these presents, that

_____

as principal and_____

as surety are held and firmly bound unto the Commonwealth of Massachusetts in the sum of Dollars and Zero Cents ($ 0.00)in lawful money of the United States of America, to be paid to the Commonwealth of Massachusetts, for which payments, well and truly to be made, we bind ourselves, our respective heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

Whereas the said principal has made a Contract with the Commonwealth acting through its Department of Conservation and Recreation ("Awarding Authority") the construction of

Now the condition of this obligation is such that if the principal shall pay for all labor performed or furnished and for all materials used or employed in said Contract and in any and all duly authorized modifications, alterations, extensions of time, changes or additions to said Contract that may hereafter be made, notice to the surety of such modifications, alterations, extensions of time, changes or additions being hereby waived, the foregoing to include any other purposes or items set out in, and to be subject to, the provisions of Massachusetts General Laws, Chapter 30, Section 39A, and Chapter 149, Section 29, as amended, then this obligation shall become null and void; otherwise it shall remain in full force and virtue.

In witness whereof we hereunto set our hand and seals this___day of_____, _____

_____(Seal) _____(Seal)

(Print Name of General Contractor) (Print Name of Surety)

By_____ By_____

(Signature – Title) (Signature – Title)

Surety Address_____

_____

PERFORMANCE BOND

BOND No. _____

Know all men by these presents, that

_____

as principal and _____

as surety are held and firmly bound unto the Commonwealth of Massachusetts in the sum of and Zero Cents ($ 0.00) in lawful money of the United States of America, to be paid to the Commonwealth of Massachusetts, for which payments, well and truly to be made, we bind ourselves, our respective heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

Whereas the said principal has made a Contract with the Commonwealth acting through its Department of Conservation and Recreation ("Awarding Authority") the construction of

Now the condition of this obligation is such that if the principal shall well and truly keep and perform all the undertakings, covenants, agreements, terms and conditions of said Contract and any extensions thereof that may be granted by the Commonwealth, with or without notice to the surety, and during the life of any guarantee required under the Contract, and shall also well and truly keep and perform all the undertakings, covenants, agreements, terms and conditions of any and all duly authorized modifications, alterations, changes or additions to said Contract that may hereafter be made, notice to the surety of such modifications, alterations, changes or additions being hereby waived, then this obligation shall become null and void; otherwise it shall remain in full force and virtue.

In the event that the Contract is abandoned by the Contractor or is terminated by the Commonwealth under the provisions of said Contract, said surety shall, if requested in writing by the Commonwealth, take such action as is necessary to complete the Contract.

In witness whereof we hereunto set our hand and seals this _____ day of _____, _____

_____(Seal) _____(Seal)

(Print Name of General Contractor) (Print Name of Surety)

By_____ By_____

(Signature – Title) (Signature – Title)

Surety Address _____

_____

CERTIFICATE OF CORPORATE VOTE

I hereby certify that I am the____clerk,_____assistant clerk, of

_____(the "Corporation") and that at a
(Name of Corporation)
duly authorized meeting of the Board of Directors of the Corporation held on

_____in_____at which a quorum was
(Date) (Location)
present and voting it was voted to authorize _____
(Name)
_____of the Corporation to execute
(Officer Title)
and deliver on behalf of the Corporation Contract, and to act as principal to execute bonds in connection therewith,

I further certify that_____is the duly qualified and acting
(Name of Corporate Officer)

_____ of the Corporation and that said vote has not been
(Officer Title)
Repealed, rescinded, or amended.

_____
Name

_____
Print Name

_____
Date

(CORPORATE SEAL)

SUBSCRIBED AND SWORN TO THIS_____DAY OF_____, 20___BEFORE ME

_____
Notary Public

My Commission Expires: _____

CERTIFICATE OF LLC VOTE

N/A

_____, 2025

I hereby certify, warrant and represent that I am the _____of

the _____(the "LLC") and that
(Name of LLC)

I am fully and unconditionally authorized pursuant to the Operating Agreement of the LLC to execute and deliver on behalf of the LLC a contract and all amendments thereto, and to act as principal and to execute bonds in connection therewith:

Mass. State Project No. _____

Project Title:_____

I further certify under the penalties of perjury that I, _____, am the duly qualified and acting member and principal of the LLC for all purposes.
.

_____
Name

_____
Print Name

_____
Date

SUBSCRIBED AND SWORN TO THIS ____DAY OF _____BEFORE ME

_____
Notary Public
My Commission Expires: _____

CERTIFICATE OF COMPLIANCE WITH STATE TAX LAWS AND WITH UNEMPLOYMENT COMPENSATION CONTRIBUTION REQUIREMENTS

Pursuant to MGL, c. 62C, s. 49A and MGL, c. 515A, s. 29A, I,

_____authorized signatory for

_____whose principal place of business is at

_____do hereby certify

under penalties of perjury that_____has filed all

state tax returns and paid all taxes as required by law and has complied with all state laws

pertaining to contributions to the unemployment compensation fund and to payments

in lieu of contributions.

The Business Organization Social Security Number or Federal Identification Number is

_____.

Signed under the penalties of perjury the_____day of_____20_____

Signature:_____

Name and Title:_____

Schedule for Participation by Minority Business Enterprise
(To be completed and submitted within five calendar days from bid opening)

NOTE I: Participation of a Minority-owned enterprise may be counted in only one category.

Minority Business Enterprise Participation in the work Waived per Addenda #1

Name & address of MBE Requirement **6%**	Dollar Value of Participation	Nature of Participation
1.		
2.		
3.		
4.		
5.		
6.		

Total MBE Commitment:_____

Percentage MBE Participation (divide Total Commitment by Total Bid Price)= _____

The bidder agrees to furnish implementation reports as required by the Department to indicate the MBE(s) which it has used or intends to use. Breach of this commitment constitutes a breach of the contract.

Name of bidder:_____

Date:_____By:_____

Letter of Intent – Minority Business Enterprise Participation

(To be completed by W or MBE and Submitted by the Low Bidder within five calendar days of bid opening)

Project Number:_____ MBE
Project Location:_____
To: _____
Name of General Bidder

1. My company has been certified by SDO (Supplier Diversity Office) and it has not changed its minority ownership, control, or management without notifying SDO within thirty (30) calendar days of such a change.

2. My company understands that if your company is awarded the contract, your company intends to enter into an agreement with my company to perform the activity described below for the prices indicated. My firm also understands that your firm, as General Bidder, will make substitutions and quantity changes as allowed or required by the provisions of the contract with the Commonwealth.

3. This firm understands that under the terms of Article XIII of the contract, only work **performed** by an MBE will be credited toward MBE participation requirements, and this firm **cannot assign or subcontract out any of its work** without prior written approval of the DCR Compliance Office, and that any such assignment or subcontracting will not be credited toward MBE participation requirements.

W or MBE PARTICIPATION

Contract Item	**Description of Activity** (with Notation such as "Labor Only", "Material Only", etc.)	Quantity	Unit Price	Total Amount

Total Dollar Value:_____

(Additional copies of this form shall be prepared by the Contractor in the quantity necessary to comply with the contract.)

Name of MBE
Firm_____Authorized Signature_____

Business Address_____

Print Name_____Title_____
Telephone No._____Cell:_____Date_____

Schedule for Participation by Women Business Enterprise
(To be completed and submitted within five calendar days from bid opening)

NOTE I: Participation of a Woman-owned enterprise may be counted in only one category.

Minority Business Enterprise Participation in the work Waived per Addenda #1

Name & address of WBE **10%**	Dollar Value of Participation	Nature of Participation
1.		
2.		
3.		
4.		
5.		
6.		

Total WBE Commitment:_____

Percentage WBE Participation (divide Total Commitment by Total Bid Price) = _____

The bidder agrees to furnish implementation reports as required by the Department to indicate the WBE(s) which it has used or intends to use. Breach of this commitment constitutes a breach of the contract.

Name of bidder:_____

Date:_____By:_____

Letter of Intent – Women Business Enterprise Participation

(To be completed by WBE and Submitted by the Low Bidder within five calendar days of bid opening)

Project Number:_____ WBE
Project Location:_____
To: _____
Name of General Bidder

4. My company has been certified by SDO (Supplier Diversity Office) and it has not changed its women ownership, control, or management without notifying SDO within thirty (30) calendar days of such a change.

5. My company understands that if your company is awarded the contract, your company intends to enter into an agreement with my company to perform the activity described below for the prices indicated. My firm also understands that your firm, as General Bidder, will make substitutions and quantity changes as allowed or required by the provisions of the contract with the Commonwealth.

6. This firm understands that under the terms of Article XIII of the contract, only work **performed** by a WBE will be credited toward WBE participation requirements, and this firm **cannot assign or subcontract out any of its work** without prior written approval of the DCR Compliance Office, and that any such assignment or subcontracting will not be credited toward WBE participation requirements.

W or MBE PARTICIPATION

Contract Item	**Description of Activity** (with Notation such as "Labor Only", "Material Only", etc.)	Quantity	Unit Price	Total Amount

Total Dollar Value:_____

(Additional copies of this form shall be prepared by the Contractor in the quantity necessary to comply with the contract.)

Name of WBE Firm_Authorized Signature_____

Business Address_____

Print Name_____Title_____

Telephone No._____Cell:_____Date_____

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF CONSERVATION AND RECREATION
VETERAN OWNED BUSINESS ENTERPRISE POLICY
AND CONTRACTOR CERTIFICATION

In accordance with Executive Order No. 546, it is the policy of the Commonwealth and its executive agencies to promote self-reliance among veterans by offering such veterans who own and control business enterprises the opportunity to participate in state contracting activity, as well as to assist and encourage the participation of businesses owned and controlled by veterans in all areas of state procurement contracting, including contracts for public construction, design services, and commodities and services.

The Massachusetts Executive Office of Administration and Finance has therefore established the Veteran-Owned Business Enterprise (VOBE) Program (the "Program") to oversee the inclusion of business enterprises owned and controlled by veterans in all areas of state procurement contracting, including contracts for construction, design and professional services, and commodities and services. For more information on this Order, see: http://www.mass.gov/governor/legislationeexecorder/executiveorder/executive-order-no-546.html.

DCR Requires Contractors to acknowledge this policy and the requirements as provided in the contract by signing this certification as well as the Contract Documents.

CONTRACTOR CERTIFICATION

As evidence by the signature of the Contractor's Authorized Signatory below, the Contractor certifies under the pains and penalties of perjury that the Contractor acknowledges the above-referenced policy as set forth in Executive Order 546, has read Executive Order 546, and will abide the requirements concerning the policy and order as set forth in the referenced Contract. The Contractor acknowledges that if the Contractor has not submitted an appropriate Schedule for VOBE Participation and appropriate Letters of Intent establishing that the VOBE participation requirements for the project will be met, the Contractor may not be considered eligible for Award of the Contract unless he/she requests a waiver by completing and submitting the waiver form to the Contracts Administrator/DCR and that request is approved. The Contractor also understands and agrees that a breach of any of these terms during the period of the Contract may be regarded as a material breach, subjecting the Contractor to sanctions, including but not limited to monetary penalties, withholding of payments, contract suspension and /or termination.

_____ Date:_____
Contractor Authorizing Signature

_____
Print Name

Title:_____ Telephone:_____

Cell:_____ Email:_____

Schedule for Participation by Veteran-Owned Business Enterprise

(To be completed and submitted within five (5) calendar days from bid opening)

NOTE: Participation of a Veteran-Owned Enterprise may be counted in only one category; the same participation cannot be used in computing the percentage of DBE/MBE/WBE participation.

Veteran-Owned Business Enterprise Participation in the work

Waived per Addenda #1

Name & address of VOBE **3%**	Dollar Value of Participation	Nature of Participation
1.		
2.		
3.		
4.		
5.		
6.		

Total VOBE Commitment: _____

Percent VOBE Participation (divide Total Commitment by Total Bid Price)= _____

The bidder agrees to furnish implementation reports as required by the Department to indicate the VOBE(s) which it has used or intends to use. Breach of this commitment constitutes a breach of the contract.

Name of bidder:_____

Date:_____By:_____

Letter of Intent – Veteran-Owned Business Enterprise Participation

(To be completed by VOBE and Submitted by the Low Bidder within five (5) calendar days of bid opening; use and prepare extra forms as needed)

DCR Contract/ Project Number:_____

Project Location:_____

To: _____

VOBE Name of General Bidder

My company has been certified by the Department of Veterans Affairs and or Supplier Diversity Office (SDO). it has not changed its veteran ownership, control, or management without notifying the Department of Veterans Affairs within thirty (30) calendar days of such a change.

1. My company understands that if your company is awarded the contract, your company intends to enter into an agreement with my company to perform the activity described below for the prices indicated. My firm also understands that your firm, as General Bidder, will make substitutions and quantity changes as allowed or required by the provisions of the contract with the Commonwealth.
2. This firm understands that under all relevant terms of the contract, only work **performed** by an VOBE will be credited toward VOBE participation requirements, and this firm **cannot assign or subcontract out any of its work** without prior written approval of the DCR Compliance Office, and that any such assignment or subcontracting will not be credited toward VOBE participation requirements.

VOBE PARTICIPATION

Contract **Description of Activity** (with Item Notation such as “Labor Only”, Quantity, Unit Price, Total Amount, “Material Only”, etc.):

Activity	Labor or Material Only?	Quantity Unit Price	Total Dollar Value

VOBE Firm Name_____

Authorized Signature_____

Printed Name_____Title_____

Telephone No._____Cell No._____

E-mail:_____@_____; Date_____

INSTRUCTIONS:

Executive Order 481 applies to all state agencies in the Executive Branch, including all executive offices, boards, commissions, agencies, departments, divisions, councils, bureaus, and offices, now existing and hereafter established. As it is the policy of the Executive Branch to prohibit the use of undocumented workers in connection with the performance of state contracts, all contracts entered after February 23, 2007, require that contractors, as a condition of receiving Commonwealth funds under any Executive Branch contract, make the following certification:

CONTRACTOR CERTIFICATION:

As evidenced by the signature of the Contractor's Authorized Signatory below, the Contractor certifies under the pains and penalties of perjury that the Contractor shall not knowingly use undocumented workers in connection with the performance of all Executive Branch contracts; that pursuant to federal requirements, the Contractor shall verify the immigration status of all workers assigned to such contracts without engaging in unlawful discrimination; and that the Contractor shall not knowingly or recklessly alter, falsify, or accept altered or falsified documents from any such worker(s). The Contractor understands and agrees that breach of any of these terms during the period of each contract may be regarded as a material breach, subjecting the Contractor to sanctions, including but not limited to monetary penalties, withholding of payments, contract suspension or termination.

_____ Date: _____

Contractor Authorizing Signature

_____

Print Name

Title:_____ Telephone: _____

Cell:_____ Email: _____

EQUAL EMPLOYMENT OPPORTUNITY COMPLIANCE FORM

Contractor's Certificate

A contractor shall not be eligible for award of a contract unless such contractor has submitted the following certification to the Awarding Authority, said certification shall be deemed a part of the resulting contract:

Contractor's Certification

X _____

(Contractor)

certifies that it intends to use the following listed **certification trades** in the work subject to this contract.

X _____

_____

_____

and, further, that it will comply with the minority manpower ratio and specific affirmative action steps contained herein; and will obtain from each of its subcontractors and submit to the Awarding Authority prior to the award of any subcontract under this contract, the subcontractor certification required by these bid conditions.

X _____

(Signature of authorized representative of contractor)

Subcontractor's Certification

Prior to the award of any subcontract, regardless of tier, the prospective subcontractor must execute and submit to the general contractor the following certification, which shall be deemed a part of the resulting subcontract:

_____

(Subcontractor)

certifies that: it intends to use the following listed construction trades in the work under the subcontract

_____

_____

_____

and, further, it will comply with the manpower ratio and specific affirmative action steps contained herein and will obtain from each of the subcontractors prior to the award of any subcontract under this subcontract, the subcontractor certification required by these bid conditions.

_____

(Signature of authorized representative of subcontractor)

To ensure that said subcontractor's certification becomes a part of all subcontracts under the general contract, no subcontract shall be executed unless or until an authorized representative of the Awarding Authority administering this contract has determined, in writing, that said certification has been incorporated in such subcontract, regardless of tier. Any subcontract executed without such written approval shall be void.

Exhibit A
Executive Order 504 Contractor Certification Form

BIDDER/CONTRACTOR LEGAL NAME:

BIDDER/CONTRACTOR VENDOR/CUSTOMER CODE: VC

Executive Order 504: For all Contracts involving the Contractor's access to personal information, as defined in M.G.L. c. 93H, and personal data, as defined in M.G.L. c. 66A, owned or controlled by Executive Department agencies, or access to agency systems containing such information or data (herein collectively "personal information"), Contractor certifies under the pains and penalties of perjury that the Contractor (1) has read Commonwealth of Massachusetts Executive Order 504 and agrees to protect any and all personal information; and (2) has reviewed all of the Commonwealth of Massachusetts Information Technology Division's Security Policies available at www.mass.gov/ITD under Policies and Standards.

Notwithstanding any contractual provision to the contrary, in connection with the Contractor's performance under this Contract, for all state agencies in the Executive Department, including all executive offices, boards, commissions, agencies, departments, divisions, councils, bureaus, and offices, now existing and hereafter established, the Contractor shall:

(1) obtain a copy, review, and comply with the contracting agency's Information Security Program (ISP) and any pertinent security guidelines, standards, and policies; (2) comply with all of the Commonwealth of Massachusetts Information Technology Division's Security Policies ("Security Policies") available at www.mass.gov/ITD under Policies and Standards.

(2) communicate and enforce the contracting agency's ISP and such Security Policies against all employees (whether such employees are direct or contracted) and subcontractors.

(3) implement and maintain any other reasonable appropriate security procedures and practices necessary to protect personal information to which the Contractor is given access by the contracting agency from the unauthorized access, destruction, use, modification, disclosure, or loss.

(4) be responsible for the full or partial breach of any of these terms by its employees (whether such employees are direct or contracted) or subcontractors during or after the term of this Contract, and any breach of these terms may be regarded as a material breach of this Contract.

(5) in the event of any unauthorized access, destruction, use, modification, disclosure or loss of the personal information (collectively referred to as the "unauthorized use"): (a) immediately notify the contracting agency if the Contractor becomes aware of the unauthorized use; (b) provide full cooperation and access to information necessary for the contracting agency to determine the scope of the unauthorized use; and (c) provide full cooperation and access to information necessary for the contracting agency and the Contractor to fulfill any notification requirements.

Breach of these terms may be regarded as a material breach of this Contract, such that the Commonwealth may exercise all contractual rights and remedies, including without limitation indemnification under Section 11 of the Commonwealth's Terms and Conditions, withholding of payments, contract suspension, or termination. In addition, the Contractor may be subject to applicable statutory or regulatory penalties, including and without limitation, those imposed pursuant to M.G.L. c. 93H and under M.G.L. c. 214, § 3B for violations under M.G.L. c. 66A.

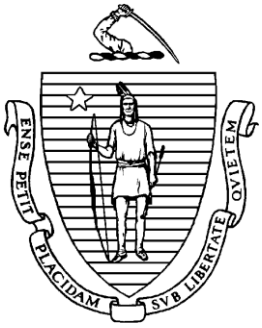
Bidder/Contractor Name: _____

Bidder/Contractor Authorized Signature: _____

Print Name and Title of Authorized Signatory: _____

Date: _____

This Certification may be signed once and photocopied to be attached to any
Commonwealth Contract that does not already contain this Certification Language and shall be interpreted to be incorporated by reference into any applicable contract subject to Executive Order 504 for this Contractor.



COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF CONSERVATION & RECREATION
STANDARD CONSTRUCTION CONTRACT

PART III

GENERAL CONDITIONS OF THE CONTRACT

FOR PROJECTS SUBJECT TO M.G.L. CH. 149 OR
M.G.L. CH. 30, SEC. 39M

TABLE OF CONTENTS

ARTICLE I: DEFINITION OF TERMS 5

ARTICLE II: EXECUTION OF THE CONTRACT, SCOPE OF WORK, INTERPRETATION OF CONTRACT DOCUMENTS 7

1. ***Execution.*** *7*
2. ***Scope of Work.*** *7*
3. ***Interpretation.*** *7*
4. ***Distribution of Work.*** *8*
5. ***Contract Price.*** *8*

ARTICLE III: CONTROL OF WORK/ADMINISTRATION OF THE CONTRACT 8

1. ***DCR.*** *8*
2. ***Right of Access to Work.*** *8*
3. ***Inspection No Waiver.*** *8*

ARTICLE IV: GENERAL PERFORMANCE OBLIGATIONS OF THE CONTRACTOR 8

1. ***Review of Contract Documents and Field Conditions.*** *8*
2. ***Supervision and Construction Procedures; Coordination; Cutting, and Patching.*** *9*
3. ***Superintendent.*** *9*
4. ***Labor.*** *10*
5. ***Notices and permits.*** *10*
6. ***Lines, Marks etc.*** *10*

7. Excavation. *10*

8. Dewatering/Hoisting/Staging. *10*

9. Corrections to the Work; Inspection No Bar to Subsequent Corrections. *11*

10. Sanitary Facilities. *11*

11. Temporary Offices. *11*

12. Telephones. *11*

13. Project Sign. *11*

14. Contract Documents and Samples at the Site. *12*

15. Safety Laws, Regulations, and Practices. *12*

16. Environmental Protection *14*

2. Dust Control. *16*

17. Debris, Excavated Material and Chemical Waste. *16*

18. Nuisances. *16*

19. Weather Protection (M.G.L. c. 149, sec. 44G and 44F(1). *17*

20. Furnishings and Equipment. *17*

21. Form for Sub-contract. *17*

22. Sales Tax Exemption and Other Taxes. *18*

23. Final Cleaning. *18*

24. Maintenance Data. *18*

25. Drainage Specifications. *18*

26. Closeout Procedures. *18*

27. Risk of Loss. *18*

28. Photographs. *18*

ARTICLE V:_____MATERIALS AND EQUIPMENT 19

1. Materials Generally. *19*

2. Shop Drawings, Product Data, and Samples. *19*

3. Tests. *20*

4. "Or Equal" Submissions. *21*

5. Delivery and Storage of Materials; Inspection. *21*

6. Defective, Damaged, or Deteriorated Materials and Rejection Thereof. *23*

7. Measurement *23*

ARTICLE VI: PROSECUTION AND PROGRESS 24

1. Beginning, Progress Schedule, and Completion of Work. *24*

2. Failure to Complete Work on Time - Liquidated Damages. *25*

3. Delays; Statutory Provisions (M.G.L. c. 30, sec. 39O). *25*

4. Occupancy and/or Use of Project Prior to Final Acceptance. *26*

5. Substantial Completion – Punch List. *26*

6. Final Acceptance of the Work. *27*

7. One-Year Warranty Repair List and Inspection. *27*

ARTICLE VII: CHANGES IN THE WORK 28

1. ***Change Orders Generally.*** *28*
2. ***Methods of Computing Equitable Adjustments.*** *28*
3. ***Work Performed Under Protest.*** *29*
4. ***False Claims, Statutory Provisions Regarding Changes.*** *30*
5. ***Mediation.*** *31*

ARTICLE VIII: PAYMENT PROVISIONS 31

1. ***Schedule of Values.*** *31*
2. ***Payment Liabilities of Contractor.*** *31*
3. ***Retention of Moneys by the DCR.*** *32*
4. ***Applications for Payment.*** *32*
5. ***Periodic Payments (M.G. L. c. 30, sec. 39K) for Building Projects.*** *33*
6. ***Payment of Subcontractors (M.G.L. c. 30, sec. 39F).*** *34*
7. ***Contracts for Public Works Governed by M.G.L. c. 30, sec. 39G:*** *37*
8. ***Liens*** *38*
9. ***Final Payment; Release of Claims by Contractor.*** *38*

ARTICLE IX. GUARANTEES AND WARRANTIES 39

1. ***General Warranty.*** *39*
2. ***Special Guarantees and Warrantees.*** *39*

ARTICLE X: MISCELLANEOUS LEGAL REQUIREMENTS. 39

1. ***Contractor to be Informed.*** *39*
2. ***Compliance with all Laws.*** *39*

ARTICLE XI: CONTRACTOR'S ACCOUNTING METHOD REQUIREMENTS (M.G.L. c. 30, sec. 39R) 41

1. ***Definitions.*** *41*
2. ***Record Keeping.*** *42*
3. ***Statement of Management Controls.*** *42*
4. ***Annual Financial Statement.*** *42*
5. ***Bid Pricing Materials.*** *42*

ARTICLE XII: EQUAL EMPLOYMENT OPPORTUNITY, NON-DISCRIMINATION, AND AFFIRMATIVE ACTION PROGRAM. 43

ARTICLE XIII: GOALS FOR PARTICIPATION BY MINORITY BUSINESS ENTERPRISES AND WOMEN BUSINESS ENTERPRISES 43

ARTICLE XIV: INSURANCE REQUIREMENTS 43

ARTICLE XV: INDEMNIFICATION 43

1. ***Generally.*** *43*
2. ***DCR's Actions.*** *43*
3. ***Survival.*** *43*

ARTICLE XVI: PERFORMANCE AND PAYMENT BONDS 44

1. ***Contractor Bonds.*** *44*
2. ***Subcontractor Bonds.*** *44*

ARTICLE XVII: TERMINATION OF CONTRACT 44

1. ***Termination for Cause.*** *44*
2. ***Termination For Convenience.*** *45*
3. ***Contractor's Duties Upon Termination for Convenience.*** *45*

ARTICLE XVIII: MISCELLANEOUS PROVISIONS 45

1. ***No Assignment by Contractor.*** *45*
2. ***Non-Appropriation.*** *46*
3. ***Claims by Others Not Valid.*** *46*
4. ***No Personal Liability of Public Officials.*** *46*
5. ***Severability.*** *46*
6. ***Choice of Laws.*** *46*
7. ***Standard Forms.*** *46*
8. ***No Waiver of Subsequent Breach.*** *46*
9. ***Remedies Cumulative.*** *46*
10. ***Notices.*** *46*

APPENDIX A to General Conditions of the Contract 47

1. ***Compliance Generally.*** *47*
2. ***Non-Discrimination and Affirmative Action.*** *47*
3. ***Liaison Committee, Reports and Records.*** *48*
4. ***Sanctions.*** *48*

APPENDIX B to General Conditions of the Contract 50

1. ***Goals.*** *50*
2. ***M/WBE Participation Credit.*** *50*
3. ***Establishing M/WBE Status.*** *50*
4. ***Subcontracts with M/WBEs.*** *50*
5. ***Performance of Contract Work by M/WBEs.*** *51*
6. ***Notification of Changes in M/WBE Work.*** *51*
7. ***Actions Required if there is a Reduction in M/WBE Participation.*** *51*
8. ***Suspension of Payment and/or Performance for Noncompliance.*** *52*
9. ***Liquidated Damages; Termination.*** *52*
10. ***Reporting Requirements.*** *53*
11. ***Awarding Authority's Right to Waive Provisions of this Article in Whole or in Part.*** *53*
12. ***Performance of contract work by SDVOBE 54-57***

APPENDIX C to the General Conditions of the Contract 54

INDEX OF THE COMMONLY USED FORMS *57*

CONTRACTOR'S WEEKLY WORKFORCE REPORT - 59 -
MINORITIES/WOMEN IN CONTRACTOR'S WEEKLY WORKFORCE REPORT - 60 -
WEEKLY PAYROLL REPORT FORM - 61 -
WEEKLY PAYROLL RECORDS REPORT & STATEMENT OF COMPLIANCE *- 62 -*
CERTIFICATE OF PAYMENT *- 63 - 03/2019*
INSTRUCTIONS FOR COMPLETING CERTIFICATE OF PAYMENT BY CONTRACTOR/DESIGNER TO MINORITY & WOMEN BUSINESS ENTERPRISES *- 64 - 03/2019*
CERTIFICATE OF COMPLETION - 65 - 03/2019
E-2 Final Acceptance *- 66 -*

ARTICLE I: DEFINITION OF TERMS

The following words shall have the following meanings as used in this Contract:

Advertisement: The Advertisement or Notice Inviting Bids or Proposals for the Work identified in Article 1 of the Department of Conservation and Recreation - Contractor Agreement.
Approval: (or approved): An approval in writing signed by the authorized signatory of the Awarding Authority.
As directed (As permitted, as required, as determined or words of like effect): The direction, permission, requirement, or determination of the Awarding Authority. Similarly, *approved*, *acceptable*, *satisfactory* or words of like import shall mean approved by or acceptable or satisfactory to the Awarding Authority.
Awarding Authority: The Department of Conservation and Recreation, the public agency awarding and administering this Contract, as identified in the Department of Conservation and Recreation - Contractor Agreement. Where the Awarding Authority is an agency of the Commonwealth, references to the Awarding Authority shall also include the Commonwealth and its agencies.
Building Code: All applicable rules and regulations to which the Awarding Authority is subject, and which are contained or referenced in the code authorized by M.G.L. c. 143, sec. 93 et seq., including all amendments thereto.
Change Order: (1) A written order not requiring the consent of the Contractor, signed by the Project Engineer, and designated as a Change Order, directing the Contractor to make changes in the Work within the general scope of the Contract, or (2) any written or oral order from the Project Engineer that causes any change in the Work, provided that the Contractor has given the Awarding Authority written notice stating the date, circumstances, and source of the order and that the Contractor regards the order as a Change Order.
Contract: The Contract formed by the Contract Documents as defined in Article 6 of the Department of Conservation and Recreation - Contractor Agreement.
Contract Documents: The documents listed in Article 6 of the Department of Conservation and Recreation - Contractor Agreement.
Contract Modification: Any alteration of the Contract Documents accomplished by a written agreement properly executed by the parties to this Contract.
Contract Price: The Contract Price stated in Article 3 of the Department of Conservation and Recreation - Contractor Agreement, which is the total sum, owed to the Contractor for all the Work.
DCR: The Department of Conservation and Recreation, the public agency awarding and administering this Contract.
Designer: The architect or engineer who prepared the plans and specifications for the work, identified as the Designer in Article 1 of the Department of Conservation and Recreation – Contractor Agreement.
Dispute Review Board: A panel of three experienced impartial reviewers organized and agreed upon by the DCR and Contractor. The Board members are provided with project plans and Specifications and become familiar with project procedures and participants. The Board meets on the job site regularly to encourage the resolution of disputes at the job level and renders non-binding recommendations on the resolution of the dispute.
Drawings: The Drawings are the graphic and pictorial portions of the Contract Documents, wherever located and whenever issued, showing the design, location, and dimensions of the Work, generally including Plans, elevations, sections, details, schedules, and diagrams.
Engineer: The Project Engineer, except that the term "Resident Engineer" shall have the meaning otherwise specified herein.
Final Acceptance: The written determination by the Awarding Authority that the Work has been 100% completed, except for the Contractor's indemnification obligations, warranty obligations, obligations to continue to maintain insurance coverage for the time periods provided in the Contract Documents, and any other obligations which are intended to survive Final Acceptance and/or the termination of the Contract.
General Bid: The completed bid form submitted by the Contractor in accordance with the requirements of either M.G.L. c. 149 or M.G.L. c. 30, sec. 39M.
Laws: All applicable statutes, regulations, ordinances, codes, laws, orders, decrees, approvals, certificates, and requirements of governmental and quasi-governmental authorities.
Neutral: An impartial third party not having an interest in the Owner, DCR, the Contractor or the Project.
Notice to Proceed: The written notice provided by the Awarding Authority to the Contractor which authorizes the Contractor to commence the Work as of a date specified therein and complete the entire Work of the Contract by a date specified therein.
Or equal (or words of like import): Equal in the opinion of the Awarding Authority, determined pursuant to the provisions of M.G.L. c. 30, sec. 39M and the provisions of these General Conditions of the Contract.

Owner: The Commonwealth of Massachusetts or political subdivision thereof, authority, or other instrumentality that will own the Work.

Plan(s): Drawing(s).

Product Data: Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor or its Subcontractors and suppliers to illustrate materials or equipment for some portion of the Work. Product data also include any such information or instructions produced by the manufacturer or distributor of such materials or equipment and made readily available by said manufacturer or distributor.

Progress Schedule: The progress schedule Approved by the Awarding Authority in accordance with Article VI of these General Conditions of the Contract.

Project: The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner, the Department of Conservation and Recreation, or by separate contractors.

Project Engineer: The Awarding Authority's representative assigned to the Project.

Punch List: A list of items determined by the Awarding Authority to be minor incomplete or unsatisfactory work items that do not materially impair the usefulness of the Work for its intended purpose.

Resident Engineer: The On-Site representative of the Awarding Authority.

Samples: Samples are physical examples that illustrate materials, equipment, or workmanship and establish standards by which the Work will be judged.

Schedule of Values: The schedule Approved by the DCR pursuant to Article VIII of these General Conditions of the Contract which allocates the Contract Price to the various portions of the Work and is used as a basis for payments to the Contractor.

Shop Drawings: Drawings, diagrams, details, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate a portion of the Work.

Site: The land and, if any, building(s), space within any such building(s), or other structures on which or in which the Contractor is to perform the Work.

Specifications: The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, construction systems, standards, and workmanship for the Work and performance of related services.

Subcontractor: Person or entity with whom the Contractor contracts to perform the Work, except as otherwise specifically provided or required herein or by Law.

Substantial Completion: For work subject to M.G.L. c. 30 sec. 39K, "substantial completion" shall occur when (1) 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 DCR, less than one percent of the original contract price, or (2) the Contractor substantially completes the Work and the DCR takes possession for occupancy, whichever occurs first. For work subject to M.G.L. c. 30 sec. 39G, "substantial completion" shall mean either that the work required by the Contract has been fully completed, completed except for work having a Contract Price of less than one percent of the then adjusted total Contract Price, or substantially all of the Work has been completed and opened to public use except for minor incomplete or unsatisfactory work items that do not materially impair the usefulness of the Work.

Superintendent: The licensed construction supervisor who is an employee of the Contractor designated to be in full-time attendance at the Site throughout the prosecution and progress of the Work and who shall have complete authority to act for the Contractor.

Work: The Work defined in Article 1 of the Department of Conservation and Recreation - Contractor Agreement, Article II, Section 2 of these General Conditions of the Contract and otherwise in the Contract Documents.

Working Hours: 7:00 a.m. to 5:00 p.m., but not more than eight hours per day, Monday through Friday, unless otherwise specified by applicable Laws or deemed necessary by the DCR for traffic considerations or to minimize another contract impacts to the public.

All terms that this Contract defines may be used with or without initial capital letters. Other terms, abbreviations and references are defined as they appear herein. Words and abbreviations that are not defined in the Contract Documents, but which have recognized technical, or trade meanings are used in accordance with those meanings. For additional definitions of terms, abbreviations and references refer to the *Special Conditions or Specifications.*

ARTICLE II: EXECUTION OF THE CONTRACT, SCOPE OF WORK, INTERPRETATION OF CONTRACT DOCUMENTS

1. Execution.

The execution of the Department of Conservation and Recreation – Contractor Agreement by the Contractor is a representation that the Contractor has visited the Site, has become familiar with local conditions under which the Work is to be performed and has correlated personal observations with requirements of the Contract Documents.

2. Scope of Work.

The Work consists of the Work identified in the Contract Documents. The Work comprises the completed construction required by the Contract Documents and includes all labor, tools, materials, supplies, equipment, permits, approvals, paperwork, calculations, submittals, and certificates necessary to develop, construct and complete the Work in accordance with all Laws, and all construction and other services required to be supervised, overseen, performed or furnished by the Contractor or that the Contract Documents require the Contractor to cause to be supervised, overseen, performed or furnished. The Contractor shall provide and perform for the Contract Price all the duties and obligations set forth in the Contract Documents.

3. Interpretation.

A. The Plans and Specifications and other Contract Documents are to be considered together and are intended to be mutually complementary, so that any work shown on the Plans though not specified in the Specifications, and any work specified in the Specifications though not shown on the Plans, is to be executed by the Contractor as a part of this Contract.

B. All things that in the opinion of the Project Engineer may be reasonably inferred from the Plans, Specifications and other Contract Documents are to be executed by the Contractor. The Project Engineer shall determine whether the detail Plans conform to the general Plans and Contract Documents, except as may be otherwise determined by the DCR.

C. The tables of contents, titles, headings and marginal notes or sub-scripts contained herein are solely to facilitate references, are not intended to be construed as provisions of the Contract, and in no way affect the interpretation of the provisions to which they refer.

D. Where reference is made in the Contract Documents to publications, standards, or codes issued by associations or societies, such reference shall be interpreted to mean the current edition of such publications, standards, or codes, including revisions in effect on the date of the Advertisement, notwithstanding any reference to a particular date. The foregoing sentence shall not apply to the dates, if any, specified with respect to insurance policy endorsement forms.

E. In case of any conflict among the Contract Documents, unless the context clearly otherwise requires, the Contract Documents shall be construed according to the following priorities:

Priority:	Contract Modifications
Second Priority:	Department of Conservation and Recreation - Contractor Agreement
Third Priority:	General Conditions of the Contract
Fourth Priority:	Special Conditions of the Contract
Fifth Priority:	Drawings -- Schedules take precedence over enlarged detail Drawings, and enlarged Detail Drawings take precedence over reduced scale Drawings; figured dimensions shall prevail over scale.
Sixth Priority:	Specifications

4. Distribution of Work.
The distribution of the Work is intended to be described under the appropriate trades and, except for filed sub-bid work, may be redistributed, except as directed herein, provided that such redistribution shall cause no controversy among the trades and no delay in the progress of the Work.

5. Contract Price.
The Contract Price constitutes full compensation to the Contractor for everything to be performed and furnished in connection with the Work and for all damages arising out of the performance of the Work and/or the action of the elements and constitutes the maximum compensation regardless of any difficulty incurred by the Contractor in connection with the Work or in consequence of any suspension or discontinuance of the Work. The costs associated with the requirements of the General Conditions and any required in the Special Conditions or Specifications shall be included in the Contract Price and no direct or separate payment shall be made to the Contractor.

ARTICLE III: CONTROL OF WORK/ADMINISTRATION OF THE CONTRACT

1. DCR.
The Project Engineer shall be responsible for the general administration of the Contract. Except as otherwise specifically provided herein, the Project Engineer shall decide all questions which may arise as to the conduct, quantity, quality, equality, acceptability, fitness, and rate of progress of the several kinds of work and materials to be performed and furnished under this Contract and shall decide all questions which may arise as to the interpretation of the Plans and Specifications and as to the fulfillment of this Contract on the part of the Contractor.

2. Right of Access to Work.
The DCR, and persons designated by it, may for any purpose enter upon the Work, the Site, and premises used by the Contractor, and the Contractor shall provide safe facilities therefor. Other contractors of the DCR may also enter upon the same for the purposes which may be required by their contracts or work. Any differences or conflicts which may arise between the Contractor and other contractors of the DCR with respect to their work shall be initially resolved by the DCR.

3. Inspection No Waiver.
No inspection by the DCR or its employees or agents, and no order, measurement, certificate, approval, payment order, payment, acceptance or any other action or inaction of any of them, shall operate as a waiver by the DCR of any provision of this Contract.

ARTICLE IV: GENERAL PERFORMANCE OBLIGATIONS OF THE CONTRACTOR

The Contractor shall complete for the Contract Price all the Work in a proper, thorough, and workmanlike manner in accordance with the Contract Documents. Without limiting the foregoing and without limiting the Contractor's obligations under any other provision of the Contract Documents, the Contractor shall for the Contract Price perform the following general obligations:

1. Review of Contract Documents and Field Conditions.

A. Before commencing the Work, the Contractor shall carefully study the Contract Documents and carefully compare all Specifications, Plans, Drawings, figures, dimensions, lines, marks, scales, directions of the Project Engineer, and any other information provided by the DCR and shall at once report to the Project Engineer in writing any questions, errors, inconsistencies, or omissions.

B. Before commencing the Work, the Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to the Contractor with the Contract Documents and shall at once report to the Project Engineer in writing any questions, errors, inconsistencies, or omissions.

C. Any work performed by the Contractor after the discovery of said discrepancies without the written approval of the DCR shall be at the Contractor's risk and expense.

D. The Contractor shall be responsible for all errors in the Work arising from the Contractor’s failure to comply with any of the requirements set forth in this section. The Contractor shall not be entitled to any extra compensation for any work or expense arising from or caused by his/her failure to comply with said requirements.

2. Supervision and Construction Procedures; Coordination; Cutting, and Patching.

A. The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and shall have control over, construction means, methods, techniques, sequences, and procedures, and shall be responsible for coordinating all portions of the Work under the Contract.

B. The Contractor shall be responsible for the proper fitting of all work and the coordination of the operations of all trades, subcontractors, and material suppliers engaged upon the Work. The Contractor shall guarantee to each of its subcontractors all dimensions which they may require for the fitting of their work to all surrounding work. Where equipment and lines of piping are shown diagrammatically, the Contractor shall be responsible for the coordination and orderly arrangement of the various lines of embedded piping and conduit included in the Work. The Contractor shall coordinate the work of any Subcontractor and prevent all interferences between the equipment, lines of piping or structural and architectural features, and avoid any unsightly arrangements in exposed work.

C. The Contractor should note that other contractors may be working on or near the Site where the Contractor's Work is being performed. The Contractor shall coordinate his/her work and the operations of all trades, subcontractors, and material suppliers engaged upon the Work so as not to interfere with or hinder the progress or completion of work being performed under another DCR contract.

D. All necessary cutting, coring, drilling, grouting, and patching required to fit together the several parts of the Work shall be done by the Contractor, except as may be specifically noted otherwise under any filed sub-bid section of the Specifications.

E. The Contractor shall be responsible to the DCR for the acts and omissions of the Contractor's employees, agents and Subcontractors, and their agents and respective contractors' employees, and other persons performing portions of the Work or supplying materials therefor.

F. The Contractor shall be responsible for the inspection of portions of the Work already performed under this Contract to determine that such portions are in proper condition to receive subsequent Work.

G. The Contractor shall employ a registered land surveyor to perform any engineering required for establishing grades, lines, levels, dimensions, layouts, and reference points for the trades. The Contractor shall be responsible for maintaining benchmarks and other survey marks and shall replace any benchmarks or survey marks that may have become disturbed or destroyed. The Contractor shall verify the materials shown on the Drawings before laying out the Work and shall be responsible for any error resulting from its failure to exercise this precaution.

H. Unless otherwise required by the Plans and Specifications, or directed in writing by the DCR, Work shall be performed during regular Working Hours. However, if the Contractor desires to carry on the Work outside of regular working hours or on Saturdays, Sundays, or Massachusetts or federal holidays, then the Contractor shall allow ample time to allow satisfactory arrangements to be made for inspecting Work in progress and shall bear the costs of such inspection. The DCR shall bill the Contractor directly for such costs.

I. Work performed outside of regular Working Hours without the consent or knowledge of the DCR shall be subject to additional inspection and testing as directed by the DCR. The cost of this inspection and testing shall be borne by the Contractor whether the Work is found to be acceptable or not. The DCR at its election shall be entitled either to issue a credit Change Order to cover such cost or to withhold such cost from any further payments due the Contractor and/or to receive a payment from the Contractor of the amount of such cost.

3. Superintendent.

A. The Contractor shall employ a Superintendent whose appointment shall be subject to the Approval of the DCR. The Superintendent shall attend the Site full-time during the performance of the Work. The Superintendent shall represent the Contractor. Communications given to and from the Superintendent shall be deemed given to and from the Contractor. Important communications shall be confirmed in writing. Other communications shall be similarly confirmed upon written request in each case. The Superintendent shall attend each job meeting. The Superintendent shall be responsible for coordinating all the Work of the Contractor and the Subcontractors.

B. The Superintendent shall be a competent employee regularly employed by the Contractor. The Superintendent shall be licensed in accordance with the Building Code, if applicable, and shall have satisfactorily performed similar duties on previous construction projects similar in type, complexity, and scale to the Project. The Superintendent's resume shall be submitted to the DCR prior to commencement of construction together with such other information as the DCR may reasonably require determining whether to Approve of his or her appointment. Any change in the Superintendent shall require the prior consent of the DCR. The Contractor shall establish an emergency telephone line by which the DCR or its agents may contact the Superintendent during non-working hours.

4. Labor.

A. The Contractor shall employ only competent workers. The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them. Whenever the DCR shall notify the Contractor in writing that any worker is, in the DCR's opinion, incompetent, unfaithful, disorderly, or otherwise unsatisfactory, such employee shall be discharged from the Work and shall not again be employed on the Project except with the consent of the DCR.

B. The Contractor shall employ enough workers to carry on the Work with all proper speed in accordance with Laws, the requirements of the Contract Documents, and the Progress Schedule.

C. The Contractor shall procure materials from such sources and shall manage its own forces and the forces of its Subcontractors and any sub-subcontractors in such a manner as will result in harmonious labor relations on the Project Site. If union and nonunion workers are employed to perform any part of the Work, the Contractor shall establish and maintain separate entrances to the Site for the use of union and nonunion workers. The Contractor shall cause persons to be employed in the Work who will work in harmony with others so employed. Should the Work be stopped or materially delayed in the DCR's reasonable judgment due to a labor dispute, the DCR shall have the right to require the Contractor to employ substitutes acceptable to the DCR.

D. The Contractor shall bear the entire expense, and no separate or direct payment shall be made by the DCR, because of extra work which may be necessary because of inferior workmanship, or for specific items of work which are normally considered a part of good workmanship in completing any phase of the work.

5. Notices and Permits.

A. The Contractor at its sole cost shall take out and pay for all approvals, permits, certificates and licenses required by Laws, pay all charges and fees, and pay for (or cause the appropriate Subcontractor to pay for) all utilities required for the proper execution of the Work. All permits secured by the Contractor, complete with the application and orders of conditions, shall be kept on file in the Contractor's office and field office with copies submitted to the Project Engineer.

B. The Contractor shall comply with all Laws and shall give all notices required thereby.

C. Except as otherwise specified in this Contract, it is not the Contractor's responsibility to ascertain that the Contract Documents are in accordance with applicable Laws. However, if the Contractor observes that portions of the Contract Documents are at variance with the requirements of Laws, the Contractor shall promptly notify the DCR in writing, and necessary changes shall be accomplished by an appropriate Contract Modification.

D. If the Contractor performs work knowing it to be contrary to Laws without giving such notice to the DCR, the Contractor shall bear full responsibility for such Work and all costs attributable thereto, including, without limitation, corrections to the Work.

6. Lines, Marks etc.

The Contractor shall furnish batter boards and stakes and shall cause to be placed and maintained thereon to be easily read, such lines, marks and directions relating to the Work as the Project Engineer shall from time to time direct. The Project Engineer shall establish base lines and benchmarks on the Drawings for the locations of the Work but all other lines and grades in the field shall be determined by the Contractor.

7. Excavation.

The Contractor shall prevent by sheeting and shoring or bracing, if necessary, any caving or bulging of the sides of any excavation made by the Contractor, leaving sheeting, and shoring in place, or if any is removed, filling solid the spaces left thereby.

8. Dewatering/Hoisting/Staging.

The Contractor shall provide pumping, drainage, and disposal of all water and other flows so that no puddle, nuisance, or damage will be caused by water or flooding. If pumping results in contaminated water the Contractor shall take appropriate measures to treat this water prior to discharge and shall seek appropriate permits for discharge of water. The Contractor shall provide all hoisting equipment and machinery required for the proper execution of the Work. The Contractor shall provide all exterior and interior staging required to be over eight feet in height, except as may be otherwise provided in the Contract Documents.

9. Corrections to the Work; Inspection No Bar to Subsequent Corrections.

The DCR's inspection of the Work shall not relieve the Contractor of its responsibilities to fulfill the Contract obligations. Defective work may be rejected by the DCR whether such work and/or materials have been previously overlooked or misjudged by the Resident Engineer or Project Engineer and accepted for payment. If the Work or any part thereof shall be found defective at any time before the Final Acceptance of the whole Work, the Contractor shall forthwith cease the performance of any defective work in progress and, whether such work is still in progress, shall forthwith correct such defect in a manner satisfactory to the Project Engineer. If any material brought upon the Site for use in the Work, or selected for the same, shall be rejected by the Project Engineer as unsuitable or not in conformity with the Contract Documents, or as damaged by casualty or deteriorated due to improper storage at the Site or to any other factor, the Contractor shall forthwith remove such materials from the Site. The Contractor shall pay for the cost of making good all work or property of other contractors, the Owner or of the Department of Conservation and Recreation destroyed or damaged by such removal or replacement; repair any injury, defect, omission, or mistake in the Work as soon as it is discovered; finish and immediately make good any defect, omission, or mistake in the Work; and complete and leave the Work in perfect condition.

10. Sanitary Facilities.

The Contractor shall provide and maintain sanitary facilities for all persons employed on the Work, beginning with the first worker at the Site. Said facilities shall meet the following requirements unless otherwise specified in the Special Conditions or Specifications.

A. There shall be no fewer facilities than the number required by applicable Laws.

B. Facilities shall be always kept in a clean sanitary condition and shall be adequately screened to be inaccessible to flies. (**Note:** If existing sanitary facilities at the Site are to be used by the Contractor, this requirement will be modified accordingly in the Special Conditions or Specifications.)

11. Temporary Offices.

A. Contractor's Field office. The Contractor shall erect a temporary field office at or near the Site of the Work at which the Contractor's authorized representative shall be always present while the Work is in progress. Instructions, notices, and other communications delivered there by the DCR shall be deemed delivered to the Contractor. The Contractor shall adequately furnish and maintain this office in a clean, orderly condition.

B. Resident Engineer's Office. The Contractor shall erect an Office for the Resident Engineer if, and as required by the Special Conditions or Specifications of the Contract.

12. Telephones.

A. The Contractor shall provide and maintain telephone service in the Contractor's field office. The Contractor shall pay for all calls and costs relating to this service. The DCR and its employees and authorized agents shall always be allowed the use of this telephone service without charge. Telephone service and equipment shall meet the requirements, if any, of the Special Conditions or Specifications.

B. The Contractor shall also provide and maintain telephone service in the Resident Engineer's Office, when the Contractor is required to erect such office, for the use of the DCR and its employees and authorized agents. The Contractor shall pay for all calls and costs relating to this service. Telephone service and equipment shall meet the requirements, if any, of the Special Conditions or Specifications.

13. Project Sign.

A. The Contractor shall furnish and erect at a suitable location, Approved by the Project Engineer, at the start of the work, a sign having dimensions of at least eight (8) feet long by four (4) feet high, bearing the words: Massachusetts Department of Conservation and Recreation. Also included may be the project title, expected completion date, and facility name.

B. The Contractor shall submit the design of the sign to the Project Engineer for review and approval prior to posting.

14. Contract Documents and Samples at the Site.

The Contractor shall maintain at the Site for the use and information of the DCR one record copy of the Drawings, Specifications, Addenda, Change Orders, Approved Shop Drawings, Product Data, Samples, updated Progress Schedule, and all other submittals, all in good order and marked currently to record changes and selections made during construction. These shall be available to the DCR and shall be delivered to the DCR upon completion of the Work.

15. Safety Laws, Regulations, and Practices.

A. The Contractor shall comply with all health and safety Laws applicable to the Work. Without limitation,
(1) If the Contractor uses or stores toxic or hazardous substances it shall comply with M.G.L. c. 111F, sec. 2, the "Right to Know" law and regulations promulgated by the Department of Public Health, 105 CMR 670, the Department of Environmental Protection, 310 CMR 33, and the Department of Labor and Workforce Development, 441 CMR 21; and shall post a Workplace Notice obtainable from the Department of Labor and Workforce Development.
(2) The Contractor shall comply with the Federal Resource Conservation and Recovery Act, the Federal Comprehensive Environmental Response, Compensation and Liability Act, M.G.L. c. 21C, M.G. L. c. 21E, and any other Laws affecting toxic or hazardous materials, solid, special, or hazardous waste (collectively "Hazardous Materials Laws"). Should the Contractor discover unforeseen materials subject to Hazardous Materials Laws at the Site, the Contractor shall immediately notify the DCR of such discovery.
(3) The Contractor shall be responsible for the location of all utilities in connection with the Work. Without limiting the foregoing, the Contractor shall comply with Dig Safe Laws. Dig Safe is the Utility Underground Plant Damage Prevention System established pursuant to M.G.L. c. 164, sec. 76D. This System is operated by Dig Safe Systems, Inc., located at 331 Montvale Avenue, Woburn, MA 01801, whose toll-free telephone number is 1-888-DIG-SAFE (1-888-344-7233). The Contractor shall notify Dig Safe of contemplated excavation, demolition, or explosive work in public or private ways, and in any utility company right of way or easement, by certified mail, with a copy to Department of Environmental Protection (DEP). This notice shall be given at least 72 hours prior to the work, but not more than sixty days before the work is to be done. Such notice shall state the name of the street or the route number of the way and shall include an accurate description of the location and nature of the proposed work. Dig-Safe is required to respond to the notice within 72 hours of receipt by designating the location of pipes, mains, wires, or conduits at the Site. The Contractor shall not commence work until Dig-Safe has responded. The work shall be performed in such manner and with reasonable precautions taken to avoid damage to utilities under the surface at the work location. The Contractor shall provide the Superintendent with current Dig-Safe regulations, and a copy of M.G.L. c. 82, sec. 40. Any costs related to the services performed by Dig-Safe shall be borne by the Contractor.
(4) The Contractor shall comply with Public Law 92-596, "Occupational Safety and Health Act of 1970" (OSHA), with respect to all rules and regulations pertaining to construction, U.S. Code Title 29, sections 651 et seq. including Volume 36, numbers 75 and 105 of the Federal Register as amended, and as published by the U.S. Department of Labor.
(5) The Contractor shall comply with M.G.L. c. 149, sec. 129A, relative to shoring and bracing of trenches.

B. The Contractor shall take reasonable precautions to prevent damage, injury, or loss to persons (whether under his management, DCR staff, or the public) or property. Nothing herein shall relieve Subcontractors of their responsibility for the safety of persons and property, and for compliance with all Laws applicable to the Work and their activities in connection therewith. Without limitation, the Contractor shall take all reasonable precautions for the safety of, and the prevention of injury or damage to (1) all agents and employees and contractors on the Work and all other persons who may be affected thereby including the general public, (2) all the Work and all materials and equipment to be incorporated therein, whether in storage on or off the Site, under the care custody or control of the Contractor or any of its Subcontractors or any contractors directly or indirectly contracting through any of them, and (3) other property at the Site or adjacent thereto, including but not limited to trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of the Work. The Contractor shall promptly remedy all damage or loss to any such property caused in whole or in part by the Contractor, any Subcontractor, or anyone directly or indirectly contracted or employed by any of them or by anyone for whose acts any of them may be liable. Without limiting the foregoing, the Contractor shall:
(1) post and maintain adequate danger signs and other warnings against hazards.
(2) promulgate safety regulations and give appropriate notices to the DCR and users of adjacent utilities and property.

(3) ensure the adequate strength and safety of all scaffolding, staging and hoisting equipment, temporary shoring, bracing, and tying.
(4) protect adjoining private or public property.
(5) provide barricades, temporary fences, and covered walkways required by prudent construction practices, Laws and/or the Contract Documents.
(6) furnish approved hard hats and other personal protective equipment, furnish approved first aid supplies, furnish the name of the first aid attendant, and maintain a posted list of emergency facilities.
(7) provide proper means of access to property where the existing access is cut off by the Contractor, including maintaining traffic over, through or around the Work included in this contract, with the maximum safety, and practicable convenience to such traffic suspended temporarily.
(8) maintain from the beginning of any darkness or twilight through the whole of every night sufficient lights on or near any obstruction to guard or protect travelers from injury from such obstruction.
(9) maintain adequate security at the Site so as not to expose the Work, the materials to be incorporated in the Work, DCR's materials stored or otherwise located upon the Site, and surrounding property to vandalism or malicious mischief.
(10) provide adequate fire protection procedures during the use of cutting torches, welding equipment, plumbers' torches and other flame and spark producing apparatus.
(11) take prompt action to correct any dangerous or hazardous conditions.

C. Use of Explosives: The use of explosives will not be permitted in the Work unless specifically authorized in the technical Specifications, Special Conditions and/or Drawings or approved by the DCR in writing. If such approval is given, the Contractor shall comply with all Laws and obtain all permits, approvals, and certificates required in connection with the same and shall exercise best efforts, including but not limited to the employment and supervision of properly qualified personnel, to prevent damage, injuries, and accidents involving said explosives.

D. Written notice shall be given by the Contractor to all public service corporations or officials owning or having charge of public or private utilities of his/her intention to commence operations affecting such utilities at least seventy-two (72) hours exclusive of Saturdays, Sundays, and legal Holidays in advance of the start of such operations, and the Contractor shall at the same time file a copy of said notice with the DCR.

E. When necessary, the Contractor shall cooperate with representatives of public service companies to avoid damage to their structures by furnishing and erecting suitable supports, props, shoring or other means of protection. Fire hydrants adjacent to the work always shall be readily accessible to fire apparatus and no materials or other obstructions shall be placed within a radius of 10 feet of a fire hydrant.

F. Although the drawings may indicate the approximate location of existing subsurface utilities in the vicinity of the work, the accuracy and completeness of the information is not guaranteed by the DCR. Before commencing any work, or operations which may endanger or damage any subsurface structures, the Contractor shall carefully locate all such structures and conduct his/her operations in such manner as to avoid damage thereto. He/she shall not interrupt live services until new services have been provided. All abandoned services shall be plugged or otherwise made secure.

G. If the Contractor wishes to have any utilities temporarily relocated for his/her convenience, other than those specified by DCR, he/she shall submit such a request in writing to the Project Engineer. If the DCR approves this request, the Contractor shall pay for the cost of the relocation at his/her sole expense.

H. Land monuments and property markers shall be carefully protected. If is necessary to remove land monuments and/or property markers to perform the contract Work, the Contractor shall do so only at the DCR's direction and after an authorized agent of the DCR has referenced their location.

I. The Contractor shall not injure or remove trees or shrubs without authorization from the DCR.

J. Disturbance of damage to any above- or below-ground structures, conduits, cables, or the like, caused by any act of omission, neglect or misconduct in the execution or non-execution of work thereof by the Contractor shall be repaired, and/or replaced by the Contractor to the satisfaction of the DCR and at no additional expense to the DCR.

K. Disturbance or damage to any structure shall be replaced or repaired by the Contractor to the satisfaction of the DCR and at no additional expense to the DCR.

L. The Contractor shall receive no extra compensation for protection and restoration of property unless said compensation is authorized in writing by the DCR, as specified under Article VI I of the Contract General Conditions.

M. The Contractor shall not permit cutting or welding in or immediately adjacent to existing property of the Department of Conservation and Recreation or of anyone else without the DCR's prior approval in each instance.

N. The Contractor shall designate by notice to the DCR a responsible member of its organization at the Site whose duties shall include preventing accidents.

O. The Contractor shall submit to the DCR without delay verbal and written reports of all accidents involving bodily injury or property damage arising in connection with the Work.

P. In any emergency affecting the safety of persons or property the Contractor shall immediately act in the exercise of reasonable judgment to prevent threatened damage, injury, or loss. The Contractor shall immediately notify the DCR of such emergency.

16. Environmental Protection

A. The DCR shall secure the required environmental permits required under M.G.L. Chapters 131 and 91, including the National Pollutant Discharges Elimination System (NPDES) Construction General Permit and those issued by the Army Corps of Engineers under Section 404 of the Clean Water Act (33 U.S.C. 1344) and Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403). The Contractor is obligated to conform to all the requirements of the permits and subsequent requirements issued by the governing agencies.

B. Contractors operating under a DEP permit shall post on the Site a sign in a format consistent with that enclosed.

C. Prevention of Water Pollution:

1. The Contractor shall take such precautions in the conduct of the Work as may be necessary to avoid contaminating water in adjacent watercourses, water resources or wetlands. All earthwork, moving of equipment, water control for excavation or foundation areas, and other operations likely to create silting shall be conducted to avoid pollution of watercourses, water resources and wetlands.
2. Erosion Control: The Contractor shall utilize such methods as may be necessary to effectively prevent erosion and sediment from entering nearby waterways.
3. Control of Surface Water Runoff: The Contractor shall keep the rate of runoff from the Site at a minimum, and control it by constructing diversion ditches, trenches, and berms, and taking any other necessary action to retard and divert runoff to protect watercourses. The Contractor shall inspect said Site controls regularly, after significant storm events (greater than one-half inch over a 24-hour period) and in accordance with a site-specific storm water pollution prevention plan (SWPPP) prepared by the Contractor. The Contractor shall repair any damage to Site controls to prevent discharge of sediments or pollutants.
4. The Contractor shall construct silt retention basins in areas of the Work adjacent to streams, or rivers, as directed by the DCR. These basins shall be removed upon completion of the Work. Water used during the Work which has become contaminated with oil, bitumen, harmful or objectionable chemicals, sewage or other pollutants shall be discharged in accordance with all Laws to avoid affecting nearby waters.
5. Under no circumstances shall the Contractor discharge pollutants into any watercourse, water resource, or wetland. When water from adjacent natural sources is used in the contract work, intake methods shall be such as to avoid contaminating the source of supply.

D. Protection of Land Resources

1. Prevention of Landscape Defacement: The Contractor shall not deface, injure, remove, cut, or destroy trees or shrubs, without authority from the DCR. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorages unless specifically approved by the DCR. Where such activity is permitted, the Contractor shall adequately wrap the tree with burlap or rags over which softwood slats shall be tied. The Contractor shall be responsible for any damage resulting from such use. Where trees may possibly be defaced, bruised, injured, or otherwise damaged by equipment, dumping, or other operations, the Contractor shall protect such trees by placing boards, planks or approved protective fencing around them.
2. Restoration of Landscape Damage: Any trees or other landscape feature scarred or damaged by equipment or operations shall be restored as nearly as possible to the original condition, as approved by DCR. All trimming or pruning shall be performed in an approved manner by licensed arborists with saws or pruning shears. Trimming with axes will not be permitted.
3. Plant Pest Control: If the Work under this contract requires the use of soil moving equipment in an area with plant infestation, the Contractor shall be subject to applicable plant quarantine regulations. In general, these regulations require the thorough cleaning of soil from equipment before such equipment is moved from regulated areas to area's noninfected

E. Noise Control: The Contractor shall use every effort and every means possible to minimize noise caused by his/her operations which the DCR may consider objectionable. Each Contractor shall provide working machinery and equipment designed to operate with the least possible noise, and when gearing is used, such gearing shall be of a type designed to reduce noise to a minimum. Compressors shall be equipped with silencers on intake lines. All gas or oil operated equipment shall be equipped with silencers or mufflers on intake and exhaust lines. Electricity shall be used for power to reduce noise. Dumping bins, hoppers and trucks used for disposal of excavated materials shall be lined with wood or other sound-deadening material if required. Where required by agencies having jurisdiction, certain noise-producing work may have to be performed during specified periods only.

E. Air Pollution Control: The Contractor shall conduct his/her operations to comply with all Laws pertaining to air pollution, including Section 142B of Chapter 111 of the Massachusetts General Laws.

1. Diesel Equipment Emission Controls

a.) All motor vehicles and construction equipment shall comply with all pertinent local, state, and federal regulations covering exhaust emission controls and safety.

b.) All Contractor and Sub-Contractor diesel-powered non-road construction equipment with engine horsepower (HP) ratings of 50 and above, which are used on the Project Site for a period more than 30 calendar days over the course of the construction period on the Project Site, shall be retrofitted with Emission Control Devices to reduce diesel emissions.

c.) The reduction of emissions of volatile organic compounds (VOCs); carbon monoxide (CO) and particulate matter (PM) from diesel-powered equipment shall be accomplished by installing Retrofit Emission Control Devices.

d.) Acceptable Retrofit Emission Control Devices for the Project shall consist of oxidation catalysts that are (1) included on the US Environmental Protection Agency (EPA) *Verified Retrofit Technology List* and/or the California Air Resources Board (CARB) *Currently Verified Technologies List*; and (2) are verified by EPA, CARB, or certified by the manufacturer to provide a minimum emissions reduction of 50 percent for VOCs, 40 percent for CO and 20 percent for PM. Attainment of the required reduction in PM emissions can also be accomplished by using less polluting Clean Fuels. Verified technologies can be identified on the following websites:

EPA: http://www.epa.gov/otaq/retrofit/retroverifiedlist.htm

CARB: http://www.arb.ca.gov/diesel/verdev/verifiedtechnologies/cvt.htm

e.) The emission control equipment can be procured through the Statewide Contract #VEH71 that has fixed costs associated with retrofitting of diesel emission control devices.

f.) Construction shall not proceed until the Contractor has submitted a certified list of the non-road diesel-powered construction equipment subject to this provision which either are or will be retrofitted with emission control devices. The list shall include (1) the equipment number, type, make, and Contractor/Sub-Contractor name; and the emission control device make, model, and EPA verification number. Contractors shall also submit a receipt or other documentation from a manufacturer or installer that verifies that appropriate equipment has been installed. The Contractor shall also identify any vehicles that will use Clean Fuels. Equipment that has been retrofitted with an emission control device shall be stenciled or otherwise clearly marked as "Low Emission Equipment".

g.) The Contractor shall submit monthly reports, updating the same information stated in Paragraph f above, including the quantity of Clean Fuel utilized. The addition or deletion of non-road diesel equipment shall be indicated in the report.

h.) The Contractor shall use methods to control nuisance odors associated with diesel emissions from construction equipment including but not limited to the following: (1) turning off diesel combustion engines on construction equipment not in active use and on trucks that are idling for five minutes or more; and (2) locating diesel equipment away from the public and sensitive receptors.

i.) All costs associated with implementation of the diesel equipment emissions control shall be borne by the respective Contractor or subcontractor and included in their cost for performing the work of the Contract.

2. Dust Control.

A. The Contractor is placed on notice that blowing dust from un-stabilized earth areas of the work under his/her control will be considered a nuisance. He/she shall, by spraying with water or by other approved means, dampen the soil to hold down the dust. The use of calcium chloride as a wetting agent will not be permitted. During working hours and before leaving the work for the evening, for weekends, or for a more extended period, the Contractor shall assess the moisture content of the soil and dampen it to the extent necessary to hold down the dust. While work is suspended, he/she shall return to work, if so, directed by the DCR, to maintain the dust control.

17. Debris, Excavated Material and Chemical Waste.

A. The Contractor shall not permit the accumulation of interior or exterior debris. The Contractor shall always keep the Work area clean. Without limitation, garbage shall be removed daily. Where no disposal area is shown on the Drawings, the Contractor shall remove and legally dispose of all materials off land owned by the Commonwealth to a location approved by the DCR. Documentation certifying proper disposal shall be submitted to the DCR.

B. The Contractor shall, at his/her own expense, and in accordance with all Laws, arrange for the waste of materials from excavations that are unacceptable for use in the refill or that are more than the refill materials required, in spoil banks off the lands owned by the Commonwealth of Massachusetts. Materials, if any, which cannot be placed at once in permanent positions may be deposited in storage piles at locations designated, but materials re- excavated from such storage piles shall not again be paid for as excavation.

C. The Contractor shall properly classify and remove debris and waste from the Site and transport and dispose of it, all in accordance with Laws, employing a qualified and properly licensed transporter, at any landfill, disposal or recycling facility licensed under applicable Laws, including without limitation, hazardous materials laws. The Contractor shall make all arrangements and give and obtain all notices, communications, documentation, permits, certificates, and approvals necessary for said disposal from the owner or officials in charge of such landfills, disposal, or recycling facilities. The Contractor shall bear all fees and costs in connection with such classification, removal, transportation, disposal, and storage, except as otherwise specifically provided or required by the Special Conditions or other Contract Document. The Contractor shall not permit any storage of debris or waste except in accordance with Laws.

D. The Contractor shall not permit any open fire on the Site.

E. Chemical Waste: Chemical waste shall be identified and labeled properly, stored in appropriate Department of Transportation approved containers in a secure location, removed from the Site, and disposed of not less frequently than monthly unless more frequently required by Laws, including without limitation hazardous materials laws, or by the Special Conditions or Specifications. Disposal of chemical waste shall be performed in accordance with requirements of the U.S. Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection (DEP). Stockpiles of contaminated soils will be placed on a protective surface and covered to prevent migration or erosive loss by wind or water. Fueling and lubricating of vehicles and equipment shall be conducted in a manner that affords the maximum protection against spills and evaporation. Lubricants shall be disposed of in accordance with procedures meeting all applicable Laws. The Contractor shall immediately notify the DCR of any hazardous materials release large enough to require reporting under applicable Laws. The Contractor shall be responsible for immediately containing and cleaning up in accordance with Laws any oil or hazardous materials releases resulting from his/her operations. Any costs incurred in cleaning up any such releases shall be borne by the Contractor.

18. Nuisances.

The Contractor shall strictly prohibit and take all necessary measures to prevent the committing of nuisances on the land of the Commonwealth and adjacent properties.

19. Weather Protection (M.G.L. c. 149, sec. 44G and 44F(1).

A. For all building projects, the Contractor shall furnish and install "weather protection," which means temporary protection of that Work adversely affected by moisture, wind and cold. Weather protection shall be achieved by covering, enclosing and/or heating working areas such that a minimum temperature of 40 degrees Fahrenheit is maintained at the working surface during the months of November through March to permit construction to be carried on during such period in accordance with the Progress Schedule. After the building or portion thereof is completely enclosed by either permanent construction or substantial temporary materials having a resistance comparable to the specified permanent construction, the Contractor shall provide heat therein of not less than 55 degrees Fahrenheit nor more than 75 degrees Fahrenheit. The foregoing provisions do not supersede any specific requirements for methods of construction, curing of materials and the like. Concrete, masonry, plaster, and all other materials that require special considerations in temperatures below 40 degrees Fahrenheit shall be installed, applied, and cured in accordance with the specific requirements for cold weather protection as defined in the project specifications.

B. The general contractor may, with the approval of the Engineer, elect to utilize the permanent heating system for temporary heat after the building is enclosed and after it has been tested and ready to operate. It shall, however, be his responsibility to thoroughly clean and restore to first-class condition any portion of the permanent heating system used for heating during construction to the satisfaction of the Engineer.

C. The Contractor shall furnish and install one thermometer for every 2,000 square feet of floor space or fraction thereof.

D. Installation of weather protection and heating devices shall comply with all safety regulations including provisions for adequate fire protection devices. Approved methods of heating should also provide for adequate ventilation to prevent exposing people and materials to carbon monoxide, carbon dioxide and other noxious fumes.

E. Within 30 calendar days after the award of this contract, the general contractor shall submit in writing to the Engineer three (3) copies of his proposed methods for "Weather Protection" for approval.

F. The Contractor shall give adequate notification to the Engineer and all subcontractors prior to the erection and removal of temporary protective enclosures.

G. Such weather protection shall be consistent with the Progress Schedule, shall permit the continuous progress of the Work necessary to maintain an orderly and efficient sequence of construction operations and shall meet such additional requirements as may be specified by the Special Conditions or Specifications.

20. Furnishings and Equipment.

When, in the opinion of the DCR, any portion of the Work is in a reasonable condition to receive fittings, furniture, or other property of the Department of Conservation and Recreation not covered by this Contract, the Contractor shall allow the DCR to bring such fittings, furniture, and/or other property into such portions of the Work and shall provide all reasonable facilities and protection thereof. No such occupancy shall be construed as interfering with the provisions relating to time of completion, or as constituting an acceptance of the whole or any part of the Work. Any furniture or fittings so installed shall be placed in the Work at the risk of the DCR except that the Contractor shall be liable for damages or losses to such furniture or fittings to the extent such damages or losses arise in whole or in part from the negligence or intentional misconduct of Contractor, Subcontractors, their agents and/or employees, or anyone for whose acts the Contractor is responsible.

21. Form for Sub-contract.

The Contractor when subcontracting with sub-bidders filed pursuant to M.G.L. c. 149, sec. 44F shall use the form for sub-Contract in M.G.L. c. 149, sec. 44F(4)(c). The Contractor shall not interpret paragraph 3 of the statutory form of Subcontract to require such sub-bidders to provide insurance with limits higher than the limits that are required by the Contract Documents, if the term “Contractor” refers to the sub-bidder and that the term “Contract Price” refers to the sub-bidder’s price stated in paragraph 1 of the statutory form of Subcontract.

22. Sales Tax Exemption and Other Taxes.
All building materials and supplies as well as the rental charges for construction vehicles, equipment and machinery rented exclusively for use on the Site, or while being used exclusively for the transportation of materials for the Work are entitled to an exemption from sales taxes under M.G.L. c. 64H, sec. 6(f). The Contractor shall take all action required to obtain the benefit of such sales tax exemption. The Contractor shall bear the cost of any sales taxes that the Contractor incurs in connection with the Work and the DCR shall not reimburse the Contractor for any such taxes. The exemption number assigned to the Contractor as an exempt purchaser shall be provided to the Contractor by the DCR upon the written request of the Contractor.

23. Final Cleaning.
At the completion of the Work, the Contractor shall remove all waste materials, rubbish, tools, equipment, machinery, and surplus materials, and professionally clean all sight-exposed surfaces so that the Work is clean and ready for occupancy and/or use. After installation of DCR furniture, telephones, and equipment, the Contractor shall provide such additional cleaning as may be necessary to remove any soil resulting from installation of such furniture, telephones, and equipment. The costs of the required cleaning are included in the Contract price.

All permanent drainage structures such as catch basins, permanent detention or retention basins, drainage conveyances, piping, sumps, and particle separators will be cleaned of sediments and debris prior to acceptance of the Work. Any sediments or debris accumulated during construction shall be removed and disposed in accordance with local and state requirements.

24. Maintenance Data.
Subject to such additional requirements as may be provided in the Special Conditions or Specifications, the Contractor shall compile 3 complete and identical binders of operating and maintenance data for the entire Work. The Contractor shall submit record maintenance data to the DCR for approval and shall instruct and train the DCR's personnel in proper inspection and maintenance procedures.

25. Drainage Specifications.
Subject to such additional requirements as may be provided in the Special Conditions or Specifications, where construction involves replacement or construction of new storm water drainage systems including but not limited to catch basins, roof drains, recharge to groundwater systems and outfall structures, the Contractor shall provide drawings and electronic records in a form acceptable to the DCR that provides specifications and a site plan that identifies locations of the drainage system components and cleanout, if applicable.

26. Closeout Procedures.
The Contractor shall take all actions and submit all items required for Final Acceptance as specified in the Contract Documents.

27. Risk of Loss.
The Contractor shall bear all risk of loss to the Work during the term of the Contract except for any portion of the Work as to which the DCR has given final acceptance. Nothing herein shall limit the Contractor's responsibilities under Article IX or XV of these General Conditions of the Contract.

28. Photographs.
A. At the request of the DCR, the Contractor shall furnish the DCR suitable 4" X 6" color photographs and/or digital image files of the construction area, and any related work areas.
B. If the DCR requires the Contractor to provide photographs of the Work, the areas to be photographed and the locational reference point from which they are to be taken will be designated by the DCR, and shall be taken according to the following schedule:
a. Before construction operations have been started.
b. Each month during the performance of the Work.
c. After construction has been completed.
C. Each photograph shall have permanently written on its face a legible description or title indicating date, location, direction from which taken, project title and item of work photographed.
D. Upon completion of all work under this contract, the Contractor shall deliver all negatives, clearly identified, to the DCR. Photographs will be placed in acetate sleeves and bound in three booklet form.
E. The cost of furnishing photographs shall be included in the prices bid for the various items scheduled in the Proposal.

ARTICLE V: MATERIALS AND EQUIPMENT

1. **Materials Generally.**

A. Unless otherwise specifically provided in the Contract Documents, the Contractor shall provide and pay for materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether incorporated or to be incorporated in the Work.

B. Materials and equipment to be installed as part of the Work (both or either of which are hereinafter referred to as "materials") shall be new, unused, of recent manufacture, assembled, and used in accordance with the best construction practices. The Contractor shall inform himself/herself as to, and shall comply with, the provisions of M.G.L. c. 7, sec. 23A, as amended, and shall abide by the same and all applicable rules, regulations, and orders made thereunder in relation to the purchase of supplies and materials in the execution of the Work, including the provisions of M.G.L. c. 7, sec. 22, paragraph 17, which provides that there be *"a preference in the purchase of supplies and materials, other considerations being equal, in favor, first, of supplies and materials manufactured and sold within the Commonwealth, and, second, of supplies and materials manufactured and sold elsewhere within the United States."*

C. All materials furnished by the DCR to the Contractor for installation in the work will be delivered by freight train, truck, or other means of common carrier to the nearest convenient public railroad siding, freight station, trucking terminal or such other designated delivery point of which he will receive due notification. The Contractor, at his/her own expense, shall do all handling and conveying of such materials at and from the noted deliver site. He shall unload and remove them promptly from the cars, trucks, or terminals upon notification of their arrival and he shall be responsible for any demurrage, delay charges, damage done or loss of materials from the time of delivery to the final acceptance of the work. Materials previously delivered shall be turned over to the Contractor as soon as possible after the date ordered to begin work. He shall make a complete inventory with the Resident Engineer as to content and condition; thereafter he shall be responsible for the care, custody, and handling until the final acceptance of the work.

2. **Shop Drawings, Product Data, and Samples.**

A. The Contractor shall furnish to the Project Engineer all samples of the materials to be used in the execution of the Work as required by the Contract Documents. The Contractor shall furnish to the DCR in a timely manner all coordination Drawings, shop details, Shop Drawings, and setting diagrams which may be necessary for acquiring and installing materials. These shall be reviewed as required by the DCR. A minimum of six (6) copies shall be submitted for final approval, one of which shall be returned to the Contractor, one given to the Resident Engineer, and four maintained by the DCR. The inspection and approval by the DCR of Shop Drawings, etc. shall be general and shall in no way relieve the Contractor from responsibility for proper fitting, coordinating, construction, and construction sequencing. The Contractor shall furnish to the DCR such information and vouchers relative to the Work, the materials therefore, and the persons employed thereon, as the DCR shall from time-to-time request.

B. Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. The purpose of their submission is to demonstrate for those portions of the Work for which submittals are required the way the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents.

C. The Contractor shall review, approve, and submit to the DCR, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the DCR or of separate contractors. Submittals made by the Contractor which are not required by the Contract Documents, or which do not comply with the Contract Documents may be returned without action. The Contractor's attention is directed to the provisions of Section 4 of this Article V and to the Specifications.

D. The Contractor shall prepare and keep current for the DCR's approval a schedule of submittals which is coordinated with the Progress Schedule and allows the DCR reasonable time to review submittals.

E. The Contractor shall perform no portion of the Work requiring submittal and review of Shop Drawings, Product Data, Samples, or similar submittals until the respective submittal has been approved by the DCR. Such Work shall be in accordance with Approved submittals.

F. By submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents that the Contractor has determined and verified materials, field measurements, and field construction criteria related thereto and has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

G. The Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the DCR's approval of Shop Drawings, Product Data, Samples, or similar submittals unless the Contractor has specifically informed the DCR in writing of such deviation at the time of submittal and the DCR has given explicit written approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals by the DCR's actions.

H. The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the DCR on previous submittals.

I. Informational submittals upon which the DCR is not expected to take responsive action may be so identified in the Contract Documents.

J. When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, such certification must be stamped by a registered Massachusetts professional in the discipline required. The DCR shall be entitled to rely upon the accuracy and completeness of such calculations and certifications.

K. Materials furnished or used or employed under the Contract must be equal in quality to the samples furnished and be satisfactory to the DCR.

3. **Tests.**

A. Any material to be used in the Work may be tested or inspected at any time, on or off Site, by or under direction of the DCR, and may be rejected if it fails to comply with specified tests. The Contractor shall test all materials unless specified otherwise in the Special Conditions or Specifications. The Contractor shall also pay for all testing of specified material unless specified otherwise in the Special Conditions or Specifications. If the Contractor requests permission to use a material that was not specified, then the Contractor in all cases shall pay for such testing. The cost of testing of materials that fail the testing criteria shall be borne by the Contractor

B. The Contractor shall notify the DCR of the proposed sources of materials in time to permit all required testing and inspection before the material is needed for incorporation into the Work. The Contractor shall have no claim arising from the Contractor's failure to designate the proposed source or to order the material in time for adequate testing and inspection. Necessary arrangements shall be made to permit the DCR to make factory, shop or other inspection of materials or equipment ordered for the Work in the process of manufacture or fabrication, as required by the Contract Documents. The DCR will not assume any obligation for the sampling and testing of materials other than on the Site, unless so required by the Specifications.

C. Where tests of materials will be made by the DCR or under its direction, the Contractor or his/her suppliers shall furnish such facilities as the DCR may require for collecting and forwarding samples and shall not make use of, nor incorporate into the Work, any material represented by the samples until the required tests have been made and the material accepted, unless otherwise directed. The Contractor in all cases shall furnish the required samples without charge. In the event of failure of materials to meet the Contract Documents, any retesting of new materials or of the same materials after reworking, shall be paid for by the Contractor.

D. The testing of the Work shall not relieve the Contractor of any of his/her obligations to fulfill the terms of the Contract as herein prescribed by the Contract Documents. Failure to reject any defective work or materials shall in no way prevent later rejection when such defect is discovered, notwithstanding that such defective work or materials had been previously overlooked or misjudged by the DCR and accepted or estimated for payment, nor shall such obligate the DCR to make final acceptance thereof. If sampling and testing reveal that the material is unsatisfactory, it will then be the responsibility of the Contractor to remove it from the Work, replace it, or blend it with such other material so that an acceptable material will be produced. The removal, replacement and blending of such material shall be done by the Contractor without additional compensation.

4. **"Or Equal" Submissions.**

A. Where products or materials are prescribed by manufacturer name, trade name, or catalog reference, the words "or Approved equal" shall be understood to follow. An item shall be considered equal to the item so named or described if in the opinion of the DCR (a) it is at least equal in quality, durability, appearance, strength, and design, (b) it performs at least equally the function imposed in the general design for the Work, and (c) it conforms substantially, even with deviations, to the detailed requirements for the items as indicated by the Specifications. Any structural or mechanical changes made necessary to accommodate products or materials substituted as an "or equal" shall be at the expense of the Contractor. If the cost of the material substituted as an "or equal" is less than the cost of the material specified, such savings in cost shall be credited to the DCR and deducted from the price. "Approved equal" shall mean an item with respect to which the DCR shall have issued a written statement to the Contractor to the effect that the item is, in the DCR's opinion, equal within the meaning of this paragraph to that prescribed in the Contract Documents.

B. The Contractor shall be responsible for providing the DCR with any information and test results that the DCR reasonably requires to determine whether a material is equal to a material named or described in the Contract Documents.

C. The Contractor shall make all requests for substitution of a material named or described in the Contract Documents in writing, and at least thirty (30) days prior to the date the materials will be used in the Work, or immediately upon becoming aware of the following exigencies: (1) the non-availability of the specified material, (2) delay of the delivery of the specified material that will preclude the completion of the Work or any part thereof within the time specified in the Contract or (3) unforeseen field conditions that necessitate the substitution of the specified material. In no event shall the Contractor maintain a claim for delays based upon the DCR's review of such substituted materials if the Contractor failed to submit a written request for such substitution in accordance with the provisions of this paragraph. A written request for a material substitution due to an exigency set forth above shall be accompanied with documentation of the exigency, including but not limited to, a photocopy of a letter from the supplier or manufacturer stating that he/she is unable to furnish the specified materials and the reasons that he/she is unable to furnish the materials, as required by the DCR. If the Contractor's proposed substitution due to an exigency is declined, the DCR shall, at its discretion, specify an "or equal" substitution.

D. The Contractor shall have the burden of proof with respect to any claimed increases in the Contract Price resulting from the improper rejection by the DCR of any material proposed by the Contractor as an equal. No increase in the Contract Price shall be permitted unless the Contractor submits documentary evidence sufficient to prove to the reasonable satisfaction of the DCR that the rejection increased the Contractor's costs over the costs provided for in the Bid pricing documents, net of all savings the Contractor obtained by substituting other "or equal" items. The Contractor shall submit copies of all pricing materials, calculations, plans, Specifications, Drawings, and other design documents that the DCR deems necessary or desirable to evidence such increased costs. In calculating the Contractor's increased costs, a deduction shall be made for all costs that the Contractor would have incurred making structural or mechanical changes to include within the Work the item later found to have been improperly rejected.

5. **Delivery and Storage of Materials; Inspection.**

A. Materials and equipment shall be progressively delivered to the Site so that there will be neither delay in the progress of the Work nor an undue accumulation of materials that are not to be used within a reasonable time, and stored so that their security, quality, and fitness of the materials for the Work is preserved.

B. Vehicle Weight Limits

1. The Contractor's attention is directed to Chapter 90, Section 19A of the General Laws as amended concerning the weight limits for construction type motor vehicles.
2. No materials supplied for the project shall be accepted in vehicles whose gross weight exceed the legal load limits as determined by the regulatory agencies of the Commonwealth and Federal Government
3. Weight slips that indicate the load exceeding the legal load limit will not be countersigned by the DCR.

C. If the Engineer so requests, the Contractor, at any time before final acceptance of the work, shall remove or uncover such portions of the finished work as may by directed. After examination, the Contractor shall restore said portions of the work to the standard required by the specifications. Should the work thus exposed or examined prove acceptable, the uncovering, or removing, and the replacing of the covering or making good of the parts removed will be paid for as extra work; but should the work so exposed or examined prove unacceptable, the uncovering or removing and the replacing of the covering or making good of the parts removed, will be at the Contractor's expense.

D. Necessary arrangements shall be made to permit the DCR to perform all required inspection and testing of materials or equipment ordered for the Work at the factory or shop during the process of manufacture or fabrication, or in storage on or off Site. The Contractor shall have no claims because of his/her failure to designate the proposed source of the material in time for adequate testing and inspection.

E. Materials stored off Site shall be insured and stored at the expense of the Contractor to guarantee the preservation of their security, quality, and fitness for the Work. Without derogating from the Contractor's responsibilities in the previous sentence, when necessary to avoid deterioration or damage, material (on or off Site) shall be placed on wooden platforms or other hard clean surfaces and not on the ground and shall be properly protected.

F. Expenses for inspection of material by DCR personnel including travel, quarters, and subsistence shall be borne by the Contractor requesting the inspection of material stored outside the Commonwealth of Massachusetts as part of the Contract Price. The policy of the DCR precludes the payment for material stored outside the boundaries of Massachusetts except in extremely limited circumstances with the express written consent of the DCR. If the Contractor requests an inspection of material stored outside the Commonwealth of Massachusetts, the DCR will initially pay for all expenses of inspecting the material incurred by DCR's personnel including travel, quarters, and subsistence. The DCR will then give Contractor an invoice for those costs and the Contractor shall submit a credit Change Order for those expenses.

G. Stored materials either at the Site or at some other location agreed upon in writing shall be so located as to facilitate prompt inspection and even though approved before storage, may again be inspected prior to their use in the Work.

H. Where no inspection of materials is arranged by the DCR and before such materials are incorporated into the work, the Contractor shall be required to submit to the DCR for approval, three copies of the Manufacturer's or Supplier's statement for each kind of material furnished, which shall contain the following information:

1. Work for which the material is consigned.
2. Name of the Contractor to which the material is supplied.
3. Description of material supplied.
4. Quantity of material supplied.
5. Means of identifying the consignment, such as label, marking, seal number, etc.
6. Date and method of shipment.
7. Statement to the effect that the material has been tested and found in conformance with the Contract Documents.
8. Results of all required tests, or in lieu of said results, the Manufacturer's, or Supplier's guarantee that he/she shall maintain said results, and make them available to the DCR for a period of not less than three years from the date of final acceptance of final payment by the Commonwealth.
9. Signature of a person duly authorized to bind the Manufacturer or Supplier.

I. All storage sites shall be restored to their original condition by the Contractor at the Contractor's expense. This shall not apply to the stripping and storing of topsoil, or to other materials salvaged from the work.

J. The Contractor shall take charge of and be liable for any loss of or injury to the materials for his/her use delivered to or in the vicinity of the place where the Work is being done, whether furnished by the DCR or otherwise. The Contractor shall notify the DCR as soon as any such materials are so delivered, allow them to be examined by the DCR, and furnish workers to assist therewith.

K. Private property shall not be used for storage purpose without the written permission of the property owner, and if requested by the DCR copies of such written permission shall be furnished by the Contractor.

6. **Defective, Damaged, or Deteriorated Materials and Rejection Thereof.**

The DCR may reject materials if the DCR reasonably determines that such materials do not conform to the Contract Documents in any manner, including but not limited to materials that have become damaged or deteriorated from improper storage whether such materials have previously been accepted. The Contractor at its own expense shall remove rejected materials from the Work. No rejected material, the defects of which have been subsequently corrected, shall be used except with the written permission of the DCR. Should the Contractor fail to remove rejected material within a reasonable time, the DCR may, in addition to any other available remedies, remove and/or replace the rejected material, and deduct the cost of such removal and/or replacement from any moneys due or to become due the Contractor. No extra time shall be allowed for completion of Work by reason of such rejection. The inspection of the Work shall not relieve the Contractor of any of its obligations herein prescribed, and any defective Work shall be corrected. Work not conforming to the Contract Documents may be rejected notwithstanding that such Work and materials have been previously overlooked or misjudged by the DCR and accepted for payment. If the Work or any part thereof shall be found defective at any time before Final Acceptance of the whole Work, the Contractor shall forthwith make good such defect in a manner satisfactory to the DCR. Nothing in the Contract shall be construed as vesting in the Contractor any property rights in the materials used after they have been attached or affixed to the Work or the Site; but all such materials shall upon being so attached or affixed become a property of the DCR.

7. **Measurement**

A. The method of measurement for materials necessary for the proper execution of the Work is set forth at the end of each Section of these Specifications. The computations to be used in determination of quantities of material furnished and of work performed under the Contract shall be selected by the DCR.

B. For the estimating of quantities in which the computations or areas by analytic and geometric methods would be comparatively laborious, it is stipulated and agreed that the planimeter shall be considered an instrument of precision adapted to the measurement of such area.

C. To aid the Resident Engineer in determining the quantities and weights of cement and other materials to be paid for, the Contractor shall, whenever so required, give him access to the proper invoices, bills of lading, etc., and shall provide scales and assistance for weighing, or assistance for measuring, any of the materials.

D. All measurements shall be confirmed by the DCR as they are made to determine the quantities of the various items of work performed. All measurements shall be made according to the United States Standard Units of Measurement.

E. Unless otherwise specified, longitudinal measurements for area computations will be made horizontally. Unless otherwise specified transverse measures for area computations will be the dimensions shown on the Drawings or in writing by the DCR.

F. All items which are measured by the linear foot, including, but not limited to pipe, culverts, guardrail, curbing, will be measured parallel to the base or foundation upon which such structures are placed, unless otherwise shown on the Drawings.

G. In computing volumes of excavation, the average end area method, or other methods acceptable to the DCR will be used.

H. A sworn weigher shall weigh all materials required to be weighed. The weighing of such materials may be witnessed by the DCR.

I. If materials are shipped by rail or trucks, the car weights or quarry weights may be accepted. Weight slips shall be provided for each shipment of material weighed. Each weight slip shall be signed by the sworn weigher, and countersigned, on delivery, by the DCR. Material listed on weight slips that are not countersigned by the DCR shall not be included for payment under the Contract.

J. When requested by the Contractor and approved by the DCR in writing, material specified to be measured in weight may be weighed and converted to volume measurement for payment purposes.

ARTICLE VI: PROSECUTION AND PROGRESS

1. Beginning, Progress Schedule, and Completion of Work.

A. The Contract time shall commence the work upon the date specified in the Notice to Proceed. The Contractor shall begin Work at the Site within ten (10) days of said date unless otherwise ordered in writing by the DCR.

B. Within seven (7) days after the issuance of the Notice to Proceed, Saturdays, Sundays and legal holidays excluded, the Contractor shall submit to the DCR a progress schedule for the term of the Contract as required by the Contract Documents, showing in detail his/her proposed progress for the construction of the various parts of the Work and the proposed times for receiving required materials. Upon approval by the DCR, said schedule shall constitute the Progress Schedule. The Contractor shall at the end of each month, or more often if required, furnish to the DCR a schedule meeting the requirements of the Specifications showing the actual progress of the parts of the Work in comparison with the Progress Schedule.

C. Time is of the essence of this Contract. The Work shall be completed within the time specified in Article 2 of the Department of Conservation and Recreation - Contractor Agreement. Should the Contractor require additional time to complete the Work, the Contractor shall document the reasons therefor and submit a written request for an extension of time within 20 days of the occurrence of the event alleged to be the cause of the delay, as provided in this Article and in Article VII of these General Conditions of the Contract. Failure to submit said written request within the time required by the preceding sentence shall preclude the Contractor from subsequently claiming any time extension due to said delay.

D. If, in the opinion of the DCR, the Contractor fails to comply with the construction schedule as set forth in the Contractor's bid or the Project specifications, the DCR may give the Contractor a notice specifying the time limits and performance standards that the Contractor is failing to meet whereupon (1) the Contractor shall, if the notice requires, discontinue all or any portion of the Work (which discontinuance shall neither terminate the Contract nor give the Contractor any claim for an increase in the Contract Price, damages, or an extension of any completion deadlines); or (2) at Contractor's sole cost increase the work force, equipment and plant, or any of them, employed on the whole or any part of the Work, to the extent required by such notice, and employ the same from day to day until the completion of the Work or such part thereof, or until the failure regarding the rate of progress, in the opinion of the DCR, shall have been sufficiently corrected.

E. If, in the opinion of the DCR, the Contractor fails to comply with the construction schedule, and whether the DCR shall have given the Contractor a notice described in D above, the DCR may (but shall not be required to) give the Contractor notice of such failure and five (5) days to cure the same. Unless the Contractor shall within that five days take all necessary steps to do so (including, if the DCR requires, increasing its forces, equipment and plant) and continue to do so until in the opinion of the DCR the failure is corrected, the DCR may at the Contractor's expense and without terminating this Contract take exclusive or joint possession of all or a portion of the Site and employ and direct the labors of existing or such additional forces, equipment and plant as may in the DCR's opinion be necessary to insure the completion of the Work or such part thereof within the time specified in the Contract Documents or at the earliest possible date thereafter. The DCR may exercise its rights under this Article at any time and from time to time without waiving any of its rights under this Contract, at law or in equity, including, without limitation, the right to deem this Contract terminated or to order the Contractor to discontinue the Work at any time thereafter. The Contractor shall continue to perform the remaining Work under this Contract even if the DCR elects to have another contractor perform a portion of the Work under this Article.

F. The DCR shall deduct the cost of any actions the DCR takes under this Article from any amount then due or which might have become due to the Contractor under this Contract had the Contractor performed as required. On demand, the Contractor shall pay the DCR any amount by which the cost of completing all or any portion of the Work exceeds the amount attributable to that Work under the Contract Documents. The DCR's sole goal will be to complete the Work that it elects to complete within the time limits stated in the Contract or soon thereafter. Consequently, the DCR shall have no obligation to obtain competitive bids or the lowest cost for completing the Work or any part thereof, except when it is required by law. The DCR's election to complete all or part of the Work shall not release the Contractor from any liability for failure to complete the Work as the Contract Documents require and shall not entitle the Contractor to a claim for an increase in the Contract Price or an extension of the time for completing the Work. If the cost that the DCR incurs in completing all or any portion of the Work is less than the amount that the Contract Documents attribute to that Work, the DCR will pay or credit the difference to the Contractor, less any other costs and expenses that the DCR incurs, including the cost of supervision, and attorneys' fees and costs.

2. <u>Failure to Complete Work on Time - Liquidated Damages.</u>

A. If liquidated damages are specified in the Department of Conservation and Recreation - Contractor Agreement, the DCR has determined that its damages because of Contractor's failure to complete the Work fully within the time specified will be difficult or impracticable to ascertain. Accordingly, if the Work is not completed to such point by the date specified in this Contract, the Contractor shall pay to the DCR the sum designated as liquidated damages in the Contract for each calendar day that the Contractor is in default in completing the Work to such point. Such moneys shall be paid as liquidated damages, not as a penalty, to cover losses and expenses to the DCR resulting solely from the fact that the Work is not completed on time.

B. Similarly, if the Contract states that by a specified date a designated portion of the Work shall be fully completed, and if such portion has not been prosecuted to such point by said date, the Contractor shall pay to the DCR the sum designated in the Contract for each calendar day that the Contractor is in default in completing such portion of the Work to such point. Such moneys shall also be paid as liquidated damages, not as a penalty, to cover losses and expenses to the Department of Conservation and Recreation resulting solely from the fact that the Work is not completed on time.

C. The DCR may recover such liquidated damages by deducting the amount thereof from any moneys due or that might become due the Contractor, and if such moneys shall be insufficient to cover the liquidated damages, then the Contractor or the Surety shall pay to the DCR the amount due.

D. Permitting the Contractor to continue and finish the Work or any portion of it after the time fixed in the Contract for its completion shall not be deemed as a waiver of any of the DCR's rights hereunder, at law or in equity.

E. Liquidated damages or a portion thereof may be waived by the DCR if the Contractor submits evidence satisfactory to the DCR that the delay was caused solely by conditions beyond the control of the Contractor and that the DCR has not suffered any damages because of said delay.

F. Failure by the DCR to specify a sum as liquidated damages in the Department of Conservation and Recreation - Contractor Agreement, or the insertion of "N/A" or "none" in the space provided therein for liquidated damages, shall not be deemed a waiver of the DCR's right to recover actual damages arising from the Contractor's failure to complete the Work on time.

3. <u>Delays; Statutory Provisions (M.G.L. c. 30, sec. 39O).</u>

A. Notwithstanding any provision of this Contract to the contrary, except as otherwise provided by law as set forth in paragraph B below, the Contractor shall not be entitled to increase the Contract Price or to receive damages on account of any hindrances or delays, avoidable or unavoidable; but if any delay is caused in the opinion of the DCR, the Contractor shall be entitled to an extension of time. The length of the extension shall be sufficient in the opinion of the DCR for the Contractor to complete the Work. Although no delay shall increase the Contract Price, the DCR may require that any change in the date by which the Contractor must complete all or any part of the Work be processed on a Change Order form.

B. If a suspension, delay, interruption or failure to act of the DCR increases the cost of performance to any Subcontractor, that Subcontractor shall have the same rights against the Contractor with respect to such increase as the Contractor shall have against the DCR by virtue of (a) and (b) of M.G.L. c. 30, s. 39O set forth below, but nothing in provisions (a) and (b) shall alter any other rights which the Contractor or the subcontractor may have against each other. As used in the statutory language of (a) and (b) below, "contract" means this Contract, "general contractor" means the Contractor and "awarding authority" means the DCR:

"*(a) The awarding authority may order the general contractor in writing to suspend, delay, or interrupt all or any part of the work for such period of time as it may determine to be appropriate for the convenience of the awarding authority; provided, however, that if there is a suspension, delay or interruption for fifteen days or more or due to a failure of the awarding authority to act within the time specified in this contract, the awarding authority shall make an adjustment in the contract price for any increase in the cost of performance of this contract but shall not include any profit to the general contractor on such increase; and provided further, that the awarding authority shall not make any adjustment in the contract price under this provision for any suspension, delay, interruption or failure to act to the extent that such is due to any cause for which this contract provides for an equitable adjustment of the contract price under any other contract provisions.*

(b) The general contractor must submit the amount of a claim under provision (a) to the awarding authority in writing as soon as practicable after the end of the suspension, delay, interruption or failure to act and, in any event, not later than the date of final payment under this contract and except for costs due to a suspension order, the awarding authority shall not approve any costs in the claim incurred more than twenty days before the general contractor notified the awarding authority in writing of the act or failure to act involved in the claim."

4. Occupancy and/or Use of Project Prior to Final Acceptance.

A. The Contractor agrees to the occupancy and/or use of the Project or any portion thereof before Final Acceptance of the Work by the DCR.

B. The DCR will cooperate with the Contractor with respect to the completion of the Work by taking such reasonable steps as may be possible to avoid interference with the Contractor's Work if they do not interfere with the proper functioning of the facility.

C. The Contractor shall not be responsible for wear and tear or damage resulting solely from temporary occupancy.

D. Occupancy and/or use of any part of the Work prior to Final Acceptance by the DCR shall not relieve the Contractor from maintaining the required payment and performance bonds and insurance (to the extent that insurance is required to be maintained after Substantial Completion) required by this Contract.

5. Substantial Completion – Punch List.

A. When the Work, or portion thereof which the DCR agrees to accept separately has reached the state of Substantial Completion as shown on an Approved payment request, the Contractor shall develop, with the participation of the DCR, the Punch List identifying those items of unfinished or unacceptable Work that remain to be performed or corrected under the Contract.

B. Before the Work shall be deemed completed to the point where it is ready for the issuance of Final Acceptance, the Contractor shall:

(1) Provide Contractor's proposed Punch List containing a statement of the reason for each item listed thereon.

(2) Advise the DCR of proposed changes in insurance in accordance with the provisions of this Contract, and provide to the DCR evidence of the Contractor's Completed Operations insurance coverage to the extent required by the Contract Documents.

(3) Execute and submit a notarized warranty on a form provided by the DCR meeting the requirements of Article IX of these General Conditions of the Contract, to commence upon the date of the Certificate of Final Acceptance, unless otherwise provided in the Certificate of Final Acceptance.

(4) Submit signed special warranties and warranties of longer than one year as required by the Contract Documents.

(5) Submit signed maintenance agreements for all portions of the Work specified to receive maintenance after the issuance of the Certificate of Final Acceptance.

(6) Submit all preliminary record Drawings to the DCR and documents and framed data in the forms required by the Contract Documents.

(7) Complete all items required to be completed by the Department of Public Safety and obtain a Certificate of Occupancy from the Department of Public Safety and similar releases which permit the full and unrestricted use of the areas claimed to be ready for occupancy.

(8) Deliver specified maintenance stocks of materials, required spare parts, and all special tools furnished by manufacturers to persons designated by the DCR and obtain written receipts for same.

(9) Make final changes of lock cylinders or cores and advise the DCR of the change of project security responsibility.

(10) Complete start-up of systems, and instruct DCR personnel on proper operation and routine maintenance of all systems and equipment.

(11) Remove all remaining temporary facilities that are no longer needed, surplus materials, and debris; (the Contractor shall not remove construction offices and trailers without the prior Approval of the DCR).

(12) Submit final utility meter readings and similar information and advise the DCR of the change of responsibility for utility charges and payments upon occupancy and/or use,

(13) Complete final clean-up of all Work, restoration of damaged land and property, including finishes, and replacement of all damaged and broken glass not listed on the Contractor's Punch List.

(14) Complete such other items as may be called for in the Special Conditions, if any, or Specifications.

C. After completing the items specified in subsection A above, the Contractor shall make a written request for the DCR's inspection for a Certificate of Final Acceptance in accordance with the Contract Documents. The DCR shall review the submittals and the Work and shall either 1) sign a Certificate of Final Acceptance or 2) notify the Contractor of incomplete and/or incorrect Work that must be completed and corrected prior to the issuance of the Certificate of Final Acceptance. The DCR shall notify the Contractor of any additions to the Punch List. In connection with the execution of the Certificate of Final Acceptance, the DCR shall assign dollar values to each item on the Punch List. Failure to include any incomplete or defective item on the Punch List shall not relieve the Contractor of the obligation to complete all Work in accordance with the Contract Documents.

6. Final Acceptance of the Work.

A. Prerequisites for Final Acceptance. After the Contractor has completed all the Work required by this Contract, including Change Orders and Punch List Items, the Contractor shall submit the following completed items to the DCR together with such additional items as may be specified in the Contract Documents:

(1) A final request for payment showing a final accounting of all changes in the Work.
(2) Certification and satisfactory evidence that all taxes, fees, and similar obligations have been paid.
(3) Consent of the Surety to Final Payment executed by applicable bonding companies.
(4) Certified copy of the Punch List stating that the Contractor has completed or corrected every item listed.
(5) Evidence of the Contractor's continuing Completed Operations Insurance coverage to the extent required by the Contract Documents.
(6) All final record Drawings and documents in the forms specified by the Contract Documents.
(7) A notarized certification that all purchases made under the tax exemption certificate were legitimate and entitled to exemption.
(8) Written certifications from the Department of Public Safety and/or the DCR, where required, to the effect that: a) the Work has been inspected for compliance with the Contract Documents and has satisfied the Department of Public Safety; b) all equipment and systems included in the Work have been tested in the presence of the DCR and are operational and satisfactory; c) the Work is completed and ready for final inspection.
(9) Such other items as may be required by the Contract Documents.

B. Reinspection; Final Acceptance. After notification from the Contractor that all remaining contract exceptions, omissions, and incompletions have been completed (except for the Contractor's continuing warranty, insurance, indemnification, and such other obligations as are intended by the terms of the Contract Documents to extend beyond the date of Final Acceptance), the DCR shall inspect the Work to verify the completion of the same. If the Work is satisfactory, the DCR shall prepare a Certificate of Final Acceptance or shall notify Contractor of items which remain to be completed prior to Final Acceptance.

7. One-Year Warranty Repair List and Inspection.

Approximately 30 days prior to the expiration of the comprehensive one-year warranty period, the Contractor shall schedule an appointment with the DCR for a re-inspection of the Work with the DCR and shall thereafter inspect the Work at the time scheduled. Based on this inspection and on prior inspections, the DCR shall issue a "Warranty Repair List" of items to be corrected by the Contractor. The Contractor shall make the repairs and/or replacements listed within 30 days of the issuance of the Warranty Repair List unless otherwise agreed by the DCR in writing.

ARTICLE VII: CHANGES IN THE WORK

1. Change Orders Generally.

A. The DCR may, pursuant to the provisions of M.G.L. c. 30, sec. 39K, authorize in writing, alterations in the line, grade, plans, form, dimensions or materials of the work, or any part thereof, either before, or after the commencement of construction. If such alterations diminish or increase the quantity included to be done and paid for at a unit price, or work substituted for the work specified is of a different cost and quality, the parties shall be governed by the aforesaid provisions of Law. No changes in the Work shall be made in absence of a Change Order defined in Article I of these General Conditions of the Contract, directing the Contractor to perform such changes. A request for a change in the provisions of this Contract may be submitted to the DCR by the Contractor, Project Engineer or Resident Engineer. The request must be made in writing and in accordance with the provisions of this Contract, Laws, and the procedures of the DCR. The DCR reserves the right to increase or decrease quantities, to eliminate portions of the work or add work of similar nature, and to direct the commencement and order of prosecution of various portions of the work.

B. A Change Order may be issued by the DCR for changes in the Work within the scope of the Contract, including but not limited to, changes in: (1) the Plans and Specifications; (2) the method or manner of performance of the Work; (3) the DCR-furnished facilities, equipment, materials, services, or Site; (4) the schedule for performance of the Work.

C. The Contractor shall immediately perform any Change Order work that is ordered by the DCR.

D. Whenever a Change Order is issued and said Change Order will cause a change in the Contractor's cost, the Contractor or the DCR may request an equitable adjustment in the Contract Price. A request for such an adjustment shall be in writing and shall be submitted by the party making such claim to the other party before commencement of the pertinent work or as soon thereafter as possible.

E. The DCR and the Contractor shall negotiate in good faith an agreement on an equitable adjustment in the Contract Price, and/or time if appropriate, before commencement of the pertinent work or as soon thereafter as is possible. In the absence of an agreement for an equitable adjustment, the DCR shall unilaterally determine the costs attributable to the change and provide the Contractor with a written notice to that effect. The determination of the DCR shall be final as to all questions of the amount and value of extra work, where the Contractor does not appeal said decision pursuant to the process set forth in this paragraph. The Contractor may appeal the decision of the DCR within thirty days of receipt of said notice, to the Commissioner of the DCR or his designee. The Contractor shall have the right to such further appeal as is provided in M.G.L. c. 30, sec. 39Q set forth in Section 4.D of this Article VII. However, if the Contractor shall exercise its rights to appeal the decision of the DCR as aforesaid, the Contractor shall be required to engage in the mediation procedures set forth in Section 5 of this Article VII, should the DCR require such mediation.

F. During the negotiation of an equitable adjustment in the Contract Price, the Contractor shall, if requested, provide the DCR with all cost and pricing data used by him in computing the amount of the equitable adjustment, and the Contractor shall certify that the pricing data used was accurate, complete, and current. If the DCR subsequently determines that the data submitted by the Contractor was incomplete, incorrect, or not current, the DCR may exclude such data from consideration under the equitable adjustment request.

2. Methods of Computing Equitable Adjustments.

A. Equitable adjustments in the Contract Price shall be determined according to one of the following methods, or a combination thereof, as determined by the DCR: (1) fixed price basis, provided that the fixed price shall be inclusive of items (a) through (e) below and shall be computed in accordance with those provisions; (2) estimated lump sum basis to be adjusted in accordance with Contract unit prices or other agreed upon unit prices provided that the unit prices shall be inclusive of all costs related to such equitable adjustment; (3) time and materials basis to be subsequently adjusted on the basis of actual costs (but subject to a predetermined "not to exceed limit") calculated as follows:

(a) the direct cost (or credit) for labor at the minimum wage rates established for this Contract pursuant to M.G.L. c. 149, sections 26-27H, and the direct cost for material and use of equipment.

(b) plus (or minus) the cost of Workmen's Compensation Insurance, Liability Insurance, Federal Social Security and Massachusetts Unemployment Compensation, or as an alternative the Contractor may elect to use a flat 30% of the total labor rate computed in accordance with subparagraph (a) above.

(c) plus, an allowance equal to 20% of the amount of (a) above for overhead, superintendence, and profit; (In the case of Item 1 work, which is the work of the Contractor and all his non-filed Subcontractors, said 20% allowance shall be paid to the Contractor and the Contractor and said non-filed Subcontractors shall agree upon the distribution of this amount as a matter of contract between them. In the case of Item 2 work, which is work performed by a Subcontractor filed pursuant to M.G.L. c. 149, sec. 44F, said 20% allowance shall be paid to the filed Subcontractor, it being understood that this provision does not apply to other Subcontractors including sub-Subcontractors listed under paragraph E of the form for sub-Bid).
(d) plus, for work performed by a Subcontractor filed pursuant to M.G.L. c. 149, sec. 44F, an additional allowance equal to 7% of the sum of (a) through (c) above as full compensation to the Contractor for processing forms and assuming full responsibility for the faithful performance of such work by said filed Subcontractor(s).
(e) plus (or minus) the actual direct additional premium costs and expenses incurred because of collective bargaining agreements or other agreements between organized labor and employers, and plus (or minus) the actual direct premium cost of payment and performance bonds required of the Contractor and filed Subcontractors for this Contract.

B. If the net change is an addition to the Contract Price, it shall include the Contractor's overhead, superintendence, and profit. On any change that involves a net credit, no allowance for overhead, superintendence and profits shall be included. For any change that does not include labor performed or materials installed in the Project, there will be no markup for the Contractor's overhead, superintendence, and profit, even though there may be a net increase in the Contract Price. Charges for small tools known as "tools of the trade" are not to be computed in the amount of any change in the Contract Price.

C. Statutory Contract adjustments made under the provisions of M.G.L. c. 149, sec. 44F shall not be considered Change Orders and shall not entitle the Contractor to any adjustments for overhead, profit, and superintendence, although the DCR may require that such Contract adjustments be processed on standard Change Order and equitable adjustment forms.

3. <u>Work Performed Under Protest.</u>
The Contractor agrees to perform all Work as directed by the DCR, and if the Project Engineer determines that certain Work that the Contractor believes to be or to warrant a Change Order under this Article does not represent a change in the Work, the Contractor shall perform said Work. The Contractor shall be deemed to have concurred with the Project Engineer's determination as aforesaid unless the Contractor shall perform Work under protest in compliance with the following sub-paragraphs (1) and (2) below:

(1) If the Contractor claims compensation for a change in the Work that is not deemed by the Project Engineer to be a change or to warrant additional compensation as claimed by the Contractor, the Contractor shall within one week after the commencement of any such work or the sustaining of any such damage submit to the Resident Engineer a written statement of the nature of such work or claim. The Contractor shall not be entitled to additional compensation for any work performed or damage sustained for which written notice is not given within the time limit specified in the preceding sentence, even though similar in character to work or damage with respect to which notice is timely given.
(2) On or before the fifteenth day of the month succeeding that in which any such extra work shall have been done or any such damage shall have been sustained, the Contractor shall file to the extent possible with the Resident Engineer, itemized statements of the details and costs of such work performed, or damage sustained. If the Contractor shall fail to make such statement to the extent possible, then the Contractor shall not be entitled to additional compensation for any such work or damages.

4. <u>False Claims, Statutory Provisions Regarding Changes.</u>

A. Criminal Penalties: The Contractor's attention is directed to M.G.L. c. 30, sec. 39I which provides criminal penalties for unauthorized deviations from the Plans and Specifications, and to M.G.L. c. 30, sec. 39J, and if performing work on a capital facility project, M.G.L. c. 7, sec. 42E-42I. The Contractor's attention is also directed to M.G.L. c. 266, sec. 67B which provides criminal penalties for false claims by Contractor under this Contract: *"Whoever makes or presents to any employee, department, agency or public instrumentality of the commonwealth, or of any political subdivision thereof, any claim upon or against any department, agency, or public instrumentality of the commonwealth, or any political subdivision thereof, knowing such claim to be false, fictitious, or fraudulent, shall be punished by a fine of not more than ten thousand dollars or by imprisonment in the state prison for not more than five years, or in the house of correction for not more than two and one-half years, or both."*

B. Differing Site Conditions (M.G.L. c. 30, sec. 39N): "*If, during the progress of the work, the contractor or the awarding authority discovers that the actual subsurface or latent physical conditions encountered at the Site differ substantially or materially from those shown on the plans or indicated in the contract documents either the contractor or the contracting authority may request an equitable adjustment in the contract price of the contract applying to work affected by the differing Site conditions. A request for such an adjustment shall be in writing and shall be delivered by the party making such claim to the other party as soon as possible after such conditions are discovered. Upon receipt of such a claim from a contractor, or upon its own initiative, the contracting authority shall make an investigation of such physical conditions, and, if they differ substantially or materially from those shown on the plans or indicated in the contract documents or from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the plans and contract documents and are of such a nature as to cause an increase or decrease in the cost of performance of the work or a change in the construction methods required for the performance of the work which results in an increase or decrease in the cost of the work, the contracting authority shall make an equitable adjustment in the contract price and the contract shall be modified in writing accordingly."*

C. Timely Decision by Awarding Authority. (M.G.L. c. 30, sec. 39P): *"Every contract subject to section thirty-nine M of this chapter or section forty-four A of chapter one hundred forty-nine which requires the awarding authority, any official, its architect or engineer to make a decision on interpretation of the specifications, approval of equipment, material or any other approval, or progress of the work, shall require that the decision be made promptly and, in any event, no later than thirty days after the written submission for decision; but if such decision requires extended investigation and study, the awarding authority, the official, architect or engineer shall, within thirty days after the receipt of the submission, give the party making the submission written notice of the reasons why the decision cannot be made within the thirty day period and the date by which the decision will be made."*

D. Change Order / Contract Interpretation Appeal Procedure (M.G.L. c. 30, sec. 39Q): The following provisions apply to every contract awarded by any state agency as defined by M.G.L. c. 7, sec. 39A for the construction, reconstruction, alteration, remodeling, repair, or demolition of any capital facility as defined by the aforesaid section 39A:

"*(a) Disputes regarding changes in and interpretations of the terms or scope of the contract and denials of or failures to act upon claims for payment for extra work or materials shall be resolved according to the following procedures, which shall constitute the exclusive method for resolving such disputes. Written notice of the matter in dispute shall be submitted promptly by the claimant to the chief executive official of the state agency which awarded the contract or his designee. No person or business entity having a contract with a state agency shall delay, suspend, or curtail performance under that contract because of any dispute subject to this section. Any disputed order, decision or action by the agency or its authorized representative shall be fully performed or complied with pending resolution of the dispute.*

"(b) Within thirty days of submission of the dispute to the chief executive official of the state agency or his designee, he shall issue a written decision stating the reasons therefore and shall notify the parties of their right of appeal under this section. If the official or his designee is unable to issue a decision within thirty days, he shall notify the parties to the dispute in writing of the reasons why a decision cannot be issued within thirty days and of the date by which the decision shall issue. Failure to issue a decision within the thirty-day period or within the additional time specified in such written notice shall be deemed to constitute a denial of the claim and shall authorize resort to the appeal procedure described below. The decision of the chief executive official or his/her designee shall be final and conclusive unless an appeal is taken as provided below.

"(c) Within twenty-one calendar days of the receipt of a written decision or of the failure to issue a decision as stated in the preceding subparagraph, any aggrieved party may file a notice of claim for an adjudicatory hearing with the division of hearing officers or the aggrieved party may file an action directly in a court of competent jurisdiction and shall serve copies thereof upon all other parties in the form and manner prescribed by the rules governing the conduct of adjudicatory proceedings of the division of hearing officers. In the event an aggrieved party exercises his option to file an action directly in court as provided in the previous sentence, the twenty-one-day period shall not apply to such filing and the period of filing such action shall be the same period otherwise applicable for filing a civil action in superior court. The appeal shall be referred to a hearing officer experienced in construction law and shall be prosecuted in accordance with the formal rules of procedure for the conduct of adjudicatory hearings of the division of hearing officers, except as provided below. The hearing officer shall issue a final decision as expeditiously as possible, but in no event more than one hundred and twenty calendar days after conclusion of the adjudicatory hearing, unless the decision is delayed by a request for extension of time for filing post-hearing briefs or other submissions assented to by all parties. Whenever, because an extension of time has been granted, the hearing officer is unable to issue a decision within one hundred and twenty days, he shall notify all parties of the reasons for the delay and the date when the decision will issue. Failure to issue a decision within the one-hundred-and-twenty-day period or within the additional period specified in such written notice shall give the petitioner the right to pursue any legal remedies available to him without further delay.

"(d) When the amount in dispute is less than ten thousand dollars, a contractor who is party to the dispute may elect to submit the appeal to a hearing officer experienced in construction law for expedited hearing in accordance with the informal rules of practice and procedure of the division of hearing officers. An expedited hearing under this subparagraph shall be available at the sole option of the contractor. The hearing officer shall issue a decision no later than sixty days following the conclusion of any hearing conducted pursuant to this subparagraph. The hearing officer's decision shall be final and conclusive and shall not be set aside except in cases of fraud."

5. Mediation.

In the case of every dispute where the dollar amount in dispute (or the estimated dollar value of the extension of time in dispute) is $50,000 or more and the Contractor appeals the decision of the DCR or his designee described in Section 4.B above, the DCR shall retain the option at its sole discretion of initiating a process whereby the DCR and the Contractor shall engage in good faith in a non-binding mediation process, which process shall be concluded within sixty days from the date that the Contractor files an appeal from said decision as provided in Section 4.B above.

ARTICLE VIII: PAYMENT PROVISIONS

1. Schedule of Values.

Before the first application for payment the Contractor shall submit to the DCR a schedule of values allocated to various portions of the Work in sufficient detail to reflect the various major components of each trade (with filed Subcontractors as well as MBE/WBE noted), including quantities when requested, aggregating the total Contract Price, and divided so as to facilitate payments for work under each section of the Specifications. The schedule shall be prepared in such form and supported by such data to substantiate its accuracy as the DCR may require. Each item in the schedule shall include its proper share of overhead and profit. When approved by the DCR, it shall constitute the Schedule of Values and shall be used only as a basis for the Contractor's requests for payments.

2. Payment Liabilities of Contractor.

A. The Contractor shall pay to the DCR all expenses, losses, and damages, as determined by the DCR, incurred in consequence of any default, defect, omission or mistake of the Contractor or his/her employees or Subcontractors or the making good thereof.

B. If the Work (or a portion thereof) is not completed to Substantial Completion and the Contractor has not fully completed the Work by the date specified in Article 2 of the Department of Conservation and Recreation - Contractor Agreement, the Contractor shall pay to the DCR liquidated damages as provided in Article VI, Section 2 of these General Conditions of the Contract.

3. Retention of Moneys by the DCR.

A. The DCR may keep any moneys which would otherwise be payable at any time hereunder, and apply the same, or so much as may be necessary therefor, to (1) the DCR's expenditures for the Contractor's account, (2) to secure the DCR's remedies against the Contractor for the Contractor's breach of its obligations under this Contract or the breach of any person performing any part of the Work and (3) the payment of any expenses, losses or damages incurred by the DCR as a result of the failure of the Contractor to perform its obligations hereunder. The DCR may retain, until all claims are settled, such moneys as the DCR estimates to be the fair value of the DCR's claims against the Contractor, and of all claims for labor performed or furnished and for materials used or employed in or in connection with the Work and for the rental of vehicles, appliances and equipment employed and for the employment of substitute contractors and labor in connection with the Work, in accordance with M.G.L. c. 30, sections 39A and 39F. The DCR may make such settlements and apply thereto any moneys retained under this Contract.

B. The Contractor shall each week examine all claims so filed, and if the same are in any respect incorrect or do not correctly show the amount due from the Contractor to the claimant for such labor and materials, the Contractor shall forthwith file with the DCR a separate written statement of all inaccuracies in each claim and of the correct amount due from the Contractor to each claimant therefor, and shall immediately file a statement of all payments thereafter made to such claimants. Each such statement shall be sworn to and contain a detailed breakdown as required by M.G.L. c. 30 s. 39F(d). Unless such statements are so filed by the Contractor the amount shown by the claims filed shall at the option of the DCR be conclusively deemed to be the accurate amount due from the Contractor therefor in all accounting with the DCR. If the moneys retained under this Contract are insufficient to pay the sums found by the DCR to be due under the claims for labor and materials filed as aforesaid, the DCR may, at its discretion, pay the same, and the Contractor shall repay to the DCR all sums paid out. The DCR may also at its discretion use any moneys retained, due or to become due under this Contract, for the purpose of paying for both labor and materials used or employed in the Work for which claims have not been filed with the DCR.

C. No moneys retained under the provisions of this Article shall be held to be statutory security for the payment of claims filed in accordance with the provisions of M.G.L. c. 149, sec. 29, as amended, for which security is provided by bond.

4. Applications for Payment.

A. The Contractor shall, once in each month on the day of the month corresponding to the day of the month specified in the Notice to Proceed referenced in Article 2 of the Department of Conservation and Recreation - Contractor Agreement, in writing and in the manner prescribed by the DCR, submit to the Resident Engineer a statement showing the total amount of Work done to the time of such estimate and the value thereof as approved by the Resident Engineer and the Project Engineer. It shall be the sole responsibility of the Contractor to deliver or cause to be delivered to the Resident Engineer said periodic estimate in proper form, approved as provided above and arithmetically correct. All periodic estimates shall contain such certifications and other evidence supporting the Contractor's right to payment as the DCR may require, including without limitation, lien waivers and other evidence, on such forms as the DCR may require, establishing that title to the equipment or materials is unencumbered and has been transferred to the Department of Conservation and Recreation. If there is no Resident Engineer assigned to the Contract, the DCR shall designate a person at the project field office or alternatively the home office of the DCR. The Contractor shall include in such periodic estimate only such materials as are incorporated in the Work, except as provided in paragraph C below. The DCR shall retain no more than five percent of such estimated value as part security for the completion of the Work and shall pay to the Contractor while carrying on the Work the balance not retained as aforesaid, subject to the approval of the DCR after deducting therefrom all previous payments and all sums to be kept under the provisions of this Contract.

B. Each periodic estimate shall constitute the Contractor's representation that (1) the payment then requested to be disbursed has been incurred by the Contractor on account of the Work and is justly due to Subcontractors or, to the Contractor in the case of other Work performed by the Contractor on account thereof, (2) the materials, supplies and equipment for which Application for Payment is being submitted have been installed or incorporated into the Work or have been stored at the Site or at such off Site storage locations as the DCR shall have Approved, (3) the materials, supplies and equipment are insured in accordance with the provisions of this Contract, (4) the materials, supplies and equipment are owned by the Department of Conservation and Recreation and are not subject to any liens or encumbrances, (5) the Work which is the subject of such periodic estimate has been performed in accordance with the Contract Documents and (6) that all due and payable bills with respect to the Work have been paid to date or shall be paid from the proceeds of such periodic estimate. The Contractor's attention is directed to the criminal penalties for false claims referenced in paragraph A above.

C. The Contractor may include in a periodic estimate the value of materials or equipment delivered at the Site (or at some location agreed to in writing) only upon delivery to the DCR of: (1) an acceptable transfer of title on the form provided by the DCR; (2) written certification by the Contractor (or applicable subcontractor) on the form provided by the DCR that the Contractor (or the Subcontractor which executed the transfer of title) is the lawful owner and that the materials or equipment are free from all encumbrances, accompanied by receipted invoices or other acceptable proof of encumbrance-free ownership if such proof is deemed necessary by the DCR; (3) a stored materials insurance binder that covers the materials for which payment is requested, that names the Department of Conservation and Recreation as an insured party should the stored materials be subjected to any casualty, loss, or theft prior to their inclusion in the Work. The material(s) or equipment must, in the judgment of the DCR (1) meet the requirements of the Contract, including prior drawing, product data, and sample approval, (2) be ready for use, and (3) be properly stored by the Contractor and be adequately protected until incorporated into the Work. See also Article V.5.C of these General Conditions of the Contract concerning the cost of inspections.

D. The DCR may make changes in any periodic estimate submitted by the Contractor in accordance with M.G.L. c. 30, sec. 39K for building projects (see below), and in accordance with M.G.L. c. 30, sec. 39G for public works projects (see below), and the payment due shall be computed in accordance with the changes so made. The provisions of said section 39K shall govern payments for building projects on which the DCR has made changes, and the provisions of said section 39G shall govern payments for public works projects on which the DCR has made changes.

E. No certificate for payment and no progress payment shall constitute acceptance of Work that is not in accordance with the Contract Documents.

F. The Contractor and all Subcontractors furnishing labor on this Contract agree to furnish certified payroll reports if requested to do so, at no additional expense to the DCR. The DCR may at all reasonable times audit such reports.

5. <u>Periodic Payments (M.G. L. c. 30, sec. 39K) for Building Projects.</u>

For building contracts, the DCR shall make payment to the Contractor in accordance with M.G.L. c. 30, sec. 39K, which provides as follows:

" Within fifteen days (30 days in the case of the commonwealth, including local housing authorities) after receipt from the contractor, at the place designated by the awarding authority if such a place is so designated, of a periodic estimate requesting payment of the amount due for the preceding month, the awarding authority 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 a subcontractor has title and has authorized the contractor to transfer title to the awarding authority upon certification by the contractor that he is the lawful awarding authority and that the materials are free from all encumbrances, but 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 thirty-nine F, 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 awarding authority, less than one percent of the original contract price, or (b) the contractor substantially completes the work and the awarding authority takes possession for occupancy, whichever occurs first, the awarding authority 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 claims 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 demands for same in accordance with the provisions of section thirty-nine F, 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 thirty-nine F. If the awarding authority fails to make payment as herein provided, there shall be added to each such payment daily interest at the rate of three percentage points above the rediscount rate then charged by the Federal Reserve Bank of Boston 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 (twenty-four days in the case of the commonwealth) after receipt of such period estimate from the contractor, at the place designated by the awarding authority 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.

The awarding authority 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 change 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 awarding authority 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 of such periodic estimate shall be the date of receipt of the corrected 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 thirty-nine G shall not apply to any contract for the construction, reconstruction, alteration, remodeling, repair, or demolition of any public building to which this section applies.

All periodic estimates shall be submitted to the awarding authority, or to its designee as set forth in writing to the contractor, and the date of receipt by the awarding authority or its designee shall be marked on the estimate. All periodic estimates shall contain a separate item for each filed sub-trade and each sub-sub-trade listed in sub-bid form as required by specifications and column listing the amount paid to each filed subcontractor as of the date of the periodic estimate is filed. The person making payment for the awarding authority shall add the daily interest provided for herein to each payment for each day beyond the due date of receipt marked on the estimate.

A certificate of the architect to the effect that the contractor has fully or substantially completed the work shall, subject to the provisions of section thirty-nine J, be conclusive for the purposes of this section.

Notwithstanding the provisions of this section, at any time after the value of the work remaining to be done is, in the estimation of the awarding authority, less than 1 per cent of the adjusted contract price, or the awarding authority has determined that the contractor has substantially completed the work and the awarding authority has taken possession for occupancy, the awarding authority may send to the general contractor by certified mail, return receipt requested, a complete and final list of all incomplete and unsatisfactory work items, including, for each item on the list, a good faith estimate of the fair and reasonable cost of completing such item. The general contractor shall then complete all such work items within 30 days of receipt of such list or before the contract completion date, whichever is later. If the general contractor fails to complete all incomplete and unsatisfactory work items within 45 days after receipt of such items furnished by the awarding authority or before the contract completion date, whichever is later, subsequent to an additional 14 days' written notice to the general contractor by certified mail, return receipt requested, the awarding authority may terminate the contract and complete the incomplete and unsatisfactory work items and charge the cost of same to the general contractor and such termination shall be without prejudice to any other rights or remedies the awarding authority may have under the contract. The awarding authority shall note any such termination in the evaluation form to be filed by the awarding authority pursuant to the provisions of section 44D of chapter 149."

6. <u>Payment of Subcontractors (M.G.L. c. 30, sec. 39F),</u>

The Contractor shall make payments to Subcontractors in accordance with the provisions of M.G.L c. 30, sec. 39F, which is quoted in this section below, where applicable. (M.G.L. c. 30, sec. 39F requires that subparagraphs (a) through (h) be set forth in contracts awarded under M.G.L. c. 30, sec. 39M and M.G.L. c. 149, sections 44A-44H; said statute requires that subparagraph (i) be set forth in contracts awarded under M.G.L. c. 149, sections 44A-44H).

"1(a) Forthwith after the general contractor receives payment on account of a periodic estimate, the general Contractor shall pay to each subcontractor the amount paid for the labor performed and the materials furnished by that subcontractor, 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.

(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 awarding authority as the estimated cost of completing the incomplete and unsatisfactory items of work, shall be due the subcontractor; and the awarding authority shall pay that amount to the general contractor. The general contractor shall forthwith pay to the subcontractor the full amount received from the awarding authority less any amount specified in any court proceedings barring such payment and less any amount claimed due from the subcontractor by the general contractor.

(c) Each payment made by the awarding authority to the general contractor 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 awarding authority shall take reasonable steps to compel the general contractor to make each such payment to each such subcontractor. If the awarding authority 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 or which is to be included in a payment to the general contractor for payment to the subcontractor as provided in subparagraphs (1) and (2) the awarding authority shall act upon the 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 awarding authority as the estimated cost of completing the incomplete and unsatisfactory items of work, the subcontractor may demand direct payment of that balance from the awarding authority. The demand shall be by a sworn statement delivered to or sent by certified mail to the awarding authority, and a copy shall be delivered to or sent by certified mail to the general contractor at the same time. The reply shall contain a detailed breakdown of the balance due under the subcontract and 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 awarding authority and delivered or so mailed a copy to the general contractor, the general contractor may reply to the demand. The reply shall be by a sworn statement to or sent by certified mail to the awarding authority 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 awarding authority, 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 including any amount due for extra labor and materials furnished to the general contractor, less any amount (i) retained by the awarding authority 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 awarding authority 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 by subparagraph (d). The awarding authority shall make further direct payments to the subcontractor forthwith after the removal of the basis for deduction from direct payments made as provided in parts (i) and (ii) of this subparagraph.

(f) The awarding authority shall forthwith deposit the amount deducted from a direct payment as provided in part (iii) of subparagraph (5) in an interest-bearing joint account in the names of the general contractor and the subcontractor in a bank in Massachusetts selected by the awarding authority or agreed upon by the general contractor and the subcontractor and shall notify the general contractor and the subcontractor of the date of the deposit and the bank receiving the deposit. The bank shall pay the amount in 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 demand for direct payments deposited in an interest-bearing account or accounts in a bank pursuant to subparagraph (6) 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 which later become payable to the General contractor and in the order of receipt of such demands from subcontractors. All direct payments shall discharge the obligation of the awarding authority to the general contractor to the extent of such payment.

(h) The awarding authority shall deduct from payments to a General contractor amounts which, together with the deposits in interest bearing accounts pursuant to subparagraph (6) 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) If the subcontractor does not receive payment as provided in subparagraph (1) or if the general contractor does not submit a periodic estimate for the value of the labor or materials performed or furnished by the subcontractor and the subcontractor does not receive payment for same when due less the deductions provided for in subparagraph (1), the subcontractor may demand direct payment by following the procedure in subparagraph (4) and the general contractor may file a sworn reply as provided in that same subparagraph. A demand made after the first day of the month following that for which the subcontractor performed or furnished the labor and materials for which the subcontractor seeks payment shall be valid even if delivered or mailed prior to the time payment was due on a periodic estimate from the general contractor. Thereafter the awarding authority shall proceed as provided in subparagraph (e), (f), (g) and (h).

(2) Any assignment by a subcontractor of the rights under this section to a surety company furnishing a bond under the provisions of section twenty-nine of chapter one hundred forty-nine shall be invalid. The assignment and subrogation rights of the surety to amounts included in a demand for direct payment which are in the possession of the awarding authority, or which are on deposit pursuant to subparagraph (6) shall be subordinate to the rights of all subcontractors who are entitled to be paid under this section and who have not been paid in full.

(3) "subcontractor" as used in this section (l) for contracts awarded as provided in sections forty-four A to forty-four L, inclusive, of chapter one hundred forty-nine shall mean a person who files a sub-bid and received a subcontract as a result of that filed sub-bid or who is approved by the awarding authority in writing as a person performing labor or both performing labor and furnishing materials pursuant to a contract with the general contractor, (ii) for contracts awarded as provided in paragraph (1) of section thirty-nine M of chapter thirty shall mean a person approved by the awarding authority in writing as a person performing labor or both performing labor and furnishing materials pursuant to a contract with the general contractor, and (iii) for contracts with the commonwealth not awarded as provided in sections forty-four A to forty-four L, inclusive, of chapter one hundred forty-nine shall also mean a person contracting with the general contractor to supply materials used or employed in a public works project for a price in excess of five thousand dollars.

(4) A general contractor or a subcontractor shall enforce a claim to any portion of the amount of a demand for direct payment deposit as provided in subparagraph (6) by a petition in equity in the superior court against the other and the bank shall not be a necessary party. A subcontractor shall enforce a claim for direct payment or a right to require a deposit as provided in subparagraph (6) by a petition in equity in the superior court against the awarding authority and the general contractor shall not be a necessary party. Upon motion of any party the court shall advance for speedy trial any petition filed as provided in this paragraph. Sections fifty-nine and fifty-nine B of chapter two hundred thirty-one shall apply to such petitions. The court shall enter an interlocutory decree upon which execution shall issue for any part of a claim found due pursuant to sections fifty-nine and fifty-nine B and, upon motion of any party, shall advance for speedy trial the petition to collect the remainder of the claim. Any party aggrieved by such interlocutory decree shall have the right to appeal therefrom as from a final decree. The court shall not consolidate for trial the petition of any subcontractor with the petition of one or more subcontractors or the same general Contract unless the court finds that a substantial portion of the evidence of the same events during the course of construction (other than the fact that the claims sought to be consolidated arise under the same general contract) is applicable to the petitions sought to be consolidated and that such consolidation will prevent unnecessary duplication of evidence. A decree in any such proceeding shall not include interest on the disputed amount deposited more than the interest earned for the period of any such deposit. No person except a subcontractor filing a demand for direct payment for which no funds due the general contractor are available for direct payment shall have a right to file a petition in court of equity against the awarding authority claiming a demand for direct payment is premature and such subcontractor must file the petition before the awarding authority has made a direct payment to the subcontractor and has made a deposit of the disputed portion as provided in part (iii) of subparagraph (5) and in subparagraph (6).

(5) In any petition to collect any claim for which a subcontractor has filed a demand for direct payment the court shall, upon motion of the general contractor, reduce by the amount of any deposit of a disputed amount by the awarding authority as provided in part (iii) of subparagraph (5) and in subparagraph (6) any amount held under a trustee writ or pursuant to a restraining order or injunction."

7. <u>Contracts for Public Works Governed by M.G.L. c. 30, sec. 39G:</u>

The following statutory provision applies only to contracts for public works governed by M.G.L. c. 30, sec. 39G: *"Upon substantial completion of the work required by a Contract with the Owner, or any agency or political subdivision thereof, for the construction, reconstruction, alteration, remodeling, repair or improvement of public ways, including bridges, and other highway structures, sewers and water mains, airports and other public works, the contractor shall present in writing to the awarding authority its certification that the work has been substantially completed. Within twenty-one days thereafter, the awarding authority shall present to the contractor either a written declaration that the work has been substantially completed or an itemized list of incomplete or unsatisfactory work items required by the Contract sufficient to demonstrate that the work has not been substantially completed. The awarding authority may include with such a list a notice setting forth a reasonable time, which shall not in any event be prior to the Contract completion date, within which the contractor must achieve substantial completion of the work. If the awarding authority fails to respond, by presentation of a written declaration or itemized list as aforesaid, to the contractor's certification within the twenty- one-day period, the contractor's certification shall take effect as the awarding authority's declaration that the work has been substantially completed.*

Within sixty-five days after the effective date of a declaration of a substantial completion, the awarding authority shall prepare and forthwith send to the contractor for acceptance a substantial completion estimate for the quantity and price of the work done and all but one percent retainage of that undisputed part of each work item and extra work item in dispute but excluding the disputed part thereof, less the estimated cost of completing all incomplete and unsatisfactory work items and less the total periodic payments made to date for the work. The awarding authority also shall deduct from the substantial completion estimate an amount equal to the sum of all demands for direct payments filed by subcontractors and not yet paid to subcontractors or deposit d in joint accounts pursuant to section thirty-nine F, but no Contract subject to said section thirty-nine F shall contain any other provision authorizing the awarding authority to deduct any amount by virtue of claims asserted against the Contract by subcontractors, material suppliers or others.

If the awarding authority fails to prepare and send to the contractor any substantial completion estimate required by this section on or before the date herein above set forth, the awarding authority shall pay to the contractor interest on the amount which would have been due to the contractor pursuant to such substantial completion estimate at the rate of three percentage points above the rediscount rate than charged by the Federal Reserve Bank of Boston from such date to the date on which the awarding authority sends that substantial completion estimate to the contractor for acceptance or to the date of payment therefor, whichever occurs first. The awarding authority shall include the amount of such interest in the substantial completion estimate.

Within fifteen days after the effective date of the declaration of substantial completion, the awarding authority shall send to the contractor by certified mail, return receipt requested, a complete list of all incomplete or unsatisfactory work items, and, unless delayed by causes beyond his control, the contractor shall complete all such work items within forty-five days after the receipt of such list or before the then Contract completion date, whichever is later. If the contractor fails to complete such work within such time, the awarding authority may, after seven days' written notice to the contractor by certified mail, return receipt requested, terminate the Contract, and complete the incomplete or unsatisfactory work items and charge the cost of same to the contractor.

Within thirty days after receipt by the awarding authority of a notice from the contractor stating that all of the work required by the Contract has been completed, the awarding authority shall prepare and forthwith send to the contractor for acceptance a final estimate for the quantity and price of the work done and all retainage on that work less all payments made to date, unless the awarding authority's inspection shows that work items required by the Contract remain incomplete or unsatisfactory, or that documentation required by the Contract has not been completed. If the awarding authority fails to prepare and send to the contractor the final estimate within thirty days after receipt of notice of completion, the awarding authority shall pay to the contractor interest on the amount which would have been due to the contractor pursuant to such final estimate at the rate hereinabove provided from the thirtieth day after such completion until the date on which the awarding authority sends the final estimate to the contractor for acceptance or the date or payment therefore, whichever occurs first, provided that the awarding authority's inspection shows that no work items required by the Contract remain incomplete or unsatisfactory. Interest shall not be paid hereunder on amounts for which interest is required to be paid in connection with the substantial completion estimate as hereinabove provided. The awarding authority shall include the amount of the interest required to be paid hereunder in the final estimate.

The awarding authority shall pay the amount due pursuant to any substantial completion or final estimate within thirty-five days after receipt of written acceptance for such estimate from the contractor and shall pay interest on the amount due pursuant to such estimate at the rate hereinabove provided from that thirty-fifth day to the date of payment. Within 15 days, 30 days in the case of the commonwealth, after receipt from the contractor, at the place designated by the awarding authority, if such place is designated, of a periodic estimate requesting payment of the amount due for the preceding periodic estimate period, the awarding authority shall make a periodic payment to the contractor for the work performed during the preceding periodic estimate period 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 a subcontractor has title and authorized the contractor to transfer title to the awarding authority, upon certification by the contractor that he is the lawful owner and that the materials are free from all encumbrances. The awarding authority shall include with each such payment interest on the amount due pursuant to such periodic estimate at the rate herein above provided from the due date. In the case of periodic payments, the contracting authority may deduct from its payment a retention based on the estimate of the fair value of its claims against the contractor, a retention for direct payments to subcontractors based on demands for same in accordance with the provisions of section thirty-nine F, and a retention to secure satisfactory performance of the contractual work not exceeding five per cent of the approved amount of any periodic payment, and the same right to retention shall apply to bonded subcontractors entitled to direct payment under section thirty-nine F of chapter thirty; provided that a five per cent value of all items that are planted in the ground shall be deducted from the periodic payments until final acceptance.

No periodic, substantial completion or final estimate or acceptance or payment thereof shall bar a contractor from reserving all rights to dispute the quantity and amount of, or the failure of the awarding authority to approve a quantity and amount of, all or part of any work item or extra work item.

Substantial completion, for the purposes of this section, shall mean either that the work required by the Contract has been completed except for work having a Contract Price of less than one percent of the then adjusted total Contract Price, or substantially all of the work has been completed and opened to public use except for minor incomplete or unsatisfactory work items that do not materially impair the usefulness of the work required by the contract"

8. <u>Liens</u>

Neither the final payment nor any part of the retained percentage shall become due until the Contractor, if required, delivers to the DCR a complete release of all liens arising out of this Contract, or receipts in full in lieu thereof and, if required in either case, an affidavit that so far as he/she has knowledge or information, the releases and receipts include all labor and material for which a lien could be filed; but the Contractor may, if any Subcontractor refuses to furnish a release or receipt in full, furnish a bond satisfactory to the DCR, to indemnify him against any lien. If any lien remains unsatisfied after all payments are made, the Contractor shall refund to the DCR, all moneys that the latter may be compelled to pay in discharging such a lien, including all costs and a reasonable attorney's fee.

9. <u>Final Payment; Release of Claims by Contractor.</u>

Upon Final Acceptance of the Work the Contractor shall be entitled to payment of the balance of the Contract Price. Final payment shall be as provided in this Article above and in accordance with any process set forth in the Special Conditions. The Contractor agrees to execute a Certificate of Final Inspection, Release (with Contractor's own exceptions listed thereon) and Acceptance as a condition precedent to Final Payment. The acceptance by the Contractor of the Final Payment made as aforesaid, or the execution of the Certificate of Final Acceptance by the Contractor, shall constitute a release of the Department of Conservation and Recreation, and every member and agent of it, from all claims of and liability to the Contractor for anything done or furnished for or relating to the Work, or for any act or neglect of the Department of Conservation and Recreation, or of any person relating to or affecting the Work, except the claim against the Department of Conservation and Recreation for the remainder, if any there be, of the amounts set forth by the Contractor in the Certificate of Final Inspection, Release and Acceptance. Final Acceptance shall not relieve the Contractor of the requirements of Articles IX, XIV, and XV of these General Conditions of the Contract, or of other provisions of this Contract, to the extent that the same are intended to survive Final Acceptance.

ARTICLE IX. GUARANTEES AND WARRANTIES

1. General Warranty.
If at any time during the period of one (1) year from the date of Final Acceptance, any part of such Work shall in the reasonable opinion of the DCR be defective or require replacing or repairing, or damage to other property of the DCR is caused by any defect in the Work, the DCR shall notify the Contractor in writing to make the required repairs or replacements and repair such damage. If the Contractor shall neglect to commence such repairs or replacements to the satisfaction of the DCR within ten (10) days from the date of the giving of such notice, then the DCR may employ other persons to make the same. The Contractor agrees, upon demand, to pay to the DCR all amounts which it expends for such repairs, replacements, and/or damages. During this one-year guarantee period any corrective work shall be performed under all the applicable terms of this Contract, and if Change Orders are issued in accordance with the terms of this Contract, the Contractor shall be entitled to compensation for special insurance, as required. This one-year guarantee shall not limit any express guaranty or warranty provided elsewhere in the Contract.

2. Special Guarantees and Warrantees.
A. The Contractor's obligation to correct Work as set forth in paragraph 1 above is in addition to, and not in substitution of, such guarantees or warranties as may be required in the various sections of the Specifications.
B. Guarantees and warranties required in the various sections of the Specifications must be delivered to the DCR before final payment to the Contractor may be made, or in the case of guarantees and warranties which originate with a subcontractor 's section of the Work, before final payment for that sub-trade or for the phase of Work to which the guarantee or warranty relates.
C. The failure to deliver a required guarantee or warranty shall constitute a failure to fully complete the Work in accordance with the Contract Documents.

ARTICLE X: MISCELLANEOUS LEGAL REQUIREMENTS.

1. Contractor to be Informed.
The Contractor shall inform itself of all existing and future Laws 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 of all orders and decrees of bodies or tribunals having any applicable jurisdiction or authority over the Work.

2. Compliance with all Laws.
The Contractor shall cause all persons employed in the performance of the Work to comply with all existing and future Laws, including but not limited to those set forth below:
A. Corporate Disclosures. The Contractor if a foreign corporation, shall comply with M.G.L. c. 30, sec. 39L.
B. Veterans Preference. In the employment of mechanics and apprentices, teamsters, chauffeurs, and laborers in the performance of Work in the Commonwealth, preference shall first be given to citizens of the Commonwealth who have been residents of the Commonwealth for at least six months at the commencement of their employment and who are veterans as defined M.G.L. c. 4, sec. 7(43), and who are qualified to perform the work to which the employment relates; and secondly, to citizens of the Commonwealth generally who have been residents of the Commonwealth for at least six months at the commencement of their employment, and if they cannot be obtained in sufficient numbers, then to citizens of the United States.

C. Prevailing Wages. The Contractor shall comply with M.G.L. c. 149, sections 26- 27H. The prevailing wage schedule is found in Exhibit A to the Instructions to Bidders, listing the prevailing minimum wage rates that must be paid to all workers employed in the Work. The DCR is not responsible for any errors, omissions, or misprints in said schedule. Such Schedule shall continue to be the minimum rate of wages payable to workers employed in the Work throughout the term of this Contract, subject to the exceptions provided in M.G.L c. 149, sections 26-27H. The Contractor shall not have any claim for extra compensation from the Department of Conservation and Recreation if the actual wages paid to workers employed in the Work exceeds the rates listed on the schedule or as otherwise provided by law. The Contractor shall cause a copy of said Schedule to be kept in a conspicuous place at the Site during the term of the Contract. If reserve police officers are employed by the Contractor, they shall be paid the prevailing wage of regular police officers. (See M.G.L c.149, sec. 34B).

D. Payroll Records and Statement of Compliance. The Contractor shall comply and shall cause its Subcontractors to comply with Massachusetts General Law c. 149, sec. 27B, which requires that a true and accurate record be kept of all persons employed on a project for which the prevailing wage rates have been provided. The Contractor and all Subcontractors shall keep these records and preserve them for a period of three years from the date of completion of the Contract. Such records shall be open to inspection by any authorized representative of the Department of Conservation and Recreation at any reasonable time, and as often as may be necessary. The Contractor shall, and shall cause its subcontractors to, submit weekly copies of their weekly payroll records to the DCR. In addition, the Contractor and each Subcontractor shall furnish to the Executive Department of Labor within fifteen days after completion of its portion of the Work a signed statement in the form required by the DCR.

E. Vehicle operators. If the Director of the Department of Labor and Workforce Development has established a Schedule of wage rates to be paid to the operators of trucks, vehicles or equipment for the Work, the Contractor shall be obligated to pay such operators at least the minimum wage rate contained on such Schedule. (See M.G.L. c.149, sections 26-27H).

F. Eight Hour Day. The Contractor shall comply with M.G.L. c. 149, sections 30 and 34, which provide that 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 part of the Work 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 extraordinary emergency.

G. Timely Payment of Wages. The Contractor shall comply with and shall cause its Subcontractors to comply with M.G.L. c. 149, sec. 148 which requires the weekly or biweekly payment of employees within six days of the end of the pay period during which wages were earned if employed for five or six days of a calendar week, and within other periods of time under certain circumstances as set forth therein.

H. Lodging, etc. The Contractor shall comply with, and shall cause its Subcontractors to comply with, M.G.L. c. 149, sec. 25 which provides that every employee under this Contract shall lodge, board, and trade where and with whom he elects, and neither the Contractor nor his agents or employees shall, either directly or indirectly, require as a condition of the employment of any person that the employee shall lodge, board, or trade at a particular place or with a particular person.

I. Truck Rates. The use by the Contractor of trucks or other motor vehicles hired from either common or contract motor carriers in the course of performance of this Contract is subject to such minimum rates and charges, and rules and regulations as may from time to time be promulgated by the Department of Public Utilities of the Commonwealth of Massachusetts or other agency of the State or Federal government which may be authorized by law to set rates or otherwise regulate the use of such vehicles. The Contractor expressly assumes the risk of any additional expense that may arise by reason of any change in such minimum rates and charges, and rules and regulations, and shall be entitled to no additional compensation or reimbursement by reason thereof.

J. Anti-Boycott Covenant (Executive Order #130). The Contractor warrants, represents and agrees that during the time this Contract is in effect, neither it nor any affiliated company, as hereafter defined, participates in or cooperates with an international boycott, as defined in Section 999(b) (3) and (4) of the Internal Revenue Code of 1954, as amended, or engages in conduct declared to be unlawful by M.G.L. c. 151E, sec. 2. If there shall be a breach in the warranty, representation or agreement contained in this paragraph, then without limiting such other rights as it may have the DCR shall be entitled to rescind this contract. As used herein, an affiliated company shall be any business entity of which at least 51% of the ownership interests are directly or indirectly owned by the Contractor or by a person or persons or business entity or entities directly or indirectly owning at least 51% of the ownership interests of the Contractor; or which directly or indirectly owns at least 51% of the ownership interests of the Contractor.

K. Contractor's Agreements with Suppliers--Anti-Boycott and Anti-Discrimination Provisions.

(1) The Contractor shall not purchase or rent any materials, equipment, machinery, vehicles or supplies for or in connection with the Work from any person or entity who does not sign, under pains and penalties of perjury, a certificate that recites: “the undersigned warrants, represents and agrees that during the time its agreement with (insert contractor’s name) is in effect for materials, supplies or equipment to be used in connection with the Department of Conservation and Recreation Contract No. (insert contract number), neither the undersigned or any affiliated company, as hereafter defined, participates in or cooperates with an international boycott, as defined in Section 999(b)(3) and (4) of the Internal Revenue Code of 1954, as amende3d, or engages in conduct declared to be unlawful by Section 2 of Chapter 151E of the Massachusetts General Laws. As used herein, an affiliated company shall be any business entity of which at least 51% of the ownership interests are directly or indirectly owned by the undersigned or by a person or persons or business entity or entities directly or indirectly owning at least 51% of the ownership interests of the undersigned; or which directly or indirectly owns at least 51% of the ownership interests of the undersigned.”

(2) The DCR shall not be obligated to pay the Contractor for the cost of any materials, supplies, or equipment purchased or rented from any individual or entity from whom the Contractor has not previously obtained and delivered to the DCR the certificate that the previous paragraph requires. The Contractor will immediately terminate its contract with any supplier who breaches the warranty, representation and agreement contained in the previous paragraph.

(3) The Contractor shall include in the Contractor's agreement with any person or entity from whom the Contractor intends to purchase or rent any materials, equipment, machinery, vehicles or supplies for or in connection with the Work, (a) a notice that this Contract obligates the Contractor to terminate the supply contract upon discovery of such breach of the sworn certificate delivered under subparagraph (1) and such termination shall be without liability to the Contractor or the DCR and (b) a provision which states: "The Governor or his designee, the secretary of administration and finance, and the state auditor or his designee shall have the right at reasonable times and upon reasonable notice to examine the books, records and other compilations of the undersigned vendor which pertain to the performance and requirements of this agreement to provide materials of any nature to the undersigned contractor in connection with DCR Contract No. (insert contract number)."

L. Access to Contractor's Records (Executive Order #195). The Governor or his/her designee, the secretary of administration and finance, and the state auditor or his/her designee shall have the right at reasonable times and upon reasonable notice to examine the books, records, and other compilations of data of the Contractor which pertain to the performance and requirements of this Contract.

ARTICLE XI: CONTRACTOR'S ACCOUNTING METHOD REQUIREMENTS (M.G.L. c. 30, sec. 39R)

1. Definitions.

The words defined herein shall have the meaning stated below whenever they appear in this Article XI:

--"Contractor" means any person, corporation, partnership, joint venture, sole proprietorship, or other entity awarded a Contract pursuant to M.G.L. c. 30, sec. 39M, and M.G.L. c. 149, sections 44A-H.

--"Contract" means any Contract awarded or executed pursuant to M.G.L. c. 30, sec. 39M, M.G.L. c. 149, sections 44A-H.

--"Independent Certified Public Account" means a person duly registered in good standing and entitled to practice as a certified public accountant under the laws of the place of his/her residence or principal office and who is in fact independent. In determining whether an accountant is independent with aspect to a particular person, appropriate consideration should be given to all relationships between the accountant and that person or any affiliate thereof. Determination of an accountant's independence shall not be confined to the relationships existing in connection with the filing of reports with the awarding authority.

--"Records" means books of original entry, accounts, checks, bank statements and all other banking documents, correspondence, memoranda, invoices, computer printouts, tapes, discs, papers and other documents or transcribed information of any type, whether expressed in ordinary or machine language.

--"Audit", when used regarding financial statements, means an examination of records by an independent certified public accountant in accordance with generally accepted accounting principles and auditing standards for the purpose of expressing a certified opinion thereon, or, in the alternative, a qualified opinion or a declination to express an opinion for stated reasons.

Accounting terms, unless otherwise defined herein, shall have a meaning in accordance with generally accepted accounting principles and auditing standards.

2. Record Keeping.

A. The Contractor shall make, and keep for at least six years after final payment, books, records, and accounts that in reasonable detail accurately and fairly reflect the transactions and dispositions of the Contractor.

B. Until the expiration of six years after final payment, the Inspector General and the DCR shall have the right to examine any books, documents, papers or records of the Contractor and Subcontractors that directly pertain to and involve transactions relating to the Contractor and Subcontractors.

C. The Contractor shall describe any change in the method of maintaining records or recording transactions which materially affects any statements filed with the DCR including the date of the change and reasons therefor and shall accompany said description with a letter from the Contractor's independent certified public accountant approving or otherwise commenting on the changes.

D. The Contractor represents that it has, prior to the execution of the Contract, filed a statement of management on internal accounting controls as set forth in Section 3 below.

E. The Contractor represents that it has, prior to the execution of the Contract, filed an audited financial statement for the most recent completed fiscal year as set forth in section 4 below and will continue to file such statement annually during the term of the Contract.

3. Statement of Management Controls.

A. The Contractor shall file with the DCR a statement of management as to whether the system of internal accounting controls of the Contractor and its subsidiaries reasonably assures that:

(1) transactions are executed in accordance with management's general and specific authorization.

(2) transactions are recorded as necessary: (a) to permit preparation of financial statements in conformity with generally accepted accounting principles, and (b) to maintain accountability for assets.

(3) access to assets is permitted only in accordance with management's general or specific authorization; and

(4) the recorded accountability for assets is compared with the existing assets at reasonable intervals and appropriate action was taken with respect to any difference.

B. The Contractor shall file with the DCR a statement prepared and signed by an independent certified public accountant, stating that the accountant has examined the statement of management on internal accounting controls, and expressing an opinion as to:

(1) whether the representations of management in response to subparagraph 3 above are consistent with the results of management's evaluation of the system of internal accounting controls; and

(2) whether such representations of management are reasonable with respect to transactions and assets in amounts which would be material when measured in relation to the applicant's financial statement.

4. Annual Financial Statement.

A. Every Contractor awarded a contract under M.G.L. c. 30, sec. 39M or M.G.L. c. 149, sections 44A-44H shall annually file with the Commissioner of the Division of Capital Asset Management and Maintenance during the term of the Contract a financial statement prepared by an independent certified public accountant based on an audit by such accountant. The final statement filed shall include the date of final payment. All statements shall be accompanied by an accountant's report. Such statements shall be made available to the DCR upon request.

B. The office of Inspector General and the DCR shall have the right to enforce the provisions of this Article. A Contractor's failure to satisfy any of the requirements of this section may be grounds for debarment pursuant to M.G.L. c. 149, sec. 44C.

5. Bid Pricing Materials.

The Contractor shall save the written calculations, pricing information, and other data that the Contractor used to calculate the bid that induced the DCR to enter this Contract (the "Bid Pricing Materials") for at least six years after the DCR makes final payment under this Contract.

ARTICLE XII: EQUAL EMPLOYMENT OPPORTUNITY, NON-DISCRIMINATION, AND AFFIRMATIVE ACTION PROGRAM.

This Contract includes the provisions of the DCR's "Equal Employment Opportunity, Non-Discrimination, and Affirmative Action Program," attached as Appendix A to these General Conditions of the Contract and incorporated herein by reference.

ARTICLE XIII: GOALS FOR PARTICIPATION BY MINORITY BUSINESS ENTERPRISES AND WOMEN BUSINESS ENTERPRISES

This Contract includes the provisions of the DCR's ”Goals for Participation by Minority Business Enterprises and Women Business Enterprises (Executive Order 390), attached as Appendix B to these General Conditions, and as set forth in Section 8 of the Instructions to Bidders, and incorporates same herein by reference**.**

ARTICLE XIV: INSURANCE REQUIREMENTS

The Contractor shall carry insurance, in the amounts and types specified in Section 7 of the Instructions for Bidders for this Contract and shall comply with all provisions relating to insurance set forth in said Section 7.

ARTICLE XV: INDEMNIFICATION

1. Generally.

To the fullest extent permitted by law, the Contractor shall indemnify, defend (with counsel subject to the supervision of the Attorney General of the Commonwealth of Massachusetts as required by M.G.L. c. 12, sec. 3) and hold harmless the Commonwealth of Massachusetts, its Department of Conservation and Recreation, and its officers, agents, divisions, employees, representatives, successors and assigns from and against all claims, damages, losses and expenses, including but not limited to court costs and attorneys’ fees, arising out of or resulting from the performance of the Work, including but not limited to those arising or resulting from:

-labor performed or furnished and/or materials used or employed in the performance of the Work.
-violations by the Contractor, any subcontractor, or by any person directly or indirectly employed or used by any of them in the performance of the Work or anyone for whose acts any of them may be liable (Contractor, subcontractor and all such persons herein collectively called "Contractor's Personnel") of any Laws.
-violations of any provision of this Contract by any of Contractor's Personnel.
-injuries to any persons or damage to any property in connection with the Work.
-any act, omission, or neglect of Contractor's Personnel.

The Contractor shall be obligated as provided above, regardless of whether such claims, damages, losses and/or expenses are caused in whole or in part by the actions or inactions of a party indemnified hereunder. In all claims by Contractor's Personnel against parties indemnified hereunder, the Contractor's indemnification obligation set forth above shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor or any subcontractor under workers' or workmen's compensation acts, disability benefit acts or other employee benefit acts. Such obligation shall not be construed to negate, abridge, or otherwise reduce any other right or obligation of indemnity which would otherwise exist as to any party or person described in this Article XV.

2. DCR's Actions.

The obligations of the Contractor under Section 1 above shall not extend to the liability of the DCR, its agents or employees, arising out of (i) the preparation or approval of maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications by the DCR, or (ii) the giving of or the failure to give directions or instructions by the DCR, its agents or employees provided such giving or failure to give is the primary cause of the injury or damage.

3. Survival.

The provisions of this Article XV are intended to survive Final Acceptance and/or any termination of this Contract.

ARTICLE XVI: PERFORMANCE AND PAYMENT BONDS

1. Contractor Bonds.

A. The Contractor shall provide performance and payment (labor and materials) bonds in the form provided by the DCR, executed by a surety licensed by the Commonwealth of Massachusetts Division of Insurance. Each such bond shall be in the amount of the Contract Price.

B. If at any time prior to final payment to the Contractor, the Surety:

-is adjudged bankrupt or has made a general assignment for the benefit of its creditors.

-has liquidated all assets and/or has made a general assignment for the benefit of its creditors.

-is placed in receivership.

-otherwise petitions a state or federal court for protection from its creditors; or

-allows its license to do business in Massachusetts to lapse or be revoked.

then the Contractor shall, within 21 days of any such action listed above, provide the DCR with new performance and payment bonds as described in Paragraph A above. Such bonds shall be provided solely at the Contractor's expense.

2. Subcontractor Bonds.

The Contractor is responsible for the costs of the payment and performance bonds of the sub-contractors for the full amount of their respective Subcontracts.

ARTICLE XVII: TERMINATION OF CONTRACT

1. Termination for Cause.

A. The DCR may without prejudice to any other right or remedy deem this Contract terminated for cause if any of the following defaults shall occur and not be cured within five days (5) days after the giving of notice thereof by the DCR to the Contractor and any surety that has given bonds in connection with this Contract:

(1) The Contractor has filed a petition, or a petition has been filed against the Contractor with its consent, under any federal or state law concerning bankruptcy, reorganization, insolvency or relief from creditors, or if such a petition is filed against the Contractor without its consent and is not dismissed within sixty (60) days; or if the Contractor is generally not paying its debts as they become due; or if the Contractor becomes insolvent; or if the Contractor consents to the appointment of a receiver, trustee, liquidate, custodian or the like of the Contractor or of all or any substantial portion of its assets and such appointment or possession is not terminated within sixty (60) days; or if the Contractor makes an assignment for the benefit of creditors;

(2) The Contractor refuses or fails, except in cases for which extension of time is provided under this Contract's express terms, to supply enough properly skilled workers or proper materials to perform its obligations under this Contract, or the DCR has determined that the rate of progress required for the timely completion of the Work is not being met.

(3) The Contractor fails to make prompt payment to Subcontractors or for materials, equipment, or labor.

(4) All or a part of the Work has been abandoned.

(5) The Contractor has sublet or assigned all or any portion of the Work, the Contract, or claims thereunder, without the prior written consent of the Department of Conservation and Recreation, except as expressly permitted in this Contract.

(6) The Contractor has failed to comply with Laws.

(7) The Contractor fails to maintain, or provide to the DCR evidence of the insurance or bonds required by this Contract, or

(8) The Contractor has failed to prosecute the Work or any portion thereof to the standards required under this Contract or has otherwise breached any material provision of this Contract.

B. The DCR shall give the Contractor, and any surety notice of such termination for cause, but the giving of notice of such termination shall not be a condition precedent or after the termination's effectiveness. In the event of such termination, and without limiting any other available remedies, the DCR may, at its option:

(1) hold the Contractor and its sureties liable in damages for a breach of Contract.

(2) notify the Contractor to discontinue all work, or any part thereof, and the Contractor shall discontinue all work, or any part thereof, as the Department of Conservation and Recreation may designate.

(3) complete the Work, or any part thereof, and charge the expense of completing the Work or part thereof, to the Contractor.

(4) require the surety or sureties to complete the Work and perform all the Contractor's obligations under this Contract.
If the DCR elects to complete all or any portion of the Work as specified in (3) above, it may take possession of all materials, equipment, tools, machinery, implements owned by the Contractor at or near the Site and finish the Work at the Contractor's expense by whatever means the DCR may deem expedient; and the Contractor shall cooperate at its expense in the orderly transfer of the same to a new contractor or to the DCR as directed by the DCR. In such case the DCR shall not make any further payments to the Contractor until the Work is finished. The Department of Conservation and Recreation shall not be liable for any depreciation, loss, or damage to said materials, machinery, implements or tools during said use and the Contractor shall be solely responsible for their removal from the Site after the Department of Conservation and Recreation has no further use for them. Unless so removed within fifteen days after notice to the Contractor to do so, they may be sold at public auction, after publication of notice thereof at least twice in any newspaper published in the county where the Work is being performed, and the proceeds credited to the Contractor's account; or they may, at the option of the DCR, be stored at the Contractor's expense subject to a lien for the storage charges.

C. Damages and expenses incurred under paragraph B above shall include, but not be limited to, costs for the DCR's extra services and Project representative services required, in the opinion of the DCR, to successfully inspect and administer the construction contract through final completion of the Work.

D. Expenses charged under paragraph B above may be deducted and paid by the DCR out of any moneys then due or to become due the Contractor under this Contract.

E. All sums, damages, and expenses incurred by the Department of Conservation and Recreation to complete the Work shall be charged to the Contractor. In case the damages and expenses charged are less than the sum that would have been payable under this Contract if the same had been completed by the Contractor, the Contractor shall be entitled to receive the difference. In case such expenses shall exceed the said sum, the Contractor shall pay the amount of the excess to the Department of Conservation and Recreation.

2. Termination For Convenience.

A. The DCR may terminate this Contract for convenience even though the Contractor is not in default by giving notice to the Contractor specifying in said notice the date of termination.

B. In case of such termination without cause, the Contractor shall be paid:
(1) all sums due and owing under this Contract through the date of termination, including any retainage withheld to the date of termination, less any amount which the DCR determines is necessary to correct or complete the Work performed to the date of termination; plus (2) a reasonable sum to cover the expenses which the Contractor would not have incurred but for the early termination of the Contract, such as demobilization of the work force, restocking charges, and termination fees payable to Subcontractors.

C. The payment provided in paragraph B above shall be considered to fully compensate the Contractor, and any consultants, Subcontractors, and suppliers, for all claims and expenses directly or indirectly attributable to the termination, including any claims for lost profits.

3. Contractor's Duties Upon Termination for Convenience.

Upon termination of this Contract for convenience as provided in Section 2 of this Article, the Contractor shall: (1) stop the Work; (2) stop placing orders and Subcontracts in connection with this Contract; (3) cancel all existing orders and Subcontracts; (4) surrender the Site to the DCR in a safe condition; (5) transfer to the DCR all materials, supplies, work in process, appliances, facilities, equipment and machinery of this Contract, and all plans, Drawings, Specifications and other information and documents used in connection with this Contract.

ARTICLE XVIII: MISCELLANEOUS PROVISIONS

1. No Assignment by Contractor.

The Contractor shall not assign by power of attorney or otherwise, or sublet or subcontract, the Work, or any part thereof, without the previous written consent of the DCR and shall not, either legally or equitably, assign any of the moneys payable under this Contract, or Contractor's claims hereunder, unless with the like consent of the DCR, whether said assignment is made before, at the time of, or after the execution of the Contract. The Contractor shall remain responsible for satisfactory performance of all Work sublet or assigned. Consent of the DCR shall not be deemed to constitute a representation or waiver of any right hereunder by the DCR as to the qualifications or the responsibility of the Contractor or Subcontractor(s).

2. Non-Appropriation.
The Commonwealth certifies that at the time of the execution of this Contract, sufficient appropriations exist and shall be encumbered to fund the Contract Price. Payments are subject to appropriation and shall be made only for work performed in accordance with the terms of this Contract. The Contractor shall not be obligated to perform, and shall not perform, work outside the scope of this Contract without an appropriate amendment to this Contract, and a sufficient appropriation(s) to support such additional work. The Commonwealth may immediately terminate or suspend this Contract if the appropriation(s) funding this Contract is eliminated or reduced to an amount which will be insufficient to support anticipated future obligations under this Contract. Such termination shall be deemed a termination for convenience subject to the provisions of paragraph 2 of Article XVII of this Contract.

3. Claims by Others Not Valid.
No person other than the Contractor and the surety on any bond given pursuant to the terms of this Contract shall acquire any interest in this Contract or any claim against the DCR hereunder, and no claim by any other person shall be valid except as provided in M.G.L. c. 30, sec. 39F of the General Laws.

4. No Personal Liability of Public Officials.
No public official, employee, or agent of the DCR shall have any personal liability for the obligations of the DCR set forth in this Contract.

5. Severability.
The provisions of this Contract are severable, and if any of these provisions shall be held unconstitutional or unenforceable by any court of competent jurisdiction, the decision of such court shall not affect or impair any of the other provisions of this Contract.

6. Choice of Laws.
This Contract shall be governed by the laws of the Commonwealth of Massachusetts for all purposes, without regard to its laws on choice of law. All proceedings under this Contract or related to the Project shall be brought in the courts of the Commonwealth of Massachusetts.

7. Standard Forms.
Unless directed otherwise in writing by the DCR, the Contractor shall use the standard forms in use by the Department of Conservation and Recreation.

8. No Waiver of Subsequent Breach.
No waiver of any breach or obligation of this Contract shall constitute a waiver of any other or subsequent breach or obligation.

9. Remedies Cumulative.
All remedies of the DCR provided in this Contract shall be construed as cumulative and may be exercised simultaneously or in any order as determined by the DCR in its sole discretion. The DCR shall also be entitled as of right to specific performance and equitable relief including the right to an injunction against any breach of any of the provisions of this Contract

10. Notices.
Notices to the Contractor shall be deemed given when hand delivered to the Contractor's temporary field office at or near the Site, or when deposited in the U.S. mail addressed to the Contractor at the Contractor's address specified in the Department of Conservation and Recreation - Contractor Agreement, or when delivered by courier to either location. Unless otherwise specified in writing by the DCR, notices and deliveries to the DCR shall be effective only when delivered to the DCR at the address specified in the Department of Conservation and Recreation - Contractor Agreement and date-stamped at the reception desk or for which a receipt has been signed by the agent or employee designated by the DCR to receive official notices.

APPENDIX A to General Conditions of the Contract

The following provisions from Article XII of the General Conditions of the Contract where DCR is the Awarding Authority.

EQUAL EMPLOYMENT OPPORTUNITY, NON-DISCRIMINATION, AND AFFIRMATIVE ACTION PROGRAM.

1. Compliance Generally.

For purpose of this Article, "minority" refers to Asians, Blacks, Western Hemisphere Hispanics, Native Americans, and Cape Verdeans; "Commission" refers to the Massachusetts Commission Against Discrimination. During the performance of this Contract, the Contractor and all its Subcontractors (hereinafter collectively referred to as the Contractor) shall comply with all applicable equal employment opportunity, non-discrimination and affirmative action requirements, including but not limited to the following:

2. Non-Discrimination and Affirmative Action.

A. The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religious creed, national origin, age, handicap, sexual orientation, or sex. The aforesaid provision shall include, but not be limited to, the following: employment rates of pay or other forms of compensation; conditions or privileges of employment; and selection for apprenticeship. The Contractor shall comply with the provisions of MGL, c. 151B and all other applicable anti-discrimination and equal opportunity laws.

B. The Contractor shall comply with the provisions of Executive Order No. 478 entitled Revoking and Superseding Executive Orders Numbers 253 and 452, with respect to affirmative action programs for handicapped individuals, which is herein incorporated by reference and made a part of this Contract.

C. In connection with the performance of the Work, the Contractor shall undertake in good faith affirmative action measures designed to eliminate any discriminatory religious creed, national origin, age, sexual orientation, or sex and to eliminate and remedy any effects of such discrimination in the past. Such affirmative action shall entail positive and aggressive measures to ensure equal opportunity in the areas of hiring, upgrading, demotion or transfer, recruitment, layoff or termination, rate of compensation, and in-service or apprenticeship training programs. This affirmative action shall include all action required to guarantee equal employment opportunity for all persons, regardless of race, color, religious creed, national origin, age, sexual orientation, or sex. A purpose of this provision is to fully ensure possible an adequate supply of skilled tradesmen for future public construction projects.

D. If the Contractor shall use any subcontractor on any work performed under this Contract, the Contractor shall take affirmative steps to negotiate with qualified minority and women subcontractors. These affirmative steps shall cover both pre-bid and post-bid periods. It shall include notification to the State Office of Minority and Women Business Assistance or its designee, while bids are in preparation, of all products, work, or services for which the Contractor intends to negotiate bids. In all solicitations either by competitive bidding or negotiation made by the Contractor either for work to be performed under a subcontract or for the procurement of materials or equipment, each potential subcontractor or supplier shall be notified in writing by the Contractor of the Contractor's obligations under this Contract relative to non-discrimination and affirmative action.

E. As part of its obligation of remedial action under this Article, the Contractor shall maintain on this project not less than the percent ratio set forth in the Owner – Contractor Agreement of minority employee worker hours to total worker hours in each job category including but not limited to bricklayers, carpenters, cement masons, electricians, ironworkers, operating engineers, and those "classes of work" enumerated in MGL, c. 149, Sec. 44F.

F. In the hiring of minority journeypersons, apprentices, trainees and advanced trainees, the Contractor shall rely on referrals from a multi-employer affirmative action program approved by the Commission, traditional referral methods utilized by the construction industry, and referrals from agencies, not more than three in number at any one time, designated by the Liaison Committee or the Awarding Authority.

3. <u>Liaison Committee, Reports and Records</u>.

A. At the option of the Awarding Authority, there may be established for the term of this Contract a body to be known as the Liaison Committee. The Liaison Committee shall be composed of one representative each from the Awarding Authority, the Commission and such other representatives as may be designated by the Commission in conjunction with the Awarding Authority. The Contractor (or his agent, if any, designated by him as the on-site equal employment opportunity officer) shall recognize the Liaison Committee as an affirmative action body, and shall establish a continuing working relationship with the Liaison Committee, consulting with the Liaison Committee on all matters related to minority recruitment, referral, employment and training.

B. The Contractor shall prepare projected staffing tables on a quarterly basis. These shall be broken down into projections, by week, of workers required in each trade. Copies shall be furnished one week in advance of the commencement of the period covered, and when updated, to the Awarding Authority and Liaison Committee. The Contractor shall prepare weekly reports in a form approved by the Awarding Authority of hours worked in each trade by each employee, identified as minority or non-minority. Copies of these shall be provided at the end of each such week to the Awarding Authority and to the Liaison Committee.

C. Records of employment referral orders, prepared by the Contractor, shall be made available to the Awarding Authority and to the Liaison Committee on request.

D. A designee of the Awarding Authority and a designee of the Liaison Committee shall each have right to access to the Site.

E. The Contractor shall comply with the provisions of MGL, c. 151B as amended, of the Massachusetts General Laws, both of which are herein incorporated by reference and made a part of this Contract.

F. The Contractor shall provide all information and reports required by the Awarding Authority or the Commission on forms and in accordance with instructions issued by either of them and will permit access to its facilities and any books, records, accounts, and other sources of information which may be determined by the Awarding Authority or the Commission to affect the employment of personnel. This provision shall apply only to information pertinent to the Owner's supplementary affirmative action Contract requirements. Where information required is in the exclusive possession of another who fails or refuses to furnish this information, the Contractor shall so certify to the Awarding Authority or the Commission as appropriate and shall set forth what efforts he has made to obtain the information.

4. <u>Sanctions</u>.

A. Whenever the Awarding Authority, the Commission, or the Liaison Committee believes the Contractor, or any Subcontractor may not be operating in compliance with the terms of this Article, the Commission shall directly, or through its designated agent, conduct an appropriate investigation, and may confer with the parties to determine if such Contractor is operating in compliance with the terms of this Article. If the Commission or its agent finds the Contractor or any Subcontractor not in compliance, it may make a preliminary report on non-compliance and notify such Contractor in writing of such steps as will in the judgment of the Commission or its agent bring such Contractor into compliance. If such Contractor fails or refuses to fully perform such steps, the Commission may make a final report of non-compliance and recommend to the Awarding Authority the imposition of one or more of the sanctions listed below. If, however, the Commission believes the Contractor or any Subcontractor has taken or is taking every possible measure to achieve compliance, it shall not make a final report of non-compliance. Within fourteen days of the receipt of the recommendations of the Commission, the Awarding Authority shall move to impose one or more of the following sanctions, as it may deem appropriate to attain full and effective enforcement:

(l) The recovery by the Awarding Authority from the Contractor of 1/100 of 1% of the Contract award price or $1,000 whichever sum is greater, in the nature of liquidated damages or, if a Subcontractor is in non-compliance, the recovery by the Awarding Authority from the Contractor, to be assessed by the Contractor as a back charge against the subcontractor, of 1/10 of 1% of the sub-contract price, or $400 whichever sum is greater, in the nature of liquidated damages, for each week that such party fails or refuses to comply.

(2) The suspension of any payment or part thereof due under the Contract until such time as the Contractor or any subcontractor can demonstrate his compliance with the terms of the Contract.
(3) The termination, or cancellation, of the Contract, in whole or in part, unless the Contractor or any Subcontractor can demonstrate within a specified times his compliance with the terms of the contract.
(4) The denial to the Contractor or any subcontractor of the right to participate in any future contracts awarded by the Awarding Authority for a period of up to three years.

B. If any time after the imposition of one or more of the above sanctions a Contractor can demonstrate that it follows this Article, the Contractor may request the Awarding Authority, in consultation with the Commission, to suspend the sanctions conditionally, pending a final determination by the Commission as to whether the Contractor complies. Upon final determination of the Commission, the Awarding Authority, based on the recommendation of the Commission, shall either lift the sanctions or reimpose them.

C. Sanctions recommended by the Commission and enumerated under Section 4 above shall not be imposed by the Awarding Authority except after an adjudicatory proceeding, as that term is used in MGL, c. 30A, has been conducted. No investigation by the Commission or its agent shall be initiated without prior notice to the Contractor.

D. Notwithstanding the provisions of 4A-4C above, if the Awarding Authority determines after investigation that the Contractor or any Subcontractor is not in compliance with the terms of this Article, it may suspend any payment or portion thereof due under the Contract until the contractor demonstrates to the satisfaction of the Awarding Authority compliance with the terms of this Article. This temporary suspension of payments by the Awarding Authority is separate from the sanctions set forth in Section 4A-4C of this Article above, which are determined by MCAD and recommend to the Awarding Authority. Payment may be suspended only after the Contractor and any other interested party shall have been given the opportunity to present evidence in support of its position at an informal hearing held by the Awarding Authority, and the Awarding Authority has concluded upon review of all the evidence that such penalty is justified. Payment shall not be suspended if the Awarding Authority finds that the Contractor made its best efforts to comply with this Article, or that some other justifiable reason exists for waiving the provisions of this Article in whole or in part.

APPENDIX B to General Conditions of the Contract

The following provisions from Article XIII of the General Conditions of the Contract where DCR is the Awarding Authority.

GOALS FOR PARTICIPATION BY MINORITY BUSINESS ENTERPRISES AND WOMEN BUSINESS ENTERPRISES (EXECUTIVE ORDER 390, MGL, c. 7, s. 40N)

1. Goals.

A. The goals for minority business enterprise and women business enterprise participation established for this Contracts are as set forth in the Owner – Contractor Agreement.

B. The Contractor and all Subcontractors, sub-subcontractors, and materials suppliers shall comply with all the terms and conditions of this Article, which include the provisions pertaining to M/WBE participation set forth in the Owner – Contractor Agreement to meet the M/WBE participation goals established for this Contract.

2. M/WBE Participation Credit.

A. If the Contractor is itself an MBE or WBE, M/WBE participation credit will be given in an amount equal to the entire Contract Price. If the Contractor is not an MBE or WBE then M/WBE participation credit will be given for the value of the Work that is performed by each MBE or WBE subcontractor or subcontractor.

B. If the Contractor is a joint venture with one or more M/WBE joint venturers, M/WBE participation credit shall be given to the joint venture as follows:

(1) If the joint venture is certified by SOMBWA as an MBE or WBE, M/WBE participation credit shall be given in an amount equal to the Contract Price.

(2) If the joint venture is not certified as an MBE or WBE by SOMWBA, M/WBE participation credit shall be given to the joint venture for the value of the Work that is performed by the M/WBE joint ventures(s), and for the value of the Work that is performed by each MBE or WBE subcontractor or sub-subcontractor.

C. MBE participation credit shall be given for the work performed by MBEs only, and WBE participation credit shall be given for the work performed by WBEs only. MBE participation may not be substituted for WBE participation, nor may WBE participation be substituted for MBE participation.

3. Establishing M/WBE Status.

A. A minority-owned business shall be considered an MBE only if it has been certified as a minority business enterprise by the State Office of Minority and Women Business Assistance ("SOMWBE").

B. A woman-owned business shall be considered a WBE only if it has been certified as a woman business enterprise by SOMWBA.

C. Certification as a disadvantaged business enterprise ("DBE"), certification as an M/WBE by any agency other than SOMWBA, or submission of an application to SOMWBA for certification as an M/WBE shall not confer M/WBE status on a firm for the purposes of this Contract.

4. Subcontracts with M/WBEs.

Within thirty (30) days after the award of this Contract, the Contractor shall (i) execute a subcontract with each M/WBE Subcontractor which has executed a Letter of Intent approved by the Awarding Authority, (ii) cause its Subcontractors to execute a sub-subcontract with each M/WBE sub-subcontractor, and (iii) furnish the Awarding Authority with a signed copy of each such subcontract and sub-subcontract.

5. <u>Performance of Contract Work by M/WBEs</u>.

A. The Contractor shall not perform with its own organization or subcontract or assign to any other firm work designated to be performed by any W/MBE in the Letters of Intent or Schedule of M/WBE Participation without the prior Approval of the Awarding Authority, nor shall any M/WBE assign or subcontract to any other firm or permit any other firm to perform any of its M/WBE Work without the prior Approval of the Awarding Authority. Any such unapproved assignment, subcontracting, sub-subcontracting, or performances of M/WBE Work by others shall be a change in the M/WBE Work for the purposes of this Contract. The Awarding Authority WILL NOT APPLY TO THE M/WBE PARTICIPATION GOALS(S) ANY SUMS ATTRIBUTABLE TO SUCH UNAPPROVED ASSIGNMENTS, SUB-CONTRACTS, SUB-SUBCONTRACTS, OR PERFORMANCE OF M/WBE WORK BY OTHERS.

B. The Contractor shall be responsible for monitoring the performance of M/WBE Work to ensure that each scheduled M/WBE performs its own M/WBE Work with its own workforce.

C. The Contractor and each M/WBE shall provide the Awarding Authority with all information and documentation that the Awarding Authority determines is necessary to ascertain whether an M/WBE has performed its own M/WBE Work. At the discretion of the Awarding Authority, failure to submit such documentation to the Awarding Authority shall establish conclusively for the purpose of giving M/WBE participation credit under this Contract that such M/WBE did not perform such work.

6. <u>Notification of Changes in M/WBE Work</u>.

A. If any time during the performance of the Contract the Contractor determines or has reason to believe that a scheduled M/WMBE is unable to unwilling to perform its M/WBE Work, or that there has been or will be a change in any M/WMBE Work, or that the Contractor will be unable to meet the M/WBE participation goal(s) for this Contract for any reason, the Co0ntractor shall immediately notify the Awarding Authority Contract Compliance Office in writing of such circumstances.

B. Any notice of a change in M/WBE Work pursuant to subparagraph "A: above shall include a revised Schedule of M/WBE Participation, and additional or amended Letters of Intent and subcontracts.

7. <u>Actions Required if there is a Reduction in M/WBE Participation</u>.

A. In the event there is a change or reduction in any M/WBE Work which will result in the Contractor failing to meet the M/WBE participation goal(s) for this Contract, other than a reduction in M/WBE Work resulting from a Change Order initiated by the Awarding Authority, then the Contractor shall immediately undertake a diligent, good faith effort to make up the shortfall in M/WBE participation as follows:

(1) The Contractor shall identify all items of the Work remaining to be performed under the Contract that may be made available for subcontracting to W/MBEs. The Contractor shall send a list of such items of work to the Awarding Authority, together with a list of the remaining items of the Work that was not made available to M/WBEs and the reason for not making such work available for subcontracting to M/WBEs.

(2) The Contractor shall send written notices soliciting proposals to perform the items of the Work that may be made available for subcontracting to W/MBEs to all W/MBEs qualified to perform such work. The Contractor shall advise the Awarding Authority of (i) each W/MBE solicited, and (ii) each W/MBE listed in the SOMWBA directory under the applicable trade category who was not solicited and the reasons, therefore. The Contractor shall also advise the Awarding Authority of the dates notices were mailed and provide a copy of the written notice(s) sent.

(3) The Contractor shall make reasonable efforts to follow up the written notices sent to M/WBEs with telephone calls or personal visits to determine with certainty whether the M/WBEs were interested in performing the work. Phone logs or other documentation must be submitted to the Awarding Authority evidencing this effort.

(4) The Contractor shall make reasonable efforts to assist M/WBEs that need assistance in obtaining insurance, bonds, or lines of credit to perform work under the Contract and shall provide the Awarding Authority with evidence that such efforts were made.

(5) The Contractor shall provide the Awarding Authority with a statement of the response received from each M/WBE solicited, including the reason for rejecting any M/WBE who submitted a proposal.
(6) The Contractor shall take any additional measures reasonably requested by the Awarding Authority to meet the M/WBE participation goal(s) established for this Contract, including, without limitation, placing advertisements in appropriate media and trade association publications announcing the Contractor's interest in obtaining proposals from M/WBEs, and/or sending written notification to M/WBE economic development assistance agencies, trade groups and other organizations notifying them of the project and of the work available to be subcontracted by the Contractor to M/WBEs.
B. If the Contractor is unable to meet the M/WBE participation goals for this Contract after complying fully with each of the requirements of paragraph "A" above, and the Contractor is otherwise in full compliance with the terms of this Article, the Awarding Authority may reduce the M/WBE participation goals for this Contract to the extent that such goals cannot be achieved.

8. Suspension of Payment and/or Performance for Noncompliance.

A. If at any time during the performance of this Contract, the Awarding Authority determines or has reason to believe that (1) there has been a change or reduction in any M/WBE Work which will result in the Contractor failing to meet the M/WBE participation goal(s) for this Contract, other than a reduction in M/WBE Work resulting from a change in the Contract work ordered by the Awarding Authority, and (2) the Contractor has failed to comply fully with all of the terms and conditions of paragraphs 1 through 7 above, the Awarding Authority may:
(1) suspend payment to the Contractor of an amount equal to the value of the work which was to have been performed by an M/WBE pursuant to the Contractor's Schedule of M/WBE Participation, but which was not so performed, to ensure that sufficient Contract funds will be available if liquidated damages are assessed pursuant to paragraph 9 and/or
(2) suspend the Contractor's performance of this Contract in whole or in part.

B. The Awarding Authority shall give the Contractor prompt written notice of any action taken pursuant to paragraph A above and shall give the Contractor and any other interested party, including any M/WBEs, an opportunity to present evidence to the Awarding Authority that the Contractor is in compliance with the requirements of this Article, or that there is some justifiable reason for waiving the requirements of this Article in whole, or in part. The Awarding Authority may invite SOMWBA and the Massachusetts Commission Against Discrimination to participate in any proceedings undertaken pursuant to this paragraph.

C. Upon a showing that the Contractor is in full compliance with the requirements of this Article, or that the Contractor has met or will meet the M/WBE participation goals for this Contract, the Awarding Authority shall release any funds withheld pursuant to clause A(1) above and lift any suspension of the Contractor's performance under clause A(2) above.

9. Liquidated Damages; Termination.

A. If payment by the Awarding Authority or performance by the Contractor is suspended by the Awarding Authority as provided in paragraph 8 above, the Awarding Authority shall have the following rights and remedies if the Contractor thereafter fails to take all action necessary to bring the Contractor into full compliance with the requirements of this Article, or if full compliance is no longer possible because the default of the Contractor is no longer susceptible to cure, if the Contractor fails to take such other action as may be required by the Awarding Authority to meet the M/WBE participation goals set forth in this Contract:
(1) the Awarding Authority may terminate this Contract, and/or
(2) the Awarding Authority may retain from final payment to the Contractor, as liquidated damages, an amount equal to the difference between (x) the total of the M/WBE participation goals set forth in this Contract, and (y) the amount of M/WBE participation credit earned by the Contractor for M/WBE Work performed under this Contract as determined by the Awarding Authority, the parties agreeing that the damages for failure to meet the M/WBE participation goals are difficult to determine and that the foregoing amount to be retained by the Awarding Authority represents the parties' best estimate of such damages. Any liquidated damages will be assessed separately for MBE and WBE participation.

B. Before exercising its rights and remedies hereunder, the Awarding Authority may, but the Awarding Authority shall not be obligated to, give the Contractor and any other interested party another opportunity to present evidence to the Awarding Authority that the Contractor is in compliance with the requirements of this Article or that there is some justifiable reason for waiving the requirements of this Article in whole or in part. The Awarding Authority may invite SOMWBA and the Massachusetts Commission Against Discrimination to participate in any proceedings undertaken hereunder.

10. Reporting Requirements.

The Contractor shall submit to the Awarding Authority al information or documentation that is necessary in the judgment of the Awarding Authority to ascertain whether the Contractor has complied with any of the provisions of this Article.

11. Awarding Authority's Right to Waive Provisions of this Article in Whole or in Part.

The Awarding Authority reserves the right to waive any provision or requirement of this Article if the Awarding Authority determines that such waiver is justified and in the public interest. No such waiver shall be effective unless in writing and signed by a representative of the Awarding Authority's Compliance Office or the office of its General Counsel. No other action or inaction by the Awarding Authority shall be construed as a waiver of ay provision of this Article.

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF CONSERVATON AND RECREATION

SPECIAL GOOD FAITH REQUIREMENTS FOR PARTICIPATION BY VETERAN OWNED BUSINESS ENTERPRISES

(Implementing Executive Order No. 546, Establishing the Veteran Owned Business Enterprise Program).

BIDDER'S INSTRUCTIONS

THE APPARENT LOW BIDDER'S COMPLIANCE WITH THE REQUIREMENTS OF THIS SECTION IS A PREREQUISITE FOR RECEIVING THE AWARD OF THE CONTRACT.

1) Participation Goals and Program Operation

In order to be an eligible VOBE for the participation goals of this Contract, the business enterprise must be listed as a veteran-owned business within the VetBiz database, located at www.VetBiz.gov, at the time of the bid submission deadline. Only a VOBE identified as a veteran-owned small business via the VetBiz database shall count towards meeting the Program participation goal.

The Contractor must demonstrate that VOBEs are eligible for the following participation goals via its listing as a veteran-owned small business within the VetBiz database, located at www.VetBiz.gov, at the time said VOBE seeks to participate in business provided under this Contract; provided, that it shall also be the responsibility of the Awarding Authority to verify the status of the SDVOBE via said VetBiz database prior to the awarding of the Contract.

a) Design Services Contracts – In furtherance of the goals and objectives of the program, commencing July 1, 2013 until such time as the Secretary for Administration and Finance has adopted a new participation goal, the participation goal, which shall be expressed in the form of a benchmark for each design services contract, shall be three (3) percent; provided, that said participation goal may be met by the veteran-owned business enterprise performing as either a general or prime contractor, a subcontractor, or both; provided further, that the awarding agency shall verify the status of business enterprise participation on a design services contract.

b) Public Construction Contracts – In furtherance of the goals and objectives of the Program, commencing July 1, 2013 until such time as the Secretary of Administration and Finance has adopted a new participation goal, the participation goal, which shall be expressed in the form of a benchmark for each public construction contract, shall be three (3) percent; provided, that said participation goal may be met by the veteran-owned business enterprise performing as either a general or prime contractor, a subcontractor, or both; provided further, that the awarding agency shall verify the status of a service veteran-owned business enterprise prior to said business enterprise participation on a public construction contract.

2) Goal Reduction/Waiver

A) The Awarding Authority reserves the right to reduce or waive the SDVOBE participation goals established for this Contract upon written request made by a Bidder using the VOBE Waiver Request Form provided by the Awarding Authority.

B) If filed Sub-Bids are solicited for this Contract, requests from prospective general Bidders to reduce or waive the VOBE participation goals for this Contract should be received by the Awarding Authority no later than four (4) working days after the list of filed Sub- Bidders is mailed by the Awarding Authority to persons who have taken out plans for the Contract, using the VOBE Waiver Request Form provided by the Awarding Authority.

C) If there are no filed sub-Bids solicited for this Contract, requests to reduce or waive the SDVOBE participation goals for this Contract should be received by the Awarding Authority no later than five (5) working days before the date set for the receipt of general Bids. **THE AWARDING AUTHORITY RESERVES THE RIGHT TO REJECT ANY REQUEST TO REDUCE OR WAIVE THE VOBE PARTICIPATION GOALS FOR THIS CONTRACT THAT IS RECEIVED AFTER THESE DEADLINES.** Such written request must demonstrate to the satisfaction of the Awarding Authority that it is not feasible for a non- VOBE or non- VOBE general Bidder to meet the goals established for this Contract based upon any or all the following:

a) actual VOBE availability.

b) the geographic location of the project to the extent related to SDVOBE availability.

c) the scope of the work.

d) the percentage of work available for subcontracting to VOBEs; and/or

e) other relevant factors, including a **documented** inability by the prospective Bidder to obtain commitments from VOBE subcontractors sufficient to meet the VOBE goals after having made a diligent, good faith effort to do so. All the foregoing documentation shall accompany the completed Waiver Request Form. Such documentation shall include, at a minimum, the following:

- A list of all items of work under the Contract that the Bidder made available for subcontracting to VOBEs. The Bidder shall identify all items of work, other than work to be performed by filed sub-Bidders, that the Bidder did not make so available and shall state the reasons for not making such work available for subcontracting to VOBEs. The Bidder shall also demonstrate that, where commercially reasonable, subcontracts were divided into units capable of being performed by VOBEs.

- Evidence that the Bidder sent written notices soliciting Bids or proposals to perform the items of work made available by the Bidder for subcontracting to all available VOBEs qualified to perform such work. The Bidder shall identify each VOBE solicited, state the dates that notices were mailed, provide a copy of the written notice(s) sent, and provide a copy of any statement or response received from each VOBE solicited, including the reason for rejecting and VOBE who submitted a bid or proposal.

- Evidence that the Bidder made reasonable efforts to follow up on the written notices sent to VOBEs with telephone calls or personal visits to determine with certainty whether the VOBEs were interested in performing the work. Phone logs or other documentation must be submitted.

- Evidence of efforts made to assist VOBE's that needed assistance in obtaining bonding or insurance, or lines of credit with suppliers if the inability of SDVOBE to obtain bonding, insurance, or lines of credit is the reason given for the Bidder's inability to meet the VOBE goals.

D) The Bidder may also submit any other information supporting its request for a waiver or reduction in the VOBE participation goals, including without limitation evidence that the Bidder placed advertisements in appropriate media and trade association publications announcing the Bidder's interest in obtaining bids or proposals from VOBEs, and/or sent written notification to VOBE economic development assistance agencies, trade groups and other organizations notifying them of the Contract and the work to be subcontracted by the Bidder to VOBEs. The Bidder shall also submit any other information reasonably requested by the Awarding Authority to show that the Bidder has taken all actions that could reasonably be expected to achieve the VOBE participation goals.

3) No later than five (5) working days after the opening of general Bids, the apparent low Bidder shall submit the following documents to the Awarding Authority's Contract Officer:

(i) a completed Schedule for Participation by VOBEs ("Schedule for Participation") in the form provided by the Awarding Authority showing VOBE participation in amounts equal to or exceeding the VOBE participation goals for this Contract; and

(ii) a completed Letter of Intent in the form provided by the Awarding Authority for each SDVOBE listed in the Schedule for Participation.

4) Each Letter of Intent shall identify and describe the work to be performed by the named VOBE (the "VOBE Work") with enough specificity to permit the Awarding Authority to identify the items of contract work that the VOBE will perform for VOBE participation credit. The Awarding Authority reserves the right to reject any Letter of Intent if the price to be paid for the VOBE Work does not bear a reasonable relationship to the value of such work under the Contract as determined by the Awarding Authority.

5) Within five (5) working days after receipt of the Schedule for VOBE Participation and Letters of Intent, the Awarding Authority shall review and either approve or disapprove the apparent low Bidder's submissions. If the apparent low Bidder has not submitted an appropriate Schedule for VOBE Participation and appropriate Letters of Intent establishing that the VOBE participation goal for the project will be met, the apparent low Bidder will be considered ineligible for Award of the Contract and the Awarding Authority will Award the Contract to the second lowest Bidder, subject to said Bidder's compliance with these conditions.

6) The Contractor is required to submit to the Awarding Authority signed subcontracts with all subcontractors prior to the commencement of work to be performed under these contracts, and/or a purchase order or invoice from each material supplier and/or manufacturer listed on the Schedule for VOBE Participation within thirty (30) days of the issuance of the Notice to Proceed by the Awarding Authority.

7) A filed Sub-Bidder is not required to submit a Schedule for VOBE Participation with its Bid. A filed Sub-Bidder may, at its option, submit a Letter of Intent with its Bid if it is a VOBE. If a filed sub-Bidder intends to sub-subcontract work to a VOBE, and the filed sub-Bidder wishes that sub-subcontract to be credited toward the participation goals for this Contract, the filed sub-Bidder should submit a Letter of Intent from that VOBE with its Bid. A filed sub-Bidder can subcontract out up to 20% of its work to VOBEs, unless such work is designated as sub-subcontract Paragraph E work in the Bid Documents, in which case the 20% cap does not apply.

This is a:

D **Design Contract**
D **Construction contract**

The goal for this contract is Three (3 %) percent of the value of the contract unless waived in part or whole by DCR in writing.

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF CONSERVATON AND RECREATION

SPECIAL GOOD FAITH REQUIREMENTS FOR PARTICIPATION BY VETERAN OWNED BUSINESS ENTERPRISES
(Implementing Executive Order No. 638, Promoting the Equitable Participation of Women and Underrepresented Groups in Construction

BIDDER'S INSTRUCTIONS

THE APPARENT LOW BIDDER'S COMPLIANCE WITH THE REQUIREMENTS OF THIS SECTION IS A PREREQUISITE FOR RECEIVING THE AWARD OF THE CONTRACT.

Pursuant to Executive Order No. 638: Promoting the Equitable Participation of Women and Underrepresented Groups in Construction ("EO No. 638"), bidders shall include in their bid submission a Plan of the how they plan to:

1. encourage the use of registered apprentices for the performance of the Work.
2. develop strong workforce equity practices.
3. partner with worker-serving organizations with a track record of reaching women and underrepresented groups; and
4. provide support services, including childcare, to facilitate the participation of women and underrepresented groups on the Work to be performed under the contract.

In addition, bidders are hereby notified that the contract shall include, and it shall be a requirement that any subcontract shall include, the following data collection and reporting obligations, at appropriate intervals, required by EO No. 638:

1. workforce needs, which may include the expected number of jobs, job hours, and job hours by occupation.
2. workforce demographics, consistent with but not limited to the requirements of M.G.L. c. 7C, §6 and M.G.L. c. 149, §44A, which may include race, gender, zip code, and other workforce characteristics.
3. benefits and supportive services provided to workers.
4. Hours worked by all employees, including women and people of color, by trade and position; and
5. Apprenticeship participation and pre-apprenticeship program completion statistics.

The Contractor shall submit to the Awarding Authority all information or documentation that is necessary in the judgment of the Awarding Authority to ascertain whether the Contractor has complied with any of the provisions of this Article.

APPENDIX C to the General Conditions of the Contract

INDEX OF THE COMMONLY USED FORMS

(Forms used during bidding are in Attachment B to the Instructions to Bidders)

Contractor's Weekly Workforce Report
Minorities/Women in Contractor's Weekly Workforce Report
Weekly Payroll Report Form and Statement of Compliance
Certification of Payment by Contractor to MBE/WBE and Instructions
Certificate of Completion by Minority/Women Business Enterprise
Certificate of Final Inspection, Release and Acceptance – E-2

CONTRACTOR'S WEEKLY WORKFORCE REPORT
THE COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF CONSERVATION AND RECREATION

DCR Project No._____Project Name _____ Project Location _____

Name of General Contractor_____Minority Goal %_____Women Goal %

Name of Contractor Filing Report_____Address _____

Week Ending_____Report No._____Date Work Began_____Date work completed _____

NOTE: **Min. = Minority** **Wom. = Women** ☐ Check here if this is a final report

Job Category	Number of Employees	Number of Employees Who Are		Total Weekly Workforce Hours	Total Weekly Workforce Hours		Weekly % Workforce Hours		Total Workforce Hours To Date	Total Workforce Hours to Date		% Of Workforce Hours to Date	
		Min.	Wom.		Min.	Wom.	Min.	Wom.		Min.	Wom.	Min.	Wom.
TOTALS:													

Mail with Weekly Payroll report to the assigned Project Manager at:

Department of Conservation & Recreation
Project Manager Name
10 Park Plaza
Boston, MA 02116

The undersigned hereby certifies under pains and penalties of perjury that the above information is true and accurate.

Authorized Signature_____Date_____

Print Name _____ Title_____

Telephone No._____FAX No._____

MINORITIES/WOMEN IN CONTRACTOR'S WEEKLY WORKFORCE REPORT
THE COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF CONSERVATION AND RECREATION

DCR Project No._____ Project Name _____

Name of General Contractor _____

Project Location _____

Name of Contractor Filing Report _____

Address _____

Week Ending _____ Report No. _____

JOB CATEGORY	NAME OF EMPLOYEE	MINORITY GROUP	GENDER

In contract Article XII, "Minority" refers to: Asian-Americans, Blacks, Western Hemisphere Hispanics, Native Americans, and Cape Verdeans

WEEKLY PAYROLL REPORT FORM
THE COMMONWEALTH OF MASSSCHUSETTS
DEPARTMENT OF CONSERVATION AND RECREATION

DCR Project No._____ Project Name_____

Project Location _____

Name of General Contractor_____

Name of Contractor Filing Report_____

Address_____

Week Ending_____ Date Work Began_____ Date work completed_____

Report No._____ ☐ Check here if this is a final report

Employee Name & Address	Work Classification	Hours Worked							(A) Total Hours	(B) Hourly Base Wage	Employer Contributions			(F) [B+C+D+E] Hourly Total Wage (prev.	(G) [A*F] Weekly Total Amount
		S	M	T	W	T	F	S			(C) Health & Welfare	(D) Pension	(E) Supp. unemployed		

NOTE: Every contractor and subcontractor are required to submit a copy of their weekly payroll records to DCR.
The undersigned states under the pains & penalties of perjury that the above provided and attached information is a true and accurate record of each person employed on the project and the hours worked and wages paid to each such employee, including payments to the referenced benefits. M.G.L. c. 149 §27B.

Authorized signature _____ Print Name_____

Print Title_____

Mail to: Department of Conservation and Recreation
Project Manager Name
10 Park Plaza
Suite 6620
Boston, MA 02116

WEEKLY PAYROLL RECORDS REPORT
& STATEMENT OF COMPLIANCE

In accordance with Massachusetts General Law c. 149, §27B, a true and accurate record must be kept of all persons employed on the public works construction project for which the enclosed rates have been provided. The ***Weekly Payroll Report Form*** includes all the information required to be kept by law. Every contractor or subcontractor is required to keep these records and preserve them for a period of three years from the date of completion of the project.

In addition, every contractor and subcontractor are required to submit a copy of their weekly payroll records to the awarding authority. This is required to be done on a weekly basis. Once collected, the awarding authority is also required to preserve those records for three years.

In addition, each such contractor, subcontractor, or public body shall furnish **to the Executive Office of Labor**, within fifteen days after completion of its portion of the work, a statement, executed by the contractor, subcontractor or public body who supervises the payment of wages, in the following form:

STATEMENT OF COMPLIANCE

Date:_____/_____/_____

I,_____, _____
(Name of signatory party) (Title)

do hereby state:

That I pay or supervise the payment of the persons employed by

_____on the _____
(Contractor, subcontractor, or public body) (Building or project)

and that all mechanics and apprentices, teamsters, chauffeurs, and laborers employed on said project have been paid in accordance with wages determined under the provisions of sections twenty-six and twenty-seven of chapter one hundred and forty-nine of the General Laws.

Signature _____

Title _____

CERTIFICATE OF PAYMENT

BY CONTRACTOR/DESIGNER TO MINORITY, WOMEN BUSINESS
& VETERAN OWNED BUSINESS ENTERPRISES

TO: Supplier Diversity Reports
Department of Conservation and
Recreation ,10 Park Plaza
Suite 6620,Boston,MA 02116

Reporting Period: Fiscal Year 20__

RE: Project:
Project Number:

Contract Start Date:

The undersigned hereby certifies under the pains and penalties of perjury that the vendor named below has made the following payments to the named Minority, Women Business and Veteran Owned Enterprises for work performed on the above project:

Firm Name of General Contractor:

Authorized Signature | Date

Print Name | Print Title

Phone Number | Email address

Work performed/payments made (use additional pages if needed):

	Firm Name	**Work Performed**	**Subcontract Amount**	**Payments This Quarter**	**FY Payments to date** (This fiscal year)	**Cumulative Payments** (Total payments over the life of the contract)
☐ MBE ☐ WBE ☐ VOBE			$	$	$	$
☐ MBE ☐ WBE ☐ VOBE			$	$	$	$
☐ MBE ☐ WBE ☐ VOBE			$	$	$	$
☐ MBE ☐ WBE ☐ VOBE			$	$	$	$
☐ MBE ☐ WBE ☐ VOBE			$	$	$	$
☐ MBE ☐ WBE ☐ VOBE			$	$	$	$
☐ MBE ☐ WBE ☐ VOBE			$	$	$	$

* MBE, WBE and VOBE payment reports are required for each quarter of the fiscal year for each of your DCR projects. Reports are to cover the following three-month periods: 1st quarter, July 1st – September 30th; 2nd quarter, October 1st – December 31st; 3rd quarter, January 1st – March 31st; 4th quarter, April 1st – June 30th. Reports must be submitted within 10 business days of your receipt of this form.

NOTICE: *Intentionally submitting false information in this document may subject the contractor/ designer to criminal prosecution and/ or debarment from public contracting.*

INSTRUCTIONS FOR COMPLETING CERTIFICATE OF PAYMENT

As part of its effort to ensure reliable, up-to-date information concerning the actual payments made to certified MBE, WBE and VOBE subcontractors on all DCR projects, we have prepared these instructions to assist you in completing the enclosed form. PLEASE READ THESE INSTRUCTIONS CAREFULLY. DCR WILL RETURN ANY CERTIFICATION OF PAYMENT THAT IS INCOMPLETE OR INACCURATE.

PLEASE NOTE: IF THIS PROJECT IS COMPLETE, ON HOLD, OR YOUR FIRM PREVIOUSLY SUBMITTED A **FINAL** CERTIFICATION OF M/WBE/VOBE PAYMENT FOR THIS PROJECT, PLEASE SO, INDICATE ON THE FORM AND RETURN IT TO: SUPPLIER DIVERSITY REPORTS, DEPARTMENT OF CONSERVATION AND RECREATION, 10 Park Plaza,Suite 6620
Boston, MA 02116

PLEASE INCLUDE THE FOLLOWING INFORMATION IN THE DESIGNATED SECTIONS OF THE FORM:

FIRM NAME: Include the M/WBE/VOBEs listed on the project's approved Schedule for Participation and any additional M/WBE/VOBEs that worked on the project. Be sure to check M/WBE/VOBE category for which they are certified. Note that any change in M/WBE/VOBEs participation used to meet the project goals must be pre-approved by the Project Manager or Engineer responsible for this project and a revised M/WBE/VOBE Schedule of Participation will be required. Contact the DCR Supplier Diversity coordinator immediately if you anticipate or have any changes in M/WBE/VOBE participation on this project.

WORK PERFORMED: Include a brief description of the work performed by each subcontractor listed. The description should match the M/WBE/VOBE Letter of Intent and approved Schedule of Participation. M/WBE/VOBEs must be certified in the category of work performed on this project for firms used to meet the project M/WBE/VOBE goals.

SUBCONTRACT AMOUNT: Include the contract or subcontract amounts listed on the M/WBE/VOBE Letters of Intent and approved Schedule of Participation. If the value of an MBE/WBE/VOBE contract or subcontract has
decreased or increased for any reason, you must contact the Project Manager or Engineer responsible for this project immediately. If additional M/WBE/VOBE firms not listed on the Schedule for Participation worked on this project list the amount of their subcontracts.

PAYMENTS THIS QUARTER: Include the amount you paid the M/WBE/VOBE subcontractor, either directly or indirectly, for work performed on this project during the three-month period covered by this Certification of Payment. If the amount paid was zero, please indicate that. Do not include payments from previous periods or estimated future payments in this column. Please note that you may be required to submit copies of cancelled checks to verify the amounts reported for firms used to meet the project's M/WBE/VOBE goals.

FY PAYMENTS TO DATE: Include the total amount you paid the M/WBE/VOBE subcontractor, either directly or indirectly, for work performed on this project for all quarters in **this fiscal year**. To ensure accurate reporting, please review the prior Certifications of Payments previously submitted for this project. Where necessary, correct any earlier mathematical or reporting errors and submit revised Certifications of Payment.

CUMULATIVE PAYMENTS: Include the total amount you paid the M/WBE/VOBE subcontractor, either directly or indirectly, for work performed over the entire life of this project (all quarters).

IF YOU HAVE ANY QUESTIONS, CONTACT DCR Supplier Diversity coordinator at 617.626.4925

CERTIFICATE OF COMPLETION

BY MINORITY/WOMEN BUSINESS/VETERAN OWNED BUSINESS ENTERPRISE
DEPARTMENT OF CONSERVATION AND RECREATION

TO: Supplier Diversity Reports
Department of Conservation and
Recreation 10 Park Plaza
Suite 6620, Boston, MA 02116

Reporting Period: Fiscal Year

RE: Project:
Project Number:
General Contractor:

Contract Start Date:

The undersigned hereby certifies under the pains and penalties of perjury that the vendor named below has received the payments to the named Minority, Women Business and Veteran Owned Enterprises for work performed on the above project:

Firm Name of Subcontractor:

Print Name | Print Title

Phone Number | Email address

DESCRIPTION OF WORK (AS SHOWN IN LETTER OF INTENT)

BRIEF DESCRIPTION OF ACTIVITY: (Note "Labor Only," "Material Only," "Material and Labor," "Complete")

_____

_____

_____

Original Subcontract Amount $ _____

Adjusted Subcontract Amount (Change Orders, etc.) $ _____

Total Payments Received to Date from Prime Contractor $ _____

Balance Due from Prime Contractor $ _____

If the completed activity is different from that listed on the Letter of Intent, please explain: _____

(If more space is needed, continue back of sheet)

The individuals signing below hereby certify under the pains and penalties of perjury that all work listed on the Contract Letter of Intent (or approved changes thereto as explained above) was completed by the MBE/WBE/VOBE firm on _____, 20_____and the above amounts listed for these services are true and accurate.

FOR CONTRACTOR

_____
Authorized Signature

_____
Print Name

FOR MBE/WBE/VOBE FIRM

_____
Authorized Signature

_____
Print Name

NOTE: To be submitted to the DCR Compliance Office within ten (10) days after completion of work by MBE/WBE/VOBE.

E-2 Final Acceptance
Certificate of Final Inspection, Release and Acceptance

Title: _____

Location: _____

Contractor: _____

This is to certify that a complete inspection of the above-referenced project was made on _____ by the undersigned, and that the entire work was completed in accordance with the plans and specifications. The undersigned recommends acceptance of the project.

_____ by: _____ Title: _____ Date:
_____ Designer Authorized
Signature

_____ _____
Resident Engineer Date Project Manager Date

_____
Project Engineer Date

CERTIFICATE OF RELEASE

1.) The undersigned hereby certifies that all work has been completed in accordance with the plans, specifications, and contract documents and that all change orders have been supported pursuant to Article VII of the General Conditions of the Contract.

2.) Contract Award Price: $ Adjusted Contract Price: $
Authorized Additions: $ Paid to Date:$
Authorized Deductions:$ Balance Due: $

3.) The undersigned further certifies that in addition to the amount set forth above, there are outstanding and unsettled the following change orders as submitted to the DCR.

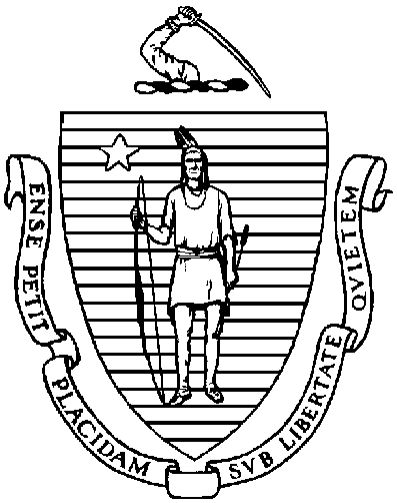
Request No.	Date:	Amount:
Request No.	Date:	Amount:
Request No.	Date:	Amount:

Subject to satisfactory disposition of change orders listed in Item 3 above, the undersigned releases the Commonwealth of Massachusetts from all further claims for wages or payments to subcontractors or suppliers except: (list on attached sheet).

_____ by: _____
Contractor Authorized Signature

The above-referenced project is accepted as of _____
Date

Deputy Commissioner, Engineering
Deputy Director
Project Manager
Resident Engineer
Office of Contract Administration
Contractor



BID PACKAGE

PART IV

SPECIAL CONDITIONS OF THE CONTRACT

PART IV

TABLE OF CONTENTS

Cambridge Conservation Commission Order of Conditions ……. 15 pages

Minor Project Modification 24-WWAR-0082-APP ……16 pages

Chapter 91 Waterways License No. WW01-0000526 …….. 20 pages

MWRA 8(m) Permit #24-07-2264M Terms and Conditions ……. 4 pages

Permanent Solution with Conditions (RTN 3-27723) …… 134 pages

Cambridge Conservation Commission

Order of Conditions

CAMBRIDGE DEPARTMENT OF PUBLIC THE WORKS

City of Cambridge
Conservation Commission

147 Hampshire Street
Cambridge, MA 02139
theworks@cambridgema.gov
P: 617 349 4680
F: 617 349 4868

Jennifer Letourneau, Conservation Commission Director

July 19, 2024

Dan Driscoll
Massachusetts Department of Conservation and Recreation
10 Park Plaza, Suite 6620
Boston, MA 02116

Re: Conservation Commission Paperwork
Order of Conditions #123-324

Mr. Driscoll:

The attached paperwork must be recorded at the Registry of Deeds and the Recording Information must be returned to my office. Please let me know if you have any questions.

Sincerely,

Jennifer Letourneau, Director
Conservation Commission

Cc: File
DEP-Northeast Region

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 5 – Order of Conditions

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP: 123-0324
MassDEP File #

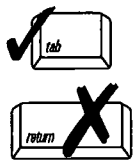
eDEP Transaction #

Cambridge
City/Town

A. General Information

Please note: this form has been modified with added space to accommodate the Registry of Deeds Requirements

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



1. From: Cambridge
Conservation Commission

2. This issuance is for (check one): a. ☒ Order of Conditions b. ☐ Amended Order of Conditions

3. To: Applicant:

Dan (a. First Name) | Driscoll (b. Last Name)
MA DCR (c. Organization)
10 Park Plaza, Suite 6620 (d. Mailing Address)
Boston (e. City/Town) | MA (f. State) | 02116 (g. Zip Code)

4. Property Owner (if different from applicant):

Priscilla (a. First Name) | Geigis (b. Last Name)
MA DCR (c. Organization)
10 Park Plaza (d. Mailing Address)
Boston (e. City/Town) | MA (f. State) | 02116 (g. Zip Code)

5. Project Location:

Memorial Drive (Eliot Bridge to JFK St) (a. Street Address) | Cambridge (b. City/Town)
274 (c. Assessors Map/Plat Number) | 1 (d. Parcel/Lot Number)

Latitude and Longitude, if known: 42d37m43s (d. Latitude) | -70d13m06s (e. Longitude)

A. General Information (cont.)

6. Property recorded at the Registry of Deeds for (attach additional information if more than one parcel):

Middlesex
a. County

b. Certificate Number (if registered land)

4412
c. Book

169
d. Page

7. Dates: 2/20/2024 a. Date Notice of Intent Filed; 6/17/2024 b. Date Public Hearing Closed; 7/19/2024 c. Date of Issuance

8. Final Approved Plans and Other Documents (attach additional plan or document references as needed):

Complete NOI with Plans
a. Plan Title

b. Prepared By

c. Signed and Stamped by

d. Final Revision Date

e. Scale

f. Additional Plan or Document Title

g. Date

B. Findings

1. Findings pursuant to the Massachusetts Wetlands Protection Act:

Following the review of the above-referenced Notice of Intent and based on the information provided in this application and presented at the public hearing, this Commission finds that the areas in which work is proposed is significant to the following interests of the Wetlands Protection Act (the Act). Check all that apply:

a. ☐ Public Water Supply
b. ☐ Land Containing Shellfish
c. ☒ Prevention of Pollution
d. ☐ Private Water Supply
e. ☐ Fisheries
f. ☒ Protection of Wildlife Habitat
g. ☒ Groundwater Supply
h. ☒ Storm Damage Prevention
i. ☒ Flood Control

2. This Commission hereby finds the project, as proposed, is: (check one of the following boxes)

Approved subject to:

a. ☒ the following conditions which are necessary in accordance with the performance standards set forth in the wetlands regulations. This Commission orders that all work shall be performed in accordance with the Notice of Intent referenced above, the following General Conditions, and any other special conditions attached to this Order. To the extent that the following conditions modify or differ from the plans, specifications, or other proposals submitted with the Notice of Intent, these conditions shall control.

B. Findings (cont.)

Denied because:

b. ☐ the proposed work cannot be conditioned to meet the performance standards set forth in the wetland regulations. Therefore, work on this project may not go forward unless and until a new Notice of Intent is submitted which provides measures which are adequate to protect the interests of the Act, and a final Order of Conditions is issued. **A description of the performance standards which the proposed work cannot meet is attached to this Order.**

c. ☐ the information submitted by the applicant is not sufficient to describe the site, the work, or the effect of the work on the interests identified in the Wetlands Protection Act. Therefore, work on this project may not go forward unless and until a revised Notice of Intent is submitted which provides sufficient information and includes measures which are adequate to protect the Act's interests, and a final Order of Conditions is issued. **A description of the specific information which is lacking and why it is necessary is attached to this Order as per 310 CMR 10.05(6)(c).**

3. ☐ Buffer Zone Impacts: Shortest distance between limit of project disturbance and the wetland resource area specified in 310 CMR 10.02(1)(a) _____ a. linear feet

Inland Resource Area Impacts: Check all that apply below. (For Approvals Only)

Resource Area	Proposed Alteration	Permitted Alteration	Proposed Replacement	Permitted Replacement
4. ☒ Bank	60 a. linear feet	60 b. linear feet	60 c. linear feet	60 d. linear feet
5. ☐ Bordering Vegetated Wetland	_____ a. square feet	_____ b. square feet	_____ c. square feet	_____ d. square feet
6. ☐ Land Under Waterbodies and Waterways	_____ a. square feet	_____ b. square feet	_____ c. square feet	_____ d. square feet
	_____ e. c/y dredged	_____ f. c/y dredged		
7. ☒ Bordering Land Subject to Flooding	630 a. square feet	630 b. square feet	550 c. square feet	550 d. square feet
Cubic Feet Flood Storage	7.8 e. cubic feet	7.8 f. cubic feet	59.89 g. cubic feet	59.89 h. cubic feet
8. ☐ Isolated Land Subject to Flooding	_____ a. square feet	_____ b. square feet		
Cubic Feet Flood Storage	_____ c. cubic feet	_____ d. cubic feet	_____ e. cubic feet	_____ f. cubic feet
9. ☒ Riverfront Area	108,250 a. total sq. feet	108,250 b. total sq. feet		
Sq ft within 100 ft	21,300 c. square feet	21,300 d. square feet	5,850 e. square feet	5,850 f. square feet
Sq ft between 100-200 ft	0 g. square feet	0 h. square feet	0 i. square feet	0 j. square feet

B. Findings (cont.)

Coastal Resource Area Impacts: Check all that apply below. (For Approvals Only)

	Proposed Alteration	Permitted Alteration	Proposed Replacement	Permitted Replacement
10. ☐ Designated Port Areas	Indicate size under Land Under the Ocean, below			
11. ☐ Land Under the Ocean	a. square feet	b. square feet		
	c. c/y dredged	d. c/y dredged		
12. ☐ Barrier Beaches	Indicate size under Coastal Beaches and/or Coastal Dunes below			
13. ☐ Coastal Beaches	a. square feet	b. square feet	c. nourishment (cu yd)	d. nourishment (cu yd)
14. ☐ Coastal Dunes	a. square feet	b. square feet	c. nourishment (cu yd)	d. nourishment (cu yd)
15. ☐ Coastal Banks	a. linear feet	b. linear feet		
16. ☐ Rocky Intertidal Shores	a. square feet	b. square feet		
17. ☐ Salt Marshes	a. square feet	b. square feet	c. square feet	d. square feet
18. ☐ Land Under Salt Ponds	a. square feet	b. square feet		
	c. c/y dredged	d. c/y dredged		
19. ☐ Land Containing Shellfish	a. square feet	b. square feet	c. square feet	d. square feet
20. ☐ Fish Runs	Indicate size under Coastal Banks, Inland Bank, Land Under the Ocean, and/or inland Land Under Waterbodies and Waterways, above			
	a. c/y dredged	b. c/y dredged		
21. ☐ Land Subject to Coastal Storm Flowage	a. square feet	b. square feet		
22. ☐ Riverfront Area	a. total sq. feet	b. total sq. feet		
Sq ft within 100 ft	c. square feet	d. square feet	e. square feet	f. square feet
Sq ft between 100-200 ft	g. square feet	h. square feet	i. square feet	j. square feet

B. Findings (cont.)

* #23. If the project is for the purpose of restoring or enhancing a wetland resource area in addition to the square footage that has been entered in Section B.5.c (BVW) or B.17.c (Salt Marsh) above, please enter the additional amount here.

23. ☐ Restoration/Enhancement *:

a. square feet of BVW _____ b. square feet of salt marsh _____

24. ☐ Stream Crossing(s):

a. number of new stream crossings _____ b. number of replacement stream crossings _____

C. General Conditions Under Massachusetts Wetlands Protection Act

The following conditions are only applicable to Approved projects.

1. Failure to comply with all conditions stated herein, and with all related statutes and other regulatory measures, shall be deemed cause to revoke or modify this Order.
2. The Order does not grant any property rights or any exclusive privileges; it does not authorize any injury to private property or invasion of private rights.
3. This Order does not relieve the permittee or any other person of the necessity of complying with all other applicable federal, state, or local statutes, ordinances, bylaws, or regulations.
4. The work authorized hereunder shall be completed within three years from the date of this Order unless either of the following apply:
   a. The work is a maintenance dredging project as provided for in the Act; or
   b. The time for completion has been extended to a specified date more than three years, but less than five years, from the date of issuance. If this Order is intended to be valid for more than three years, the extension date and the special circumstances warranting the extended time period are set forth as a special condition in this Order.
   c. If the work is for a Test Project, this Order of Conditions shall be valid for no more than one year.
5. This Order may be extended by the issuing authority for one or more periods of up to three years each upon application to the issuing authority at least 30 days prior to the expiration date of the Order. An Order of Conditions for a Test Project may be extended for one additional year only upon written application by the applicant, subject to the provisions of 310 CMR 10.05(11)(f).
6. If this Order constitutes an Amended Order of Conditions, this Amended Order of Conditions does not extend the issuance date of the original Final Order of Conditions and the Order will expire on 7/19/2027 unless extended in writing by the Department.
7. Any fill used in connection with this project shall be clean fill. Any fill shall contain no trash, refuse, rubbish, or debris, including but not limited to lumber, bricks, plaster, wire, lath, paper, cardboard, pipe, tires, ashes, refrigerators, motor vehicles, or parts of any of the foregoing.

C. General Conditions Under Massachusetts Wetlands Protection Act

8. This Order is not final until all administrative appeal periods from this Order have elapsed, or if such an appeal has been taken, until all proceedings before the Department have been completed.

9. No work shall be undertaken until the Order has become final and then has been recorded in the Registry of Deeds or the Land Court for the district in which the land is located, within the chain of title of the affected property. In the case of recorded land, the Final Order shall also be noted in the Registry's Grantor Index under the name of the owner of the land upon which the proposed work is to be done. In the case of the registered land, the Final Order shall also be noted on the Land Court Certificate of Title of the owner of the land upon which the proposed work is done. The recording information shall be submitted to the Conservation Commission on the form at the end of this Order, which form must be stamped by the Registry of Deeds, prior to the commencement of work.

10. A sign shall be displayed at the site not less then two square feet or more than three square feet in size bearing the words,

    "Massachusetts Department of Environmental Protection" [or, "MassDEP"]

    "File Number 123-324 "

11. Where the Department of Environmental Protection is requested to issue a Superseding Order, the Conservation Commission shall be a party to all agency proceedings and hearings before MassDEP.

12. Upon completion of the work described herein, the applicant shall submit a Request for Certificate of Compliance (WPA Form 8A) to the Conservation Commission.

13. The work shall conform to the plans and special conditions referenced in this order.

14. Any change to the plans identified in Condition #13 above shall require the applicant to inquire of the Conservation Commission in writing whether the change is significant enough to require the filing of a new Notice of Intent.

15. The Agent or members of the Conservation Commission and the Department of Environmental Protection shall have the right to enter and inspect the area subject to this Order at reasonable hours to evaluate compliance with the conditions stated in this Order, and may require the submittal of any data deemed necessary by the Conservation Commission or Department for that evaluation.

16. This Order of Conditions shall apply to any successor in interest or successor in control of the property subject to this Order and to any contractor or other person performing work conditioned by this Order.

C. General Conditions Under Massachusetts Wetlands Protection Act (cont.)

17. Prior to the start of work, and if the project involves work adjacent to a Bordering Vegetated Wetland, the boundary of the wetland in the vicinity of the proposed work area shall be marked by wooden stakes or flagging. Once in place, the wetland boundary markers shall be maintained until a Certificate of Compliance has been issued by the Conservation Commission.

18. All sedimentation barriers shall be maintained in good repair until all disturbed areas have been fully stabilized with vegetation or other means. At no time shall sediments be deposited in a wetland or water body. During construction, the applicant or his/her designee shall inspect the erosion controls on a daily basis and shall remove accumulated sediments as needed. The applicant shall immediately control any erosion problems that occur at the site and shall also immediately notify the Conservation Commission, which reserves the right to require additional erosion and/or damage prevention controls it may deem necessary. Sedimentation barriers shall serve as the limit of work unless another limit of work line has been approved by this Order.

19. The work associated with this Order (the "Project")
    (1) ☐ is subject to the Massachusetts Stormwater Standards
    (2) ☒ is NOT subject to the Massachusetts Stormwater Standards

    If the work is subject to the Stormwater Standards, then the project is subject to the following conditions:

    a) All work, including site preparation, land disturbance, construction and redevelopment, shall be implemented in accordance with the construction period pollution prevention and erosion and sedimentation control plan and, if applicable, the Stormwater Pollution Prevention Plan required by the National Pollution Discharge Elimination System Construction General Permit as required by Stormwater Condition 8. Construction period erosion, sedimentation and pollution control measures and best management practices (BMPs) shall remain in place until the site is fully stabilized.

    b) No stormwater runoff may be discharged to the post-construction stormwater BMPs unless and until a Registered Professional Engineer provides a Certification that:
    i. all construction period BMPs have been removed or will be removed by a date certain specified in the Certification. For any construction period BMPs intended to be converted to post construction operation for stormwater attenuation, recharge, and/or treatment, the conversion is allowed by the MassDEP Stormwater Handbook BMP specifications and that the BMP has been properly cleaned or prepared for post construction operation, including removal of all construction period sediment trapped in inlet and outlet control structures;
    ii. as-built final construction BMP plans are included, signed and stamped by a Registered Professional Engineer, certifying the site is fully stabilized;
    iii. any illicit discharges to the stormwater management system have been removed, as per the requirements of Stormwater Standard 10;

C. General Conditions Under Massachusetts Wetlands Protection Act (cont.)

iv. all post-construction stormwater BMPs are installed in accordance with the plans (including all planting plans) approved by the issuing authority, and have been inspected to ensure that they are not damaged and that they are in proper working condition;

v. any vegetation associated with post-construction BMPs is suitably established to withstand erosion.

c) The landowner is responsible for BMP maintenance until the issuing authority is notified that another party has legally assumed responsibility for BMP maintenance. Prior to requesting a Certificate of Compliance, or Partial Certificate of Compliance, the responsible party (defined in General Condition 18(e)) shall execute and submit to the issuing authority an Operation and Maintenance Compliance Statement ("O&M Statement) for the Stormwater BMPs identifying the party responsible for implementing the stormwater BMP Operation and Maintenance Plan ("O&M Plan") and certifying the following:

i.) the O&M Plan is complete and will be implemented upon receipt of the Certificate of Compliance, and

ii.) the future responsible parties shall be notified in writing of their ongoing legal responsibility to operate and maintain the stormwater management BMPs and implement the Stormwater Pollution Prevention Plan.

d) Post-construction pollution prevention and source control shall be implemented in accordance with the long-term pollution prevention plan section of the approved Stormwater Report and, if applicable, the Stormwater Pollution Prevention Plan required by the National Pollution Discharge Elimination System Multi-Sector General Permit.

e) Unless and until another party accepts responsibility, the landowner, or owner of any drainage easement, assumes responsibility for maintaining each BMP. To overcome this presumption, the landowner of the property must submit to the issuing authority a legally binding agreement of record, acceptable to the issuing authority, evidencing that another entity has accepted responsibility for maintaining the BMP, and that the proposed responsible party shall be treated as a permittee for purposes of implementing the requirements of Conditions 18(f) through 18(k) with respect to that BMP. Any failure of the proposed responsible party to implement the requirements of Conditions 18(f) through 18(k) with respect to that BMP shall be a violation of the Order of Conditions or Certificate of Compliance. In the case of stormwater BMPs that are serving more than one lot, the legally binding agreement shall also identify the lots that will be serviced by the stormwater BMPs. A plan and easement deed that grants the responsible party access to perform the required operation and maintenance must be submitted along with the legally binding agreement.

f) The responsible party shall operate and maintain all stormwater BMPs in accordance with the design plans, the O&M Plan, and the requirements of the Massachusetts Stormwater Handbook.

C. General Conditions Under Massachusetts Wetlands Protection Act (cont.)

g) The responsible party shall:
1. Maintain an operation and maintenance log for the last three (3) consecutive calendar years of inspections, repairs, maintenance and/or replacement of the stormwater management system or any part thereof, and disposal (for disposal the log shall indicate the type of material and the disposal location);
2. Make the maintenance log available to MassDEP and the Conservation Commission ("Commission") upon request; and
3. Allow members and agents of the MassDEP and the Commission to enter and inspect the site to evaluate and ensure that the responsible party is in compliance with the requirements for each BMP established in the O&M Plan approved by the issuing authority.

h) All sediment or other contaminants removed from stormwater BMPs shall be disposed of in accordance with all applicable federal, state, and local laws and regulations.

i) Illicit discharges to the stormwater management system as defined in 310 CMR 10.04 are prohibited.

j) The stormwater management system approved in the Order of Conditions shall not be changed without the prior written approval of the issuing authority.

k) Areas designated as qualifying pervious areas for the purpose of the Low Impact Site Design Credit (as defined in the MassDEP Stormwater Handbook, Volume 3, Chapter 1, Low Impact Development Site Design Credits) shall not be altered without the prior written approval of the issuing authority.

l) Access for maintenance, repair, and/or replacement of BMPs shall not be withheld. Any fencing constructed around stormwater BMPs shall include access gates and shall be at least six inches above grade to allow for wildlife passage.

Special Conditions (if you need more space for additional conditions, please attach a text document):
See Attachment

20. For Test Projects subject to 310 CMR 10.05(11), the applicant shall also implement the monitoring plan and the restoration plan submitted with the Notice of Intent. If the conservation commission or Department determines that the Test Project threatens the public health, safety or the environment, the applicant shall implement the removal plan submitted with the Notice of Intent or modify the project as directed by the conservation commission or the Department.

D. Findings Under Municipal Wetlands Bylaw or Ordinance

1. Is a municipal wetlands bylaw or ordinance applicable? ☐ Yes ☒ No

2. The _____ hereby finds (check one that applies):
   Conservation Commission

   a. ☐ that the proposed work cannot be conditioned to meet the standards set forth in a municipal ordinance or bylaw, specifically:

   _____ _____
   1. Municipal Ordinance or Bylaw 2. Citation

   Therefore, work on this project may not go forward unless and until a revised Notice of Intent is submitted which provides measures which are adequate to meet these standards, and a final Order of Conditions is issued.

   b. ☐ that the following additional conditions are necessary to comply with a municipal ordinance or bylaw:

   _____ _____
   1. Municipal Ordinance or Bylaw 2. Citation

3. The Commission orders that all work shall be performed in accordance with the following conditions and with the Notice of Intent referenced above. To the extent that the following conditions modify or differ from the plans, specifications, or other proposals submitted with the Notice of Intent, the conditions shall control.
   The special conditions relating to municipal ordinance or bylaw are as follows (if you need more space for additional conditions, attach a text document):

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 5 – Order of Conditions
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
123-0324
MassDEP File #

eDEP Transaction #

Cambridge
City/Town

E. Signatures

This Order is valid for three years, unless otherwise specified as a special condition pursuant to General Conditions #4, from the date of issuance.

7/19/2024
1. Date of Issuance

Please indicate the number of members who will sign this form.
This Order must be signed by a majority of the Conservation Commission.

1
2. Number of Signers

The Order must be mailed by certified mail (return receipt requested) or hand delivered to the applicant. A copy also must be mailed or hand delivered at the same time to the appropriate Department of Environmental Protection Regional Office, if not filing electronically, and the property owner, if different from applicant.

Signatures:

Jennifer Letourneau, Director

☒ by hand delivery on

7/19/2024
Date

☐ by certified mail, return receipt requested, on

Date

F. Appeals

The applicant, the owner, any person aggrieved by this Order, any owner of land abutting the land subject to this Order, or any ten residents of the city or town in which such land is located, are hereby notified of their right to request the appropriate MassDEP Regional Office to issue a Superseding Order of Conditions. The request must be made by certified mail or hand delivery to the Department, with the appropriate filing fee and a completed Request for Departmental Action Fee Transmittal Form, as provided in 310 CMR 10.03(7) within ten business days from the date of issuance of this Order. A copy of the request shall at the same time be sent by certified mail or hand delivery to the Conservation Commission and to the applicant, if he/she is not the appellant.

Any appellants seeking to appeal the Department's Superseding Order associated with this appeal will be required to demonstrate prior participation in the review of this project. Previous participation in the permit proceeding means the submission of written information to the Conservation Commission prior to the close of the public hearing, requesting a Superseding Order, or providing written information to the Department prior to issuance of a Superseding Order.

The request shall state clearly and concisely the objections to the Order which is being appealed and how the Order does not contribute to the protection of the interests identified in the Massachusetts Wetlands Protection Act (M.G.L. c. 131, § 40), and is inconsistent with the wetlands regulations (310 CMR 10.00). To the extent that the Order is based on a municipal ordinance or bylaw, and not on the Massachusetts Wetlands Protection Act or regulations, the Department has no appellate jurisdiction.

G. Recording Information

Prior to commencement of work, this Order of Conditions must be recorded in the Registry of Deeds or the Land Court for the district in which the land is located, within the chain of title of the affected property. In the case of recorded land, the Final Order shall also be noted in the Registry's Grantor Index under the name of the owner of the land subject to the Order. In the case of registered land, this Order shall also be noted on the Land Court Certificate of Title of the owner of the land subject to the Order of Conditions. The recording information on this page shall be submitted to the Conservation Commission listed below.

Cambridge
Conservation Commission

Detach on dotted line, have stamped by the Registry of Deeds and submit to the Conservation Commission.

To:

Cambridge
Conservation Commission

Please be advised that the Order of Conditions for the Project at:

Memorial Drive Phase 3 — Project Location
123-324 — MassDEP File Number

Has been recorded at the Registry of Deeds of:

County | Book | Page

for: Property Owner

and has been noted in the chain of title of the affected property in:

Book | Page

In accordance with the Order of Conditions issued on:

Date

If recorded land, the instrument number identifying this transaction is:

Instrument Number

If registered land, the document number identifying this transaction is:

Document Number

Signature of Applicant

DEP File #123-324
Memorial Drive Phase 3 – Reconstruction Project
City of Cambridge

Documents and Plans:
The complete file is available for review in the Cambridge Conservation Commission office.
Owner: MA DCR
Consultant: Stantec

Special Conditions:

21. Work shall conform to the Notice of Intent under the Massachusetts Wetlands Protection Act, M.G.L. ch. 131, sec. 40, submitted to the Cambridge Conservation Commission on **February 20, 2024,** and the additional information and modifications outlined in the supplemental documents and plans provided by the applicant. Specifically, the proposed work shall conform to the most recent revisions to the Notice of Intent document and plans, received by the Commission as stated above.

22. Any further proposed or executed changes in the plans approved under this Order shall require the applicant to seek an amended Order of Conditions or to file a new Notice of Intent, or to inquire of the Cambridge Conservation Commission in writing whether the change or changes is/are substantial enough to require a new filing. Any errors in the plans or information by the applicant shall be considered changes and the above procedures shall be followed.

23. Prior to any work on the site, the applicant shall record this Order of Conditions at the Registry of Deeds pursuant to Condition 9. Failure to do so shall be deemed cause to revoke this Order.

24. The applicant shall provide to the Conservation Commission copies of all other permits, variances, licenses, or determinations which may be necessary for this project by other local, state, and federal agencies. The applicant shall provide copies of all applicable permits to the Commission at least 2 weeks prior to commencement of work authorized under any such permit.

25. This Order of Conditions shall be included in all construction contracts and subcontracts dealing with the work proposed and shall supersede all conflicting contract requirements that are less protective of Wetland Resource Areas.

26. The sign with the DEP File Number for this project, required in Condition 10, on DEP Form 5.

27. The applicant or its agent shall specify to the Commission, prior to commencement of activity on the site, the name and telephone number of the person(s) designated by the applicant to be responsible for compliance with the conditions of this Order on the site and his/her alternate.

28. An on-site project kickoff meeting will be scheduled a minimum of 72 hours in advance of starting demolition/construction activities. Compliance with submittals to the Conservation Commission as well as inspection of erosion/sedimentation controls, tree protection and temporary stockpile locations will be conducted at this meeting.

29. The applicant shall provide to the Conservation Commission copies of project inspectional reports during construction including but not limited to maintenance and operation and vegetation monitoring including existing trees.

30. The members and agents of the Conservation Commission shall have the right to enter the site to verify compliance with this Order and to require the submittal of additional data deemed necessary by the Commission for that verification. The Commission understands that construction-site safety procedures must be followed during site visits.

31. During project construction and operations, the applicant or its contractors shall provide and maintain free and safe passage by pedestrians and bicyclists along the roads or walkways adjacent to the site.

32. If some unexpected or unforeseen event occurs, that needs to be addressed, all work shall stop until the event can be brought to the attention of the Director of the Commission and a decision made by the Director as to whether it needs to be brought before the Commission.

33. If a workday commences with heavy rain, work may take place in the buffer zone or resource area that day as long as approved erosion and sedimentation controls are in good working order.

34. Trucks entering and leaving the site shall have their loads completely covered in compliance with M.G.L. Chapter 85 section 36. The applicant shall also instruct all drivers on site that vehicles shall not idle for longer than 5 minutes in compliance with M.G.L. Chapter 90 section 16A.

35. The responsible parties must coordinate with the Conservation Commission Director and DCR Arborist if any tree limbs or tree roots need to be cut during the construction activities.

36. Prior to submitting a Request for Certificate of Compliance, as-built plans and confirmation that the landscape and hardscape have been completed must be submitted to the Conservation Commission.

Minor Project Modification

24-WWAR-0082-APP

Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection
100 Cambridge Street Suite 900 Boston, MA 02114 • 617-292-5500

Maura T. Healey
Governor

Kimberley Driscoll
Lieutenant Governor

Rebecca L. Tepper
Secretary

Bonnie Heiple
Commissioner

August 29, 2024

Massachusetts Department of Conservation and Recreation c/o Dan Driscoll
C/o Caroline Santangelo, Stantec
40 Water Street Third Floor
Boston MA 02109-3604

RE: 24-WWAR-0082-APP
Request for Minor Project Modification to Chapter 371, Acts of 1929, License No. HLC2263
Reconstruction of Portion of Memorial Drive Parkway, Filled Tidelands of the Charles River, Cambridge, Middlesex County

Dear Ms. Santangelo,

The Massachusetts Department of Environmental Protection Waterways Regulation Program (the "Department") received your letter, dated August 16, 2024, on behalf of the Massachusetts Department of Conservation and Recreation (DCR, the "Requestor"), seeking a Minor Project Modification to Chapter 371, Acts of 1929 and Board of Harbor and Land Commissioners (HLC) License Numbers 2263, 2264, and 2451, pursuant to 310 CMR 9.22(3), for reconstructing and improving a portion of Memorial Drive parkway from the Eliot Bridge downstream to the Andeson Memorial Bridge along the Charles River in the City of Cambridge, Middlesex County (the "project site" or "licensed site"). This request included**:**

- Letter in support of a Minor Project Modification to Chapter 371 of the Massachusetts Legislative Acts of 1929 and three HLC Licenses, signed by Priscilla Geigis, Deputy Commissioner of DCR, dated August 14, 2024
- Chapter 371 of the Massachusetts Legislative Acts of 1929 for the improvement of the Charles River Basin for recreational and other purposes, for the laying out and construction of certain parkways along the basin, and for the improvement of certain streets in Boston and Cambridge near said basin
- HLC License No. 2263 issued on July 19, 1899 for the placement of fill in the Charles River.
- HLC License No. 2264 issued on July 19, 1899 for the placement of fill in the Charles River.

- HLC License No. 2451 issued on February 28, 1901 for the placement of fill in the Charles River.
- Wetlands Protection Act Order of Conditions (DEP File #123-0324) issued by the Cambridge Conservation Commission on July 19, 2024, not including the plans referenced in the Order
- Plans titled "*MEMORIAL DRIVE-PHASE III CAMBRIDGE, MASSAHCUSTTS*", 13 sheets, dated July 10, 2024, delineating the Chapter 91 jurisdiction line and the scope and details of the work, not stamped

Regulatory Review

The Project Site includes a ±0.81-mile section of land south of Memorial Drive (US Route 3/MA Route 2) between the Eliot Bridge and the Anderson Memorial Bridge. This area owned by DCR includes the existing parkway and parkland located along the north side of the Charles River and partially within Filled Tidelands, one of the geographic areas subject to Chapter 91 jurisdiction pursuant to 310 CMR 9.04(2). The above-mentioned State Legislative Act and HLC License No. 2263 License authorized the placement of the historic fill on the project site and the General Court of Massachusetts authorized fill of the Charles River tidelands for recreational purposes and construction of parkways.

The intent of the Memorial Drive Phase III Reconstruction Project is to improved views of the Charles River and enhance the public safety and recreational experience of the DCR facility. The proposed modifications include the following activities:

- Realigning roadway slightly
- Narrowing the existing four-lane parkway to a two-lane cross-section with two 3-foot-wide shoulders aligned with the existing landward curb line for a portion of the project area
- Replacing an existing 6.5-foot-wide pathway on the river side of the parkway with an 11-foot-wide paved multi-use path and adjacent 5-foot-wide stabilized aggregate path
- Replacing the existing sidewalk on the landward side of the parkway with a new ADA-compliant 5-foot-wide paved sidewalk
- Replacing or supplementing existing stormwater controls with filtration swales and deep-sump hooded catch basins
- Creating more green space with seating areas and vegetative plantings/trees, and
- Installing additional signalized ped/bike crossings on Memorial Drive

The modifications do not include two new elevated overlook structures proposed within the Project Site for providing views of the Charles River, which will be licensed separately.

The parkland is considered a *Public Service Project* as defined in 310 CMR 9.02, given that it is a public facility owned and controlled by the DCR. Additionally, the proposed modifications will be confined to the footprint of the existing authorized fill and still be used as a public park/facility. Any disturbed areas will be restored for public use safely upon completion of the project.

Conclusion

Based on the collective representations made in the documents submitted and listed above, and in reliance of the information contained therein, the Department finds that the proposed modifications to an authorized public service project represent an insignificant deviation in terms of size, configuration, materials, other relevant design or fabrication parameters of the original referenced authorization and will not change the use of the facility and have no impacts on the navigable waterway or water-dependent use on or offsite. Therefore, the Department determines that the work, as proposed complies with the Minor Project Modification standards pursuant to 310 CMR 9.22(3)(a) and does not require a new License or Amendment. The work approved herein is depicted on the attached plans.

The Department will retain this letter and the referenced submissions in the Waterways Program. The proposed modification project must conform to and be consistent with all submitted documentation. Please be advised that this Departmental action does not relieve or exempt you of the requirement to obtain all other applicable local, State and/or Federal authorizations necessary to perform said activities.

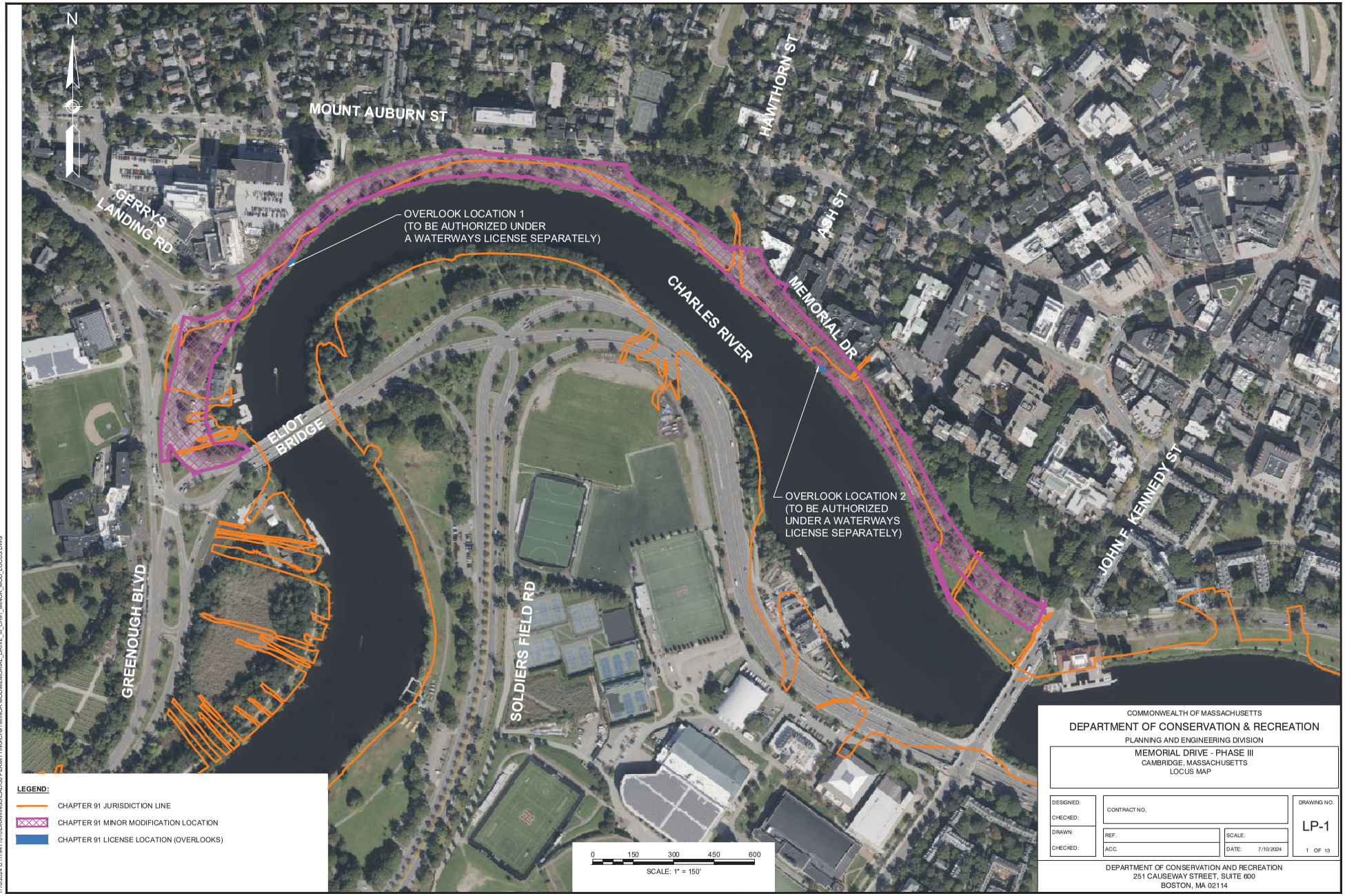
Should you have any other questions, please contact the Waterways Regulation Program at dep.waterways@mass.gov. Thank you.

Sincerely,

Daniel J. Padien
Program Chief
Waterways Regulation Program

cc: Dan Driscoll, Massachusetts Department of Conservation and Recreation
Greg Robbins, Massachusetts Department of Conservation and Recreation
Cambridge Conservation Commission

encl: Project plan (13 sheets)



COMMONWEALTH OF MASSACHUSETTS

DEPARTMENT OF CONSERVATION & RECREATION

PLANNING AND ENGINEERING DIVISION

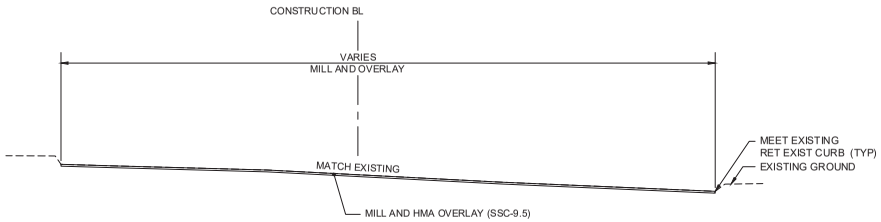
MEMORIAL DRIVE - PHASE III

CAMBRIDGE, MASSACHUSETTS

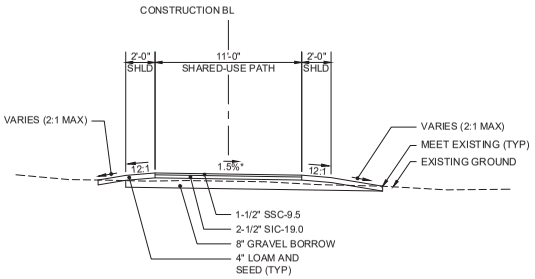
LOCUS MAP

DESIGNED:	CONTRACT NO.	DRAWING NO.
CHECKED:		LP-1
DRAWN:	REF.	SCALE:
CHECKED:	ACC.	DATE: 7/10/2024
		1 OF 13

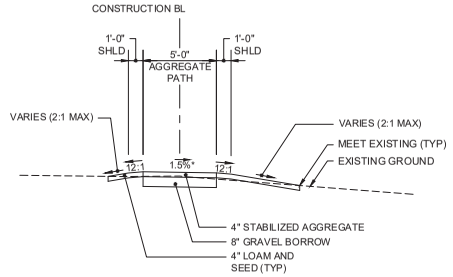
DEPARTMENT OF CONSERVATION AND RECREATION
251 CAUSEWAY STREET, SUITE 600
BOSTON, MA 02114



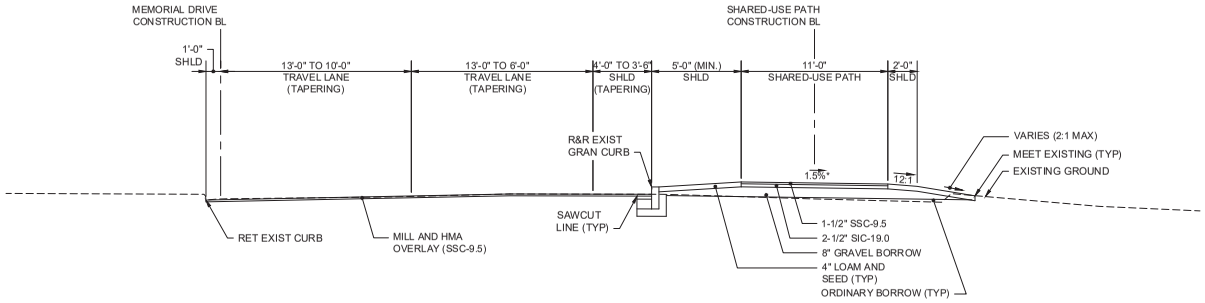
TYPICAL MILL AND OVERLAY ROADWAY SECTION
NOT TO SCALE
STA 101+43± TO STA 105+37±



TYPICAL FULL DEPTH SHARED-USE PATH SECTION
NOT TO SCALE
STA 500+26± TO STA 508+70±



TYPICAL FULL DEPTH AGGREGATE PATH SECTION
NOT TO SCALE
STA 600+06± TO STA 603+60±
STA 700+00± TO STA 709+65±
STA 800+00± TO STA 806+57±
STA 900+00 TO STA 901+89±
STA 1000+00 TO STA 1000+75±



TYPICAL MILL AND OVERLAY ROADWAY SECTION
NOT TO SCALE
STA 27+26± TO STA 29+65±

PAVEMENT NOTES

PROPOSED MILL AND OVERLAY ROADWAY SECTIONS

MILL: 2-3/4" (MAX) PAVEMENT MILLING
OVERLAY: 1-1/2" SUPERPAVE SURFACE COURSE 9.5 (SSC-9.5)

PROPOSED FULL DEPTH PAVEMENT SHARED-USE PATH SECTIONS

SURFACE: 1-1/2" SUPERPAVE SURFACE COURSE 9.5 (SSC-9.5)

INTERMEDIATE: 2-1/2" SUPERPAVE INTERMEDIATE COURSE 19.0 (SIC-19.0)

BASE: 8" (MIN) GRAVEL BORROW, TYPE b

PROPOSED FULL DEPTH AGGREGATE PATH SECTIONS

SURFACE: 4" STABILIZED AGGREGATE (SEE SPECIFICATIONS)

BASE: 8" (MIN) GRAVEL BORROW, TYPE b

PROPOSED FULL DEPTH FLEXIBLE POROUS PAVEMENT WALK SECTIONS

SURFACE: 2" FLEXIBLE POROUS PAVEMENT (SEE SPECIFICATIONS)

BASE: 2" CRUSHED STONE

CEMENT CONCRETE SIDEWALK AND WHEELCHAIR RAMP SECTIONS

SURFACE: 6" CEMENT CONCRETE
(4000psi, ¾", 610 lbs. AIR ENTRAINED)

BASE: 8" (MIN) GRAVEL BORROW, TYPE b

PROPOSED FULL DEPTH ROADWAY PAVEMENT SECTIONS (LESS THAN 4 FEET WIDE)

SURFACE: 1-1/2" SUPERPAVE SURFACE COURSE 9.5 (SSC-9.5) OVER

INTERMEDIATE: 2-1/2" SUPERPAVE INTERMEDIATE COURSE 19.0 (SIC-19.0) OVER

BASE: 6" HES CEMENT CONCRETE OVER

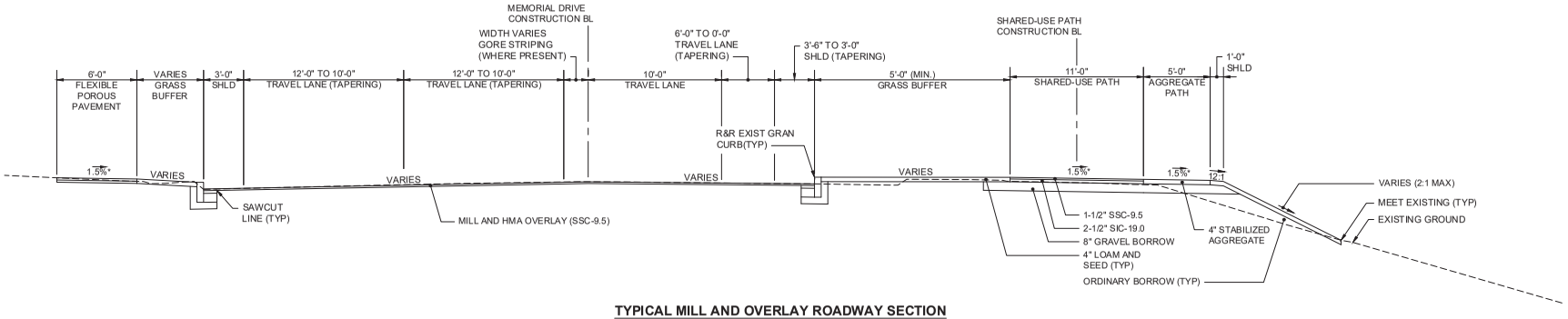
SUBBASE: 8" GRAVEL BORROW, TYPE b

* - TOLERANCE FOR CONSTRUCTION ±0.5% (TYP)

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF CONSERVATION & RECREATION
PLANNING AND ENGINEERING DIVISION
MEMORIAL DRIVE - PHASE III
CAMBRIDGE, MASSACHUSETTS
TYPICAL SECTIONS
PART 1 OF 3

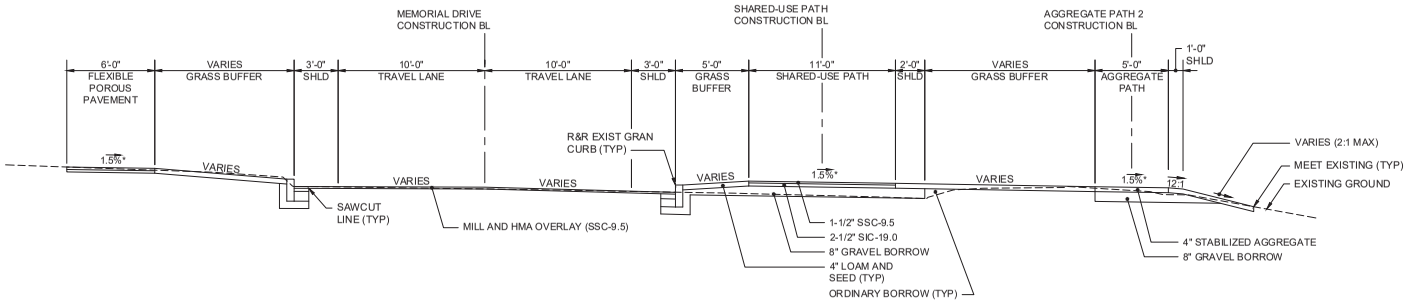
DESIGNED:	CONTRACT NO.	DRAWING NO.
CHECKED:		TS-1
DRAWN:	REF. / SCALE:	
CHECKED:	ACC. / DATE: 7/10/2024	2 OF 13

DEPARTMENT OF CONSERVATION AND RECREATION
251 CAUSEWAY STREET, SUITE 600
BOSTON, MA 02114



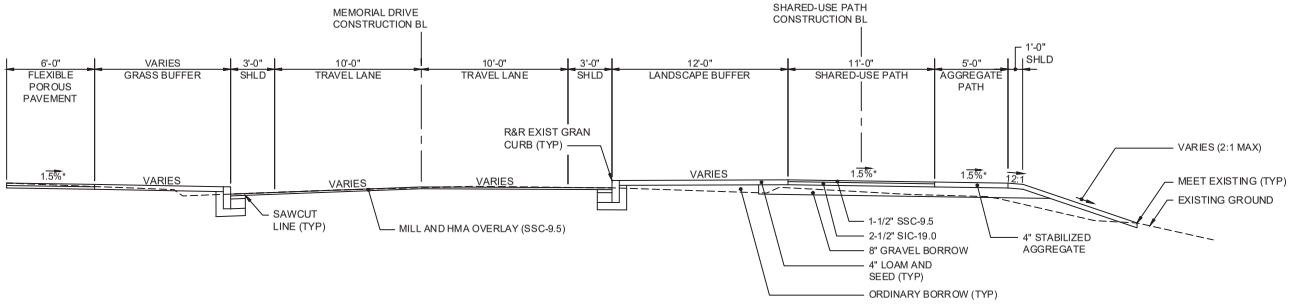
TYPICAL MILL AND OVERLAY ROADWAY SECTION

NOT TO SCALE
STA 29+65± TO STA 34+70±



TYPICAL MILL AND OVERLAY ROADWAY SECTION

NOT TO SCALE
STA 34+70± TO STA 44+01±



TYPICAL MILL AND OVERLAY ROADWAY SECTION

NOT TO SCALE
STA 46+63± TO STA 49+15±
STA 50+00± TO STA 55+38±
STA 58+18± TO STA 63+00±

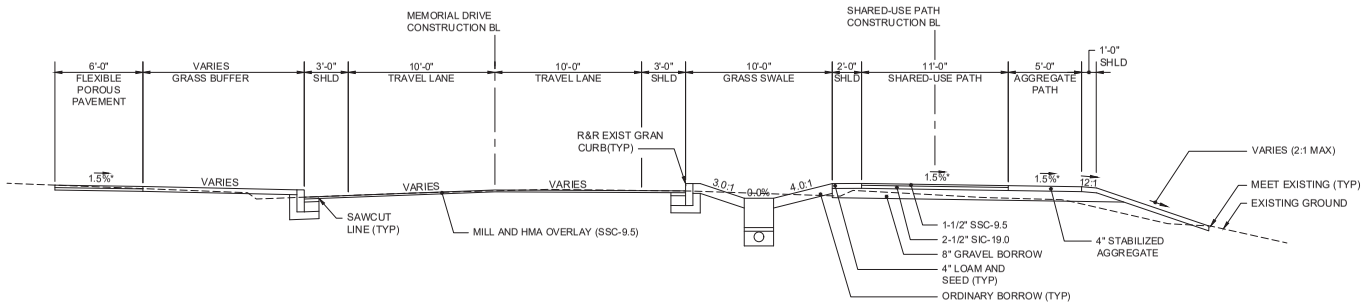
COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF CONSERVATION & RECREATION
PLANNING AND ENGINEERING DIVISION

MEMORIAL DRIVE - PHASE III
CAMBRIDGE, MASSACHUSETTS
TYPICAL SECTIONS
PART 2 OF 3

DESIGNED:	CONTRACT NO.	DRAWING NO.
CHECKED:		TS-2
DRAWN:	REF.	SCALE:
CHECKED:	ACC.	DATE: 7/10/2024
		3 OF 13

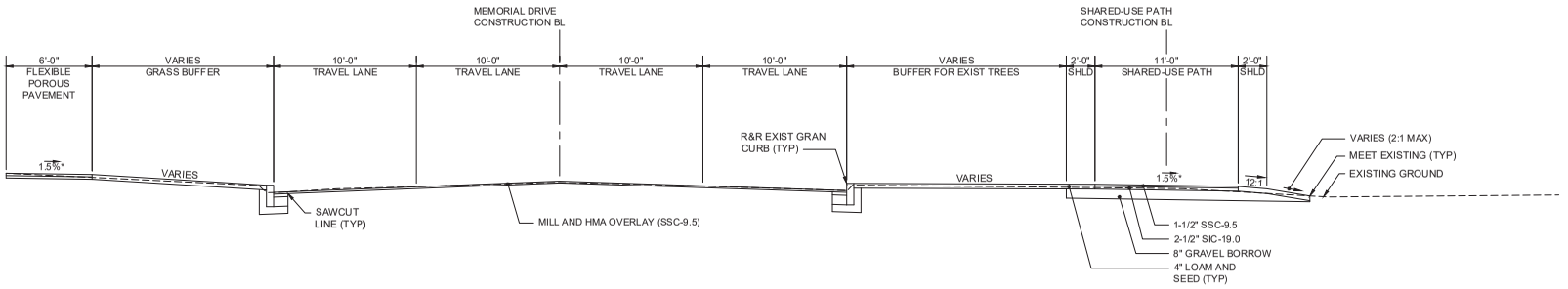
DEPARTMENT OF CONSERVATION AND RECREATION
251 CAUSEWAY STREET, SUITE 600
BOSTON, MA 02114

7/10/2024 U:\17941101\DRAWINGS\CAD\30 PERMITTING\CH91\MINOR MOD\MEMORIAL_DRIVE_III_CH91_MINOR_MOD_TYPICAL_SECTIONS.DWG



TYPICAL MILL AND OVERLAY ROADWAY SECTION

NOT TO SCALE
STA 44+01± TO STA 46+63±
STA 49+15± TO STA 50+00±
STA 55+38± TO STA 58+18±



TYPICAL MILL AND OVERLAY ROADWAY SECTION

NOT TO SCALE
STA 63+00± TO STA 68+00±

COMMONWEALTH OF MASSACHUSETTS

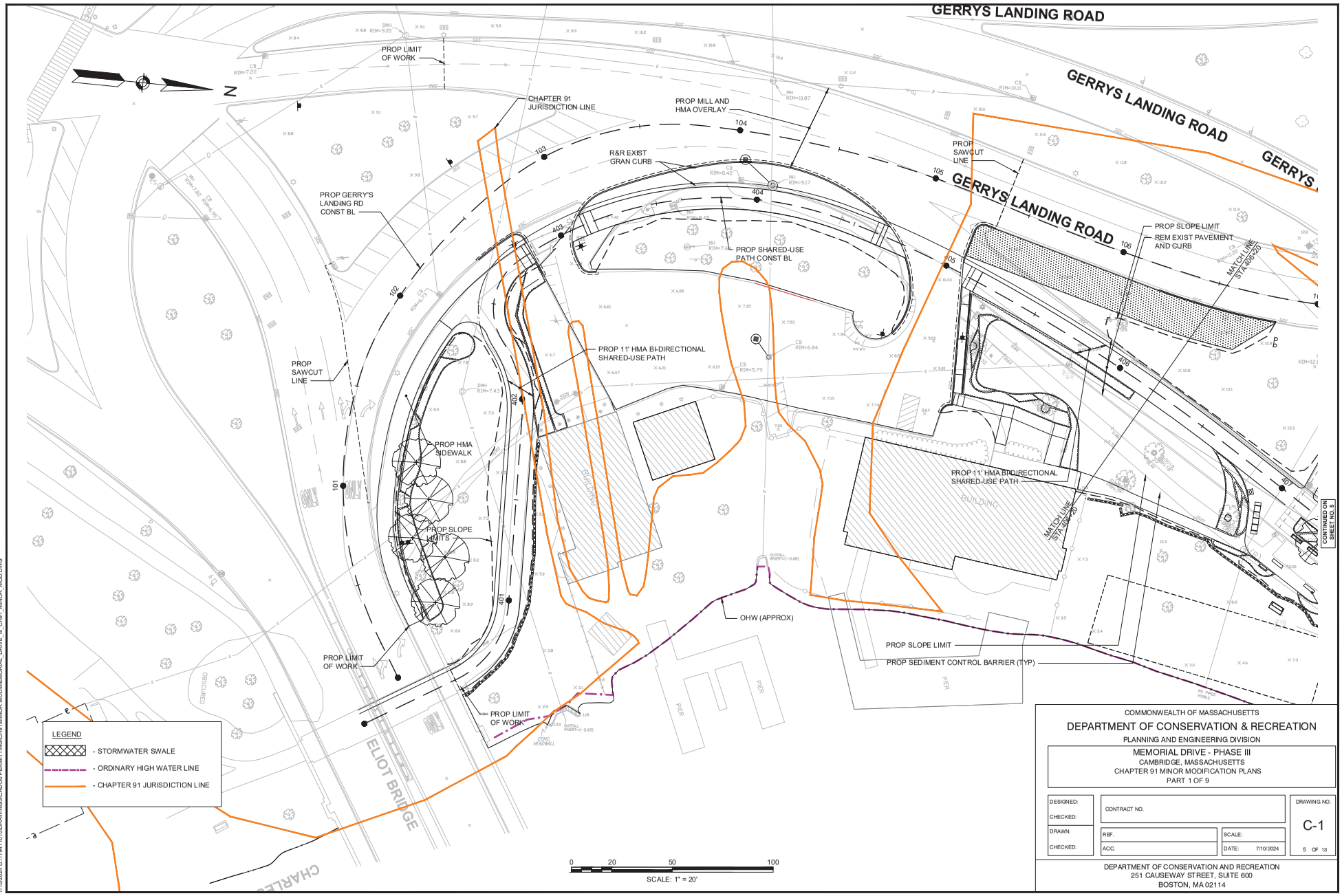
DEPARTMENT OF CONSERVATION & RECREATION

PLANNING AND ENGINEERING DIVISION

MEMORIAL DRIVE - PHASE III
CAMBRIDGE, MASSACHUSETTS
TYPICAL SECTIONS
PART 3 OF 3

DESIGNED:	CONTRACT NO.	DRAWING NO.
CHECKED:		TS-3
DRAWN:	REF. / SCALE:	
CHECKED:	ACC. / DATE: 7/10/2024	4 OF 13

DEPARTMENT OF CONSERVATION AND RECREATION
251 CAUSEWAY STREET, SUITE 600
BOSTON, MA 02114



COMMONWEALTH OF MASSACHUSETTS

DEPARTMENT OF CONSERVATION & RECREATION

PLANNING AND ENGINEERING DIVISION

MEMORIAL DRIVE - PHASE III

CAMBRIDGE, MASSACHUSETTS

CHAPTER 91 MINOR MODIFICATION PLANS

PART 1 OF 9

DESIGNED:	CONTRACT NO.	DRAWING NO. C-1
CHECKED:		
DRAWN:	REF.	SCALE:
CHECKED:	ACC.	DATE: 7/10/2024

5 OF 13

DEPARTMENT OF CONSERVATION AND RECREATION
251 CAUSEWAY STREET, SUITE 600
BOSTON, MA 02114

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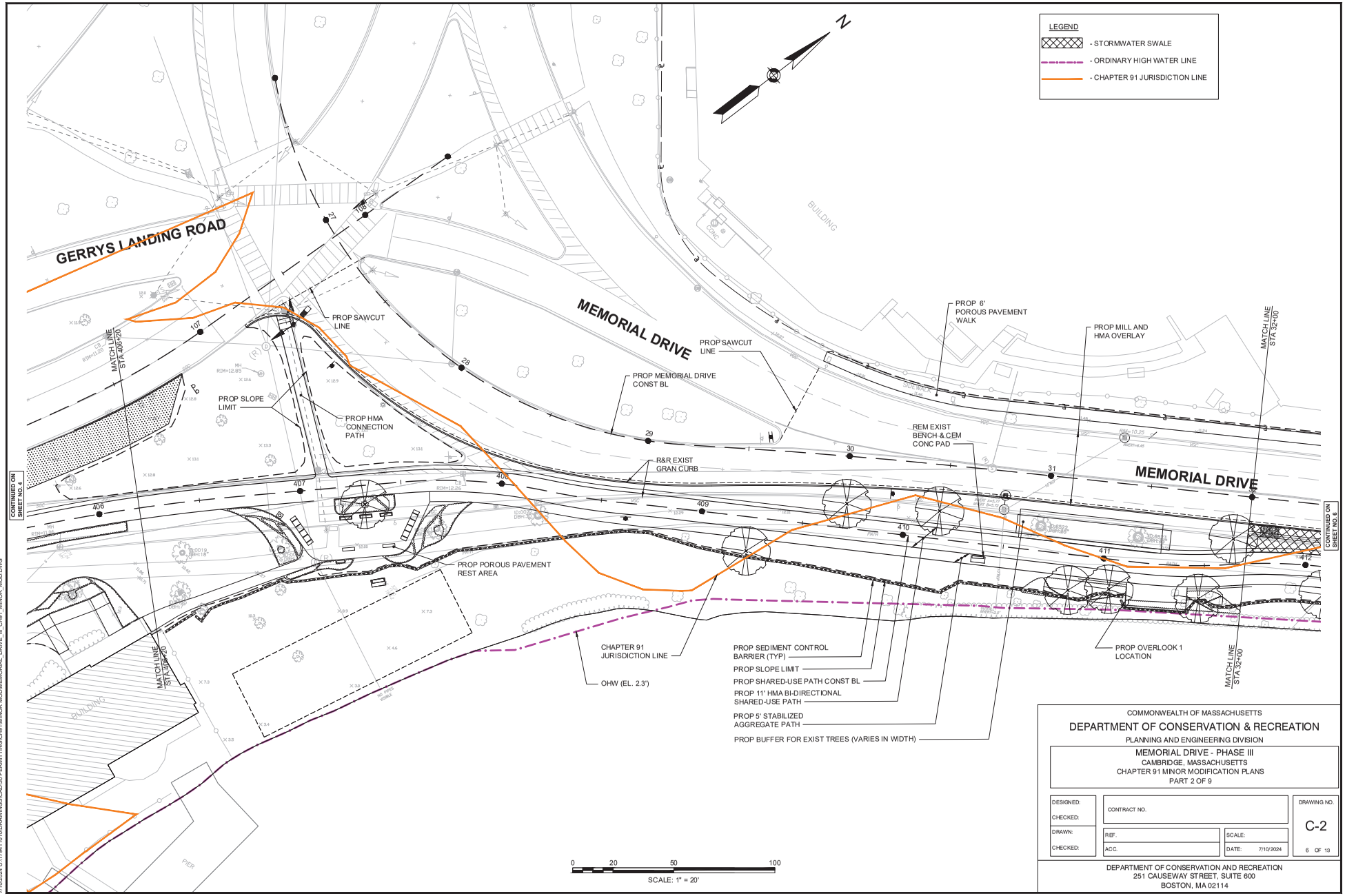


COMMONWEALTH OF MASSACHUSETTS

DEPARTMENT OF CONSERVATION & RECREATION

PLANNING AND ENGINEERING DIVISION

MEMORIAL DRIVE - PHASE III

CAMBRIDGE, MASSACHUSETTS

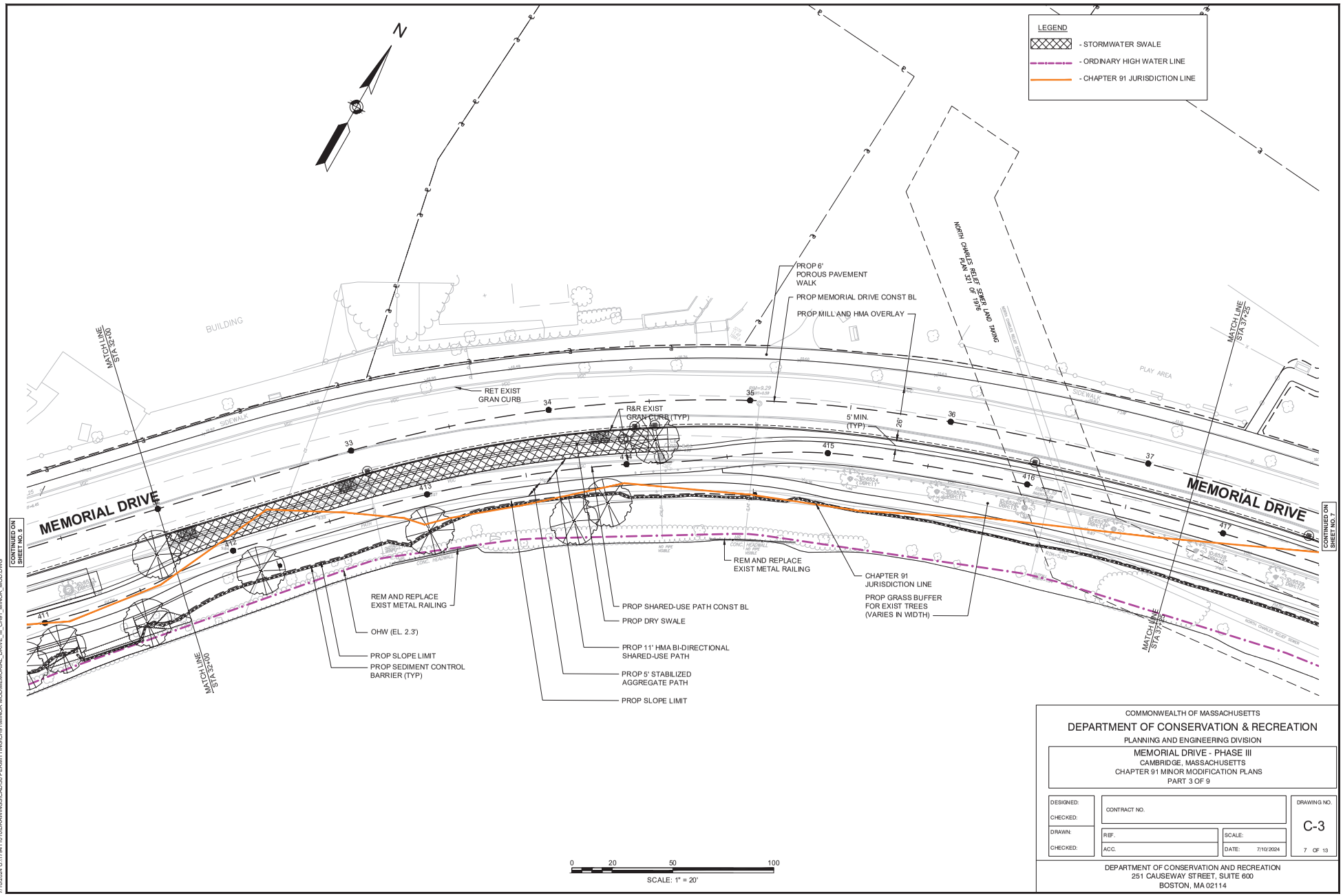
CHAPTER 91 MINOR MODIFICATION PLANS

PART 2 OF 9

DESIGNED:	CONTRACT NO.	DRAWING NO. C-2
CHECKED:		
DRAWN:	REF.	SCALE:
CHECKED:	ACC.	DATE: 7/10/2024

6 OF 13

DEPARTMENT OF CONSERVATION AND RECREATION
251 CAUSEWAY STREET, SUITE 600
BOSTON, MA 02114



COMMONWEALTH OF MASSACHUSETTS

DEPARTMENT OF CONSERVATION & RECREATION

PLANNING AND ENGINEERING DIVISION

MEMORIAL DRIVE - PHASE III

CAMBRIDGE, MASSACHUSETTS

CHAPTER 91 MINOR MODIFICATION PLANS

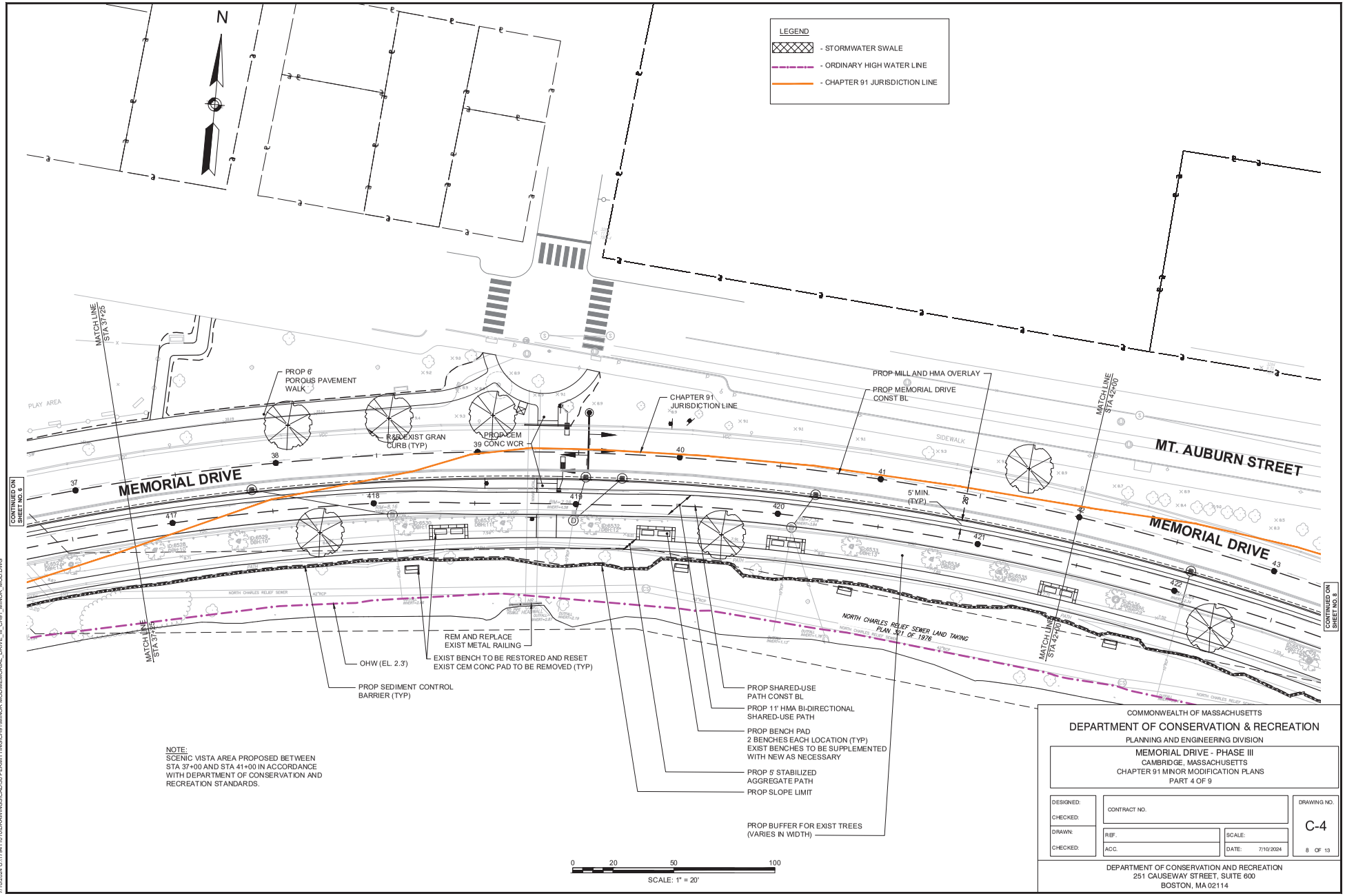
PART 3 OF 9

DESIGNED:	CONTRACT NO.	DRAWING NO. C-3
CHECKED:		
DRAWN:	REF.	SCALE:
CHECKED:	ACC.	DATE: 7/10/2024

7 OF 13

DEPARTMENT OF CONSERVATION AND RECREATION
251 CAUSEWAY STREET, SUITE 600
BOSTON, MA 02114

7/10/2024 U:\17941\10\10\DRAWINGS\CAD\30 PERMITTING\CH91\MINOR MOD\MEMORIAL_DRIVE_III_CH91_MINOR_MOD.DWG



NOTE:
SCENIC VISTA AREA PROPOSED BETWEEN STA 37+00 AND STA 41+00 IN ACCORDANCE WITH DEPARTMENT OF CONSERVATION AND RECREATION STANDARDS.

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF CONSERVATION & RECREATION
PLANNING AND ENGINEERING DIVISION

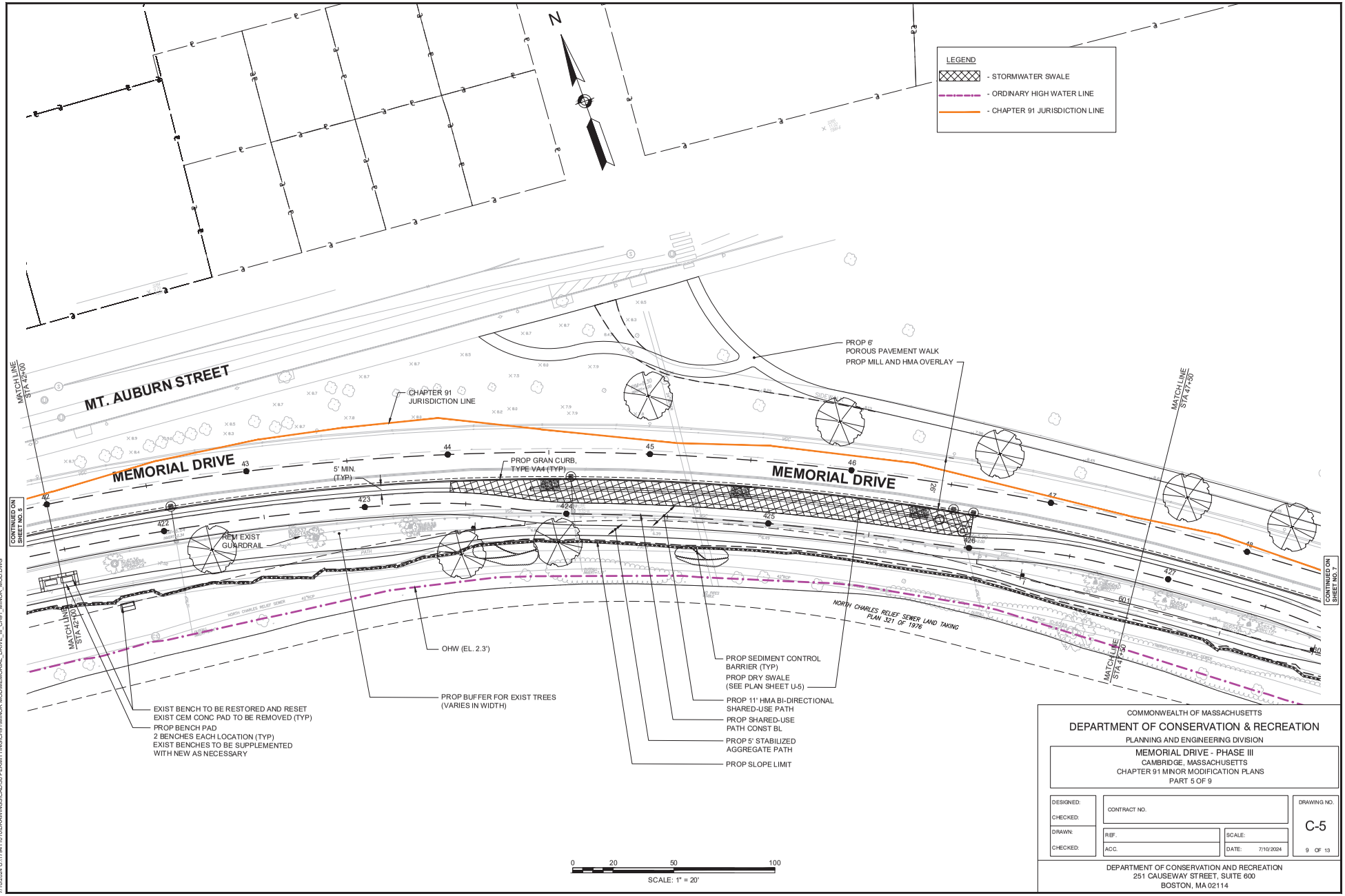
MEMORIAL DRIVE - PHASE III
CAMBRIDGE, MASSACHUSETTS
CHAPTER 91 MINOR MODIFICATION PLANS
PART 4 OF 9

DESIGNED:	CONTRACT NO.	DRAWING NO. C-4
CHECKED:		
DRAWN:	REF.	SCALE:
CHECKED:	ACC.	DATE: 7/10/2024

8 OF 13

DEPARTMENT OF CONSERVATION AND RECREATION
251 CAUSEWAY STREET, SUITE 600
BOSTON, MA 02114

7/10/2024 U:\17941\01\DRAWINGS\CAD\30 PERMITTING\CH91\MINOR MOD\MEMORIAL_DRIVE_III_CH91_MINOR_MOD.DWG



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COMMONWEALTH OF MASSACHUSETTS

DEPARTMENT OF CONSERVATION & RECREATION

PLANNING AND ENGINEERING DIVISION

MEMORIAL DRIVE - PHASE III

CAMBRIDGE, MASSACHUSETTS

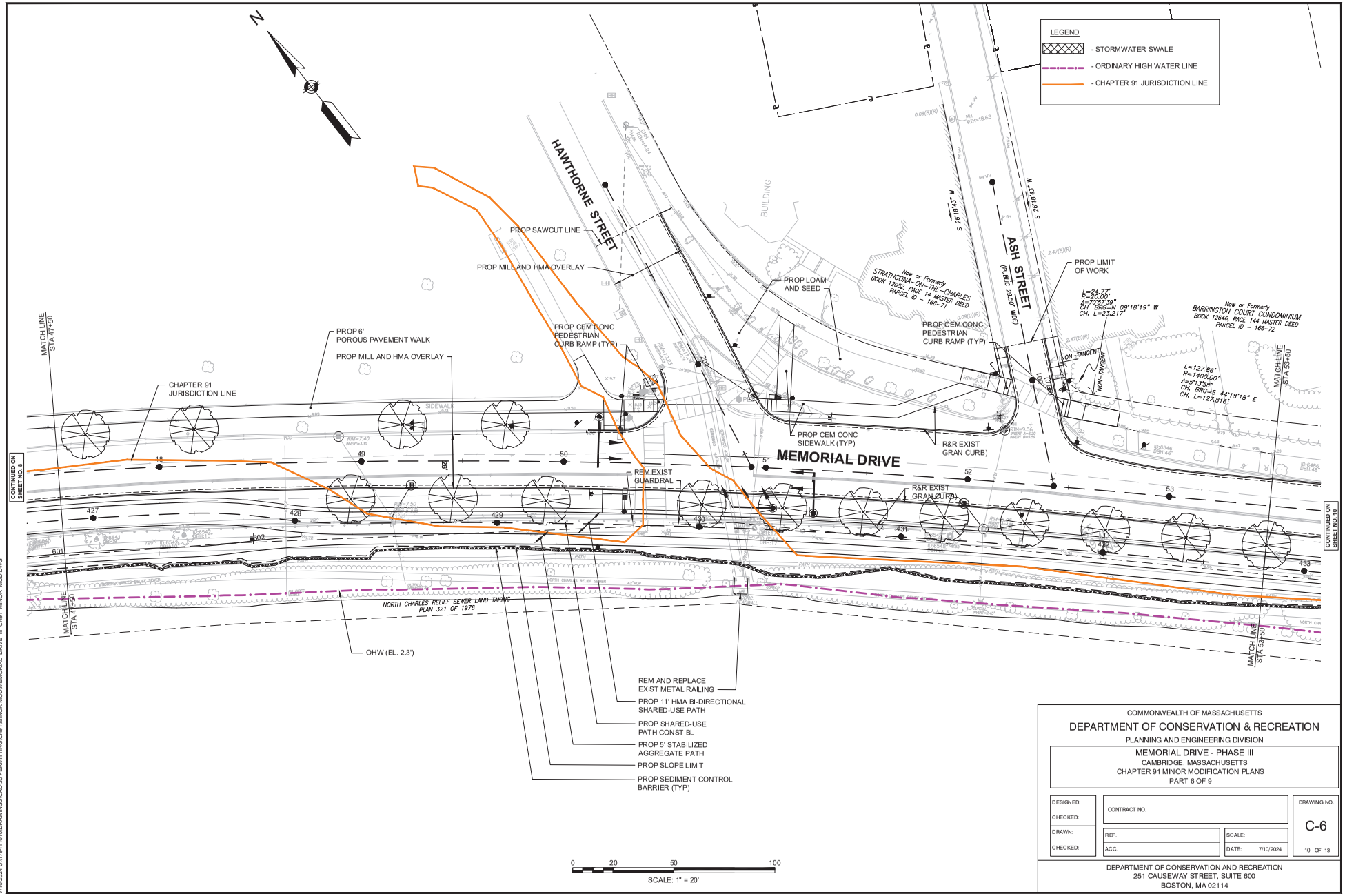
CHAPTER 91 MINOR MODIFICATION PLANS

PART 5 OF 9

DESIGNED:	CONTRACT NO.	DRAWING NO. C-5
CHECKED:		
DRAWN:	REF.	SCALE:
CHECKED:	ACC.	DATE: 7/10/2024

9 OF 13

DEPARTMENT OF CONSERVATION AND RECREATION
251 CAUSEWAY STREET, SUITE 600
BOSTON, MA 02114



COMMONWEALTH OF MASSACHUSETTS

DEPARTMENT OF CONSERVATION & RECREATION

PLANNING AND ENGINEERING DIVISION

MEMORIAL DRIVE - PHASE III

CAMBRIDGE, MASSACHUSETTS

CHAPTER 91 MINOR MODIFICATION PLANS

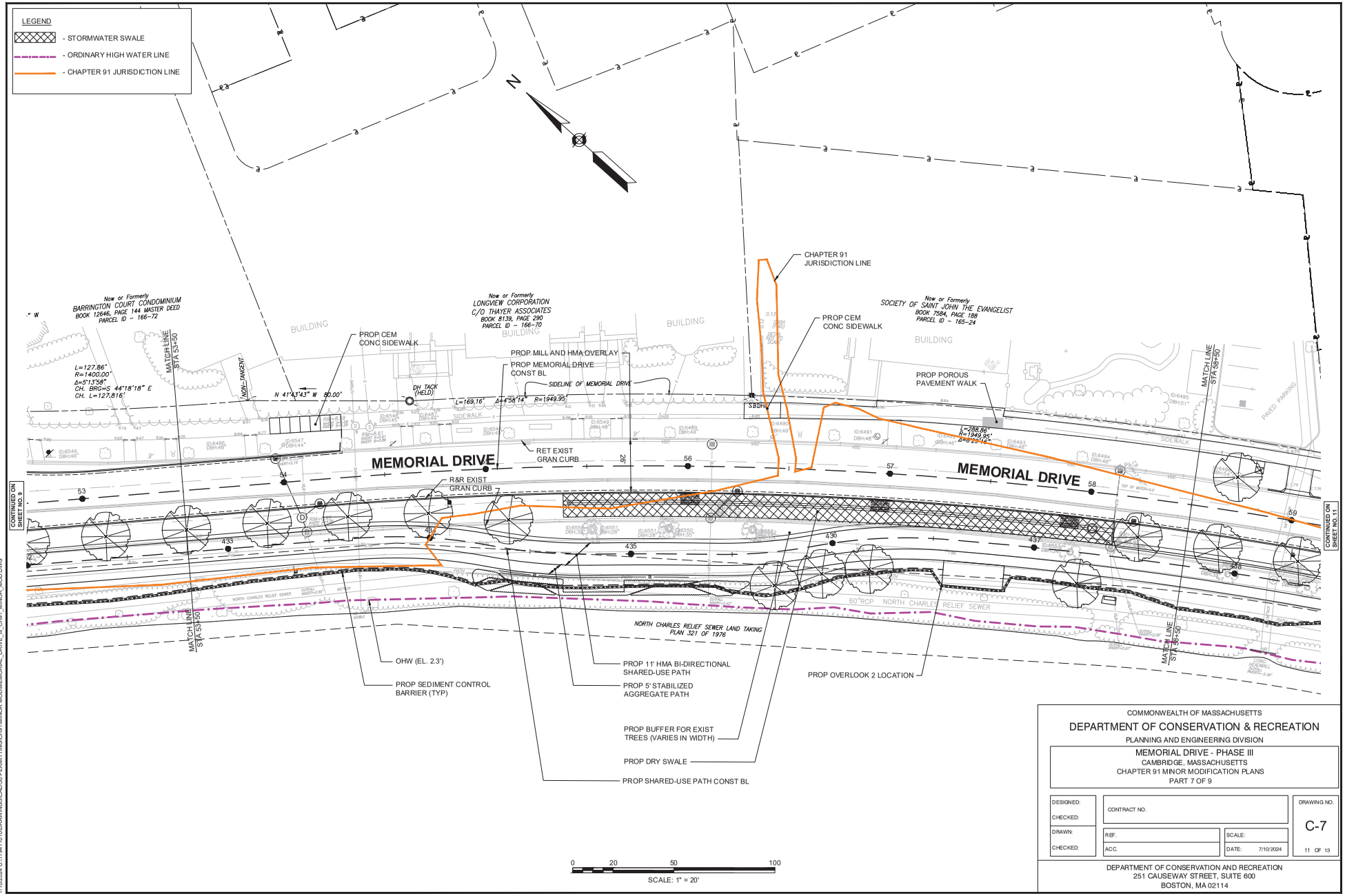
PART 6 OF 9

DESIGNED:	CONTRACT NO.	DRAWING NO. C-6
CHECKED:		
DRAWN:	REF.	SCALE:
CHECKED:	ACC.	DATE: 7/10/2024

10 OF 13

DEPARTMENT OF CONSERVATION AND RECREATION
251 CAUSEWAY STREET, SUITE 600
BOSTON, MA 02114

7/10/2024 U:\17941\10\10\DRAWINGS\CAD\30 PERMITTING\CH91\MINOR MOD\MEMORIAL_DRIVE_III_CH91_MINOR_MOD.DWG



COMMONWEALTH OF MASSACHUSETTS

DEPARTMENT OF CONSERVATION & RECREATION

PLANNING AND ENGINEERING DIVISION

MEMORIAL DRIVE - PHASE III

CAMBRIDGE, MASSACHUSETTS

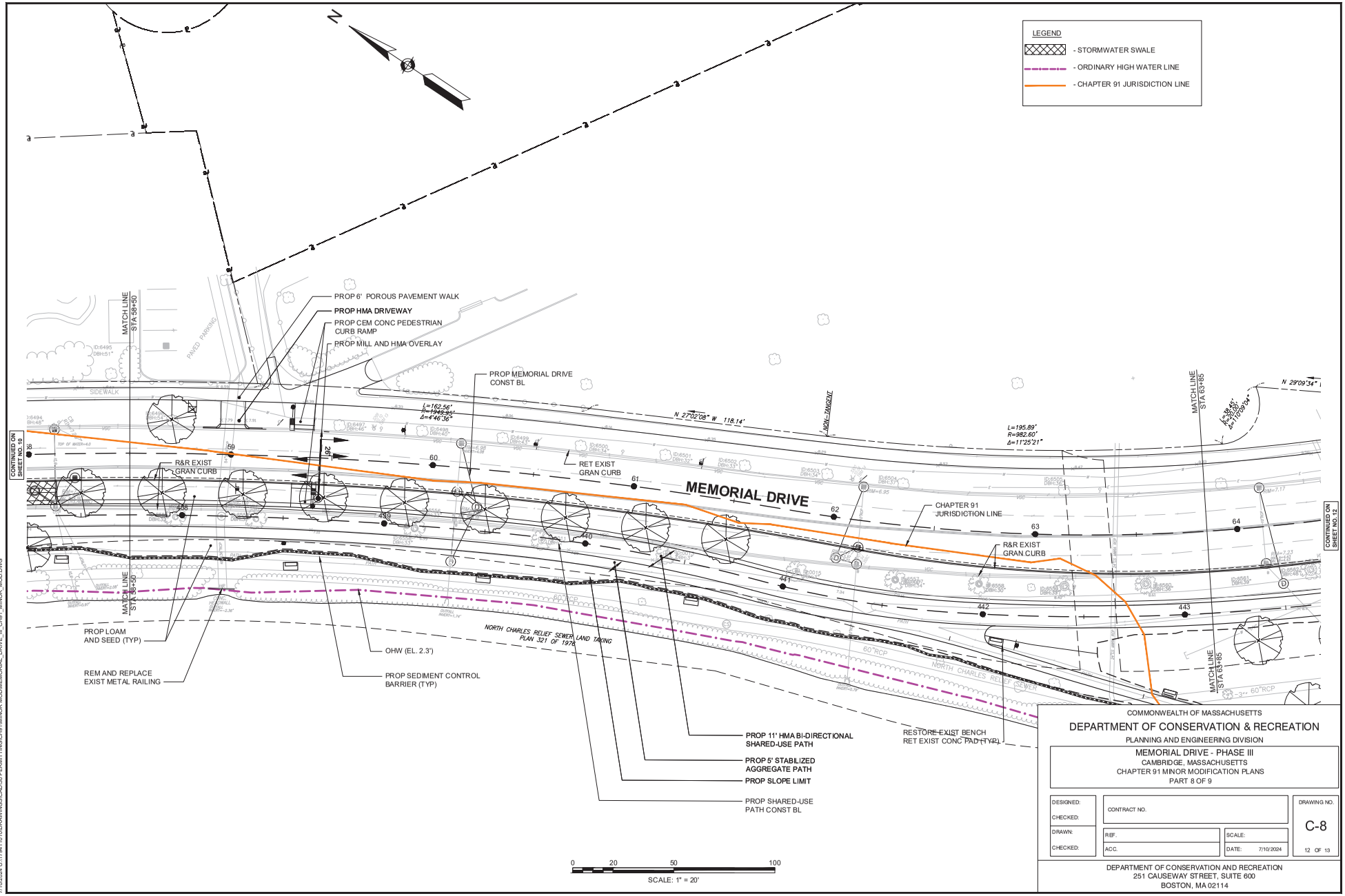
CHAPTER 91 MINOR MODIFICATION PLANS

PART 7 OF 9

DESIGNED:	CONTRACT NO.	DRAWING NO. C-7
CHECKED:		
DRAWN:	REF.	SCALE:
CHECKED:	ACC.	DATE: 7/10/2024

11 OF 13

DEPARTMENT OF CONSERVATION AND RECREATION
251 CAUSEWAY STREET, SUITE 600
BOSTON, MA 02114



COMMONWEALTH OF MASSACHUSETTS

DEPARTMENT OF CONSERVATION & RECREATION

PLANNING AND ENGINEERING DIVISION

MEMORIAL DRIVE - PHASE III

CAMBRIDGE, MASSACHUSETTS

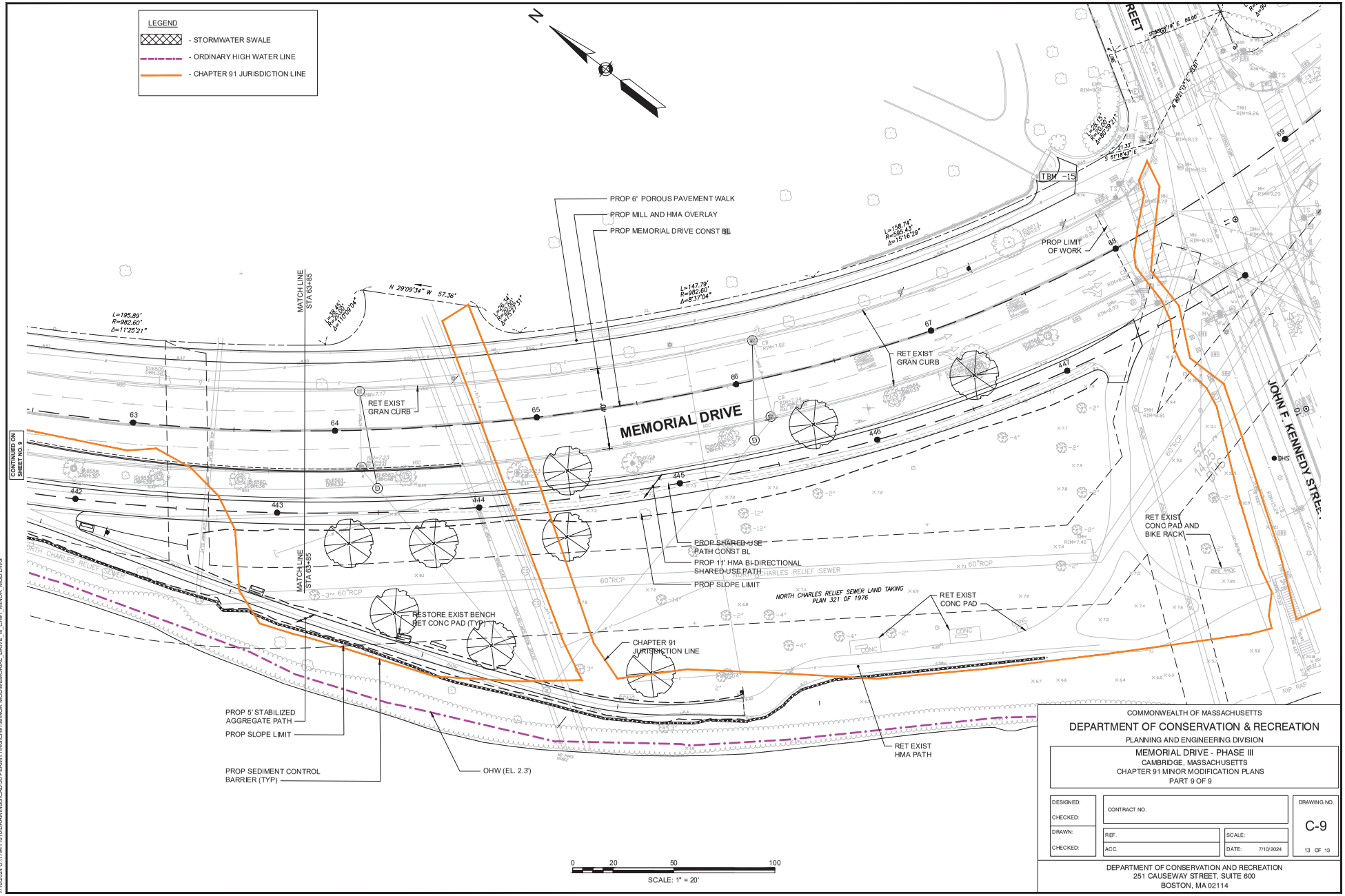
CHAPTER 91 MINOR MODIFICATION PLANS

PART 8 OF 9

DESIGNED:	CONTRACT NO.	DRAWING NO. C-8
CHECKED:		
DRAWN:	REF.	SCALE:
CHECKED:	ACC.	DATE: 7/10/2024

12 OF 13

DEPARTMENT OF CONSERVATION AND RECREATION
251 CAUSEWAY STREET, SUITE 600
BOSTON, MA 02114



COMMONWEALTH OF MASSACHUSETTS

DEPARTMENT OF CONSERVATION & RECREATION

PLANNING AND ENGINEERING DIVISION

MEMORIAL DRIVE - PHASE III

CAMBRIDGE, MASSACHUSETTS

CHAPTER 91 MINOR MODIFICATION PLANS

PART 9 OF 9

DESIGNED:	CONTRACT NO.	DRAWING NO. C-9
CHECKED:		
DRAWN:	REF.	SCALE:
CHECKED:	ACC.	DATE: 7/10/2024

13 OF 13

DEPARTMENT OF CONSERVATION AND RECREATION
251 CAUSEWAY STREET, SUITE 600
BOSTON, MA 02114

7/10/2024 U:\17941\10\10\DRAWINGS\CAD\30 PERMITTING\CH91\MINOR MOD\MEMORIAL_DRIVE_III_CH91_MINOR_MOD.DWG

Chapter 91 Waterways License

No. WW01-0000526

Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection

100 Cambridge Street Suite 900 Boston, MA 02114 • 617-292-5500

Maura T. Healey
Governor

Kimberley Driscoll
Lieutenant Governor

Rebecca L. Tepper
Secretary

Bonnie Heiple
Commissioner

February 28, 2025

Massachusetts Department of Conservation and Recreation, Priscilla Geigis, Deputy Commissioner
c/o Caroline Santangelo, Stantec
40 Water Street, Third Floor
Boston, MA 02109-3604

RE: ISSUANCE OF CHAPTER 91 WATERWAYS LICENSE No. WW01-0000526
Memorial Drive Parkway (adjacent to Parcel Map 241, Lot 14 and Parcel Map 165, Lot 24), Filled Tidelands of the Charles River, Cambridge, Middlesex County

Dear Deputy Commissioner Geigis:

The Department of Environmental Protection hereby issues the above-referenced Waterways License, enclosed, authorizing the Licensee to perform certain activities pursuant to M.G.L. Chapter 91, the Public Waterfront Act and the regulations 310 CMR 9.00. Any change in use or alteration of any structure or fill not authorized by this License shall render this License void.

No work shall be undertaken until the License and accompanying Mylar Plans have been duly recorded in the applicable County Registry of Deeds or the Land Court for the district in which the land is located, within the chain of title of the affected property.

RECORDING OF THE LICENSE

This License and accompanying Mylar Plans must be recorded within the chain of title of the affected property at the appropriate Registry of Deeds or, if registered land, with the Land Registration Office within sixty (60) days from the date of license issuance. In the case of recorded land, the License shall also be noted in the Registry's Grantor Index under the name of the owner of the land upon which the project is located. In the case of the registered land, the License shall also be noted on the Land Court Certificate of Title of the owner of the land upon which the project is located. Failure to record this License within the chain of title of the affected property within sixty (60) days of the date of issuance will render this License void pursuant to 310 CMR 9.18.

Upon recording the License and Plan, you must notify the Department by accessing your Authorization record at https://eplace.eea.mass.gov/citizenaccess and entering the recording information. Instructions for entering recording information may be found at the following link: https://www.mass.gov/doc/eplace-waterways-recording-information-amendment/download Failure to notify the Department of the recording of this License is a violation of 310 CMR 9.00.

CERTIFICATE OF COMPLIANCE

Pursuant to 310 CMR 9.19, once the licensed project is complete, the Licensee must file a Request for a Certificate of Compliance form, BRP WW05, within sixty (60) days of completion but in no event later than five (5) years from the License's issuance date, or any extension thereof, in accordance with 310 CMR 9.19(1). The license for any project for which such a request is not filed and certificate issued may be revoked pursuant to 310 CMR 9.26.

Please contact the Waterways Regulation Program at dep.waterways@mass.gov if there are any questions.

Sincerely,

Daniel J. Padien
Program Chief
Waterways Regulation Program

cc: Mayor's Office, City of Cambridge
Office of the City Manager, City of Cambridge
Cambridge Planning Board
Cambridge Conservation Commission (DEP File #123-0324)
MassDCR, Priscilla Geigis, Deputy Commissioner

Encl: Chapter 91 Waterways License No. WW01-0000526

The Commonwealth of Massachusetts

No. WW01-0000526

Whereas, Massachusetts Department of Conservation and Recreation

of -- Boston -- in the County of -- Suffolk -- and Commonwealth aforesaid, has applied to the Department of Environmental Protection for License to construct and maintain two (2) overlook decks, as further detailed below ----------

and has submitted plans of the same; and whereas due notice of said application, ~~and of the time and place fixed for a hearing thereon,~~ has been given, as required by law, to the -- Municipal Official -- of the -- City of Cambridge; ----------

Now, said Department, having heard all parties desiring to be heard, and having fully considered said application, hereby, subject to the approval of the Governor, authorizes and licenses the said --

Massachusetts Department of Conservation and Recreation -- subject to the provisions of the ninety-first chapter of the General Laws, and of all laws which are or may be in force applicable thereto, to -- install and maintain two (2) pile-supported timber overlook decks (each 12 feet wide by 30 feet long) ----------

on filled tidelands of -- the Charles River -- adjacent to Memorial Drive Parkway (Overlook 1 located adjacent to 300 Mount Auburn Street (Parcel Map 241, Lot 14) and Overlook 2 located adjacent to the Society of Saint John the Evangelist Church (Parcel Map 165, Lot 24)) -- in the -- City of Cambridge -- and in accordance with the locations shown and details indicated on the accompanying License Plan No. WW01-0000526 (13 Sheets), sealed and signed on February 2, 2025 by Richard A, Azzalina, P.E. No. 40219.

Specific Legislative Authorizations and Licenses issued previously at the project site include Harbor

and Land Commission (HLC) License No. 2263 issued on July 26, 1899, HLC License No. 2264 issued on July 19, 1899, HLC License No. 2451 issued on February 28, 1901, and Chapter 371 of the State Legislative Acts of 1929; these authorized structures and/or fill shall be maintained in accordance with the terms and conditions of said Licenses and plans, except as may be modified herein.

The structures authorized hereby shall be limited to the following uses: public access to waterfront open space for passive recreational purposes.

The structures and/or fill authorized pursuant to this License are valid for an unlimited term, pursuant to 310 CMR 9.15(1)(c).

This License is subject to the following Special Conditions and Standard Conditions:

SPECIAL WATERWAYS LICENSE CONDITIONS

1. The Licensee shall maintain all structures and fill in accordance with the terms and conditions specified herein or this License may expire, pursuant to 310 CMR 9.25(1)(c).

2. Any structural alteration, change in use, or any other modification from that explicitly authorized herein and contained on said License Plan, shall require the prior review of the Department to determine whether additional licensing is required pursuant to M.G.L. Chapter 91 and the Waterways Regulations at 310 CMR 9.00.

3. The use by the public of the publicly accessible overlooks authorized herein shall be considered a permitted use, to which the limited liability provisions of M.G.L. Chapter 21, § 17c shall apply.

4. The Licensee shall install and maintain in good repair, a sign adjacent to each overlook that identifies the overlooks are authorized for public use.

5. All structures authorized under this License shall be constructed to meet the Engineering and Construction Standards pursuant to 310 CMR 9.37.

6. The Licensee shall allow agents of the Department to enter the project site to verify compliance with the conditions of this License.

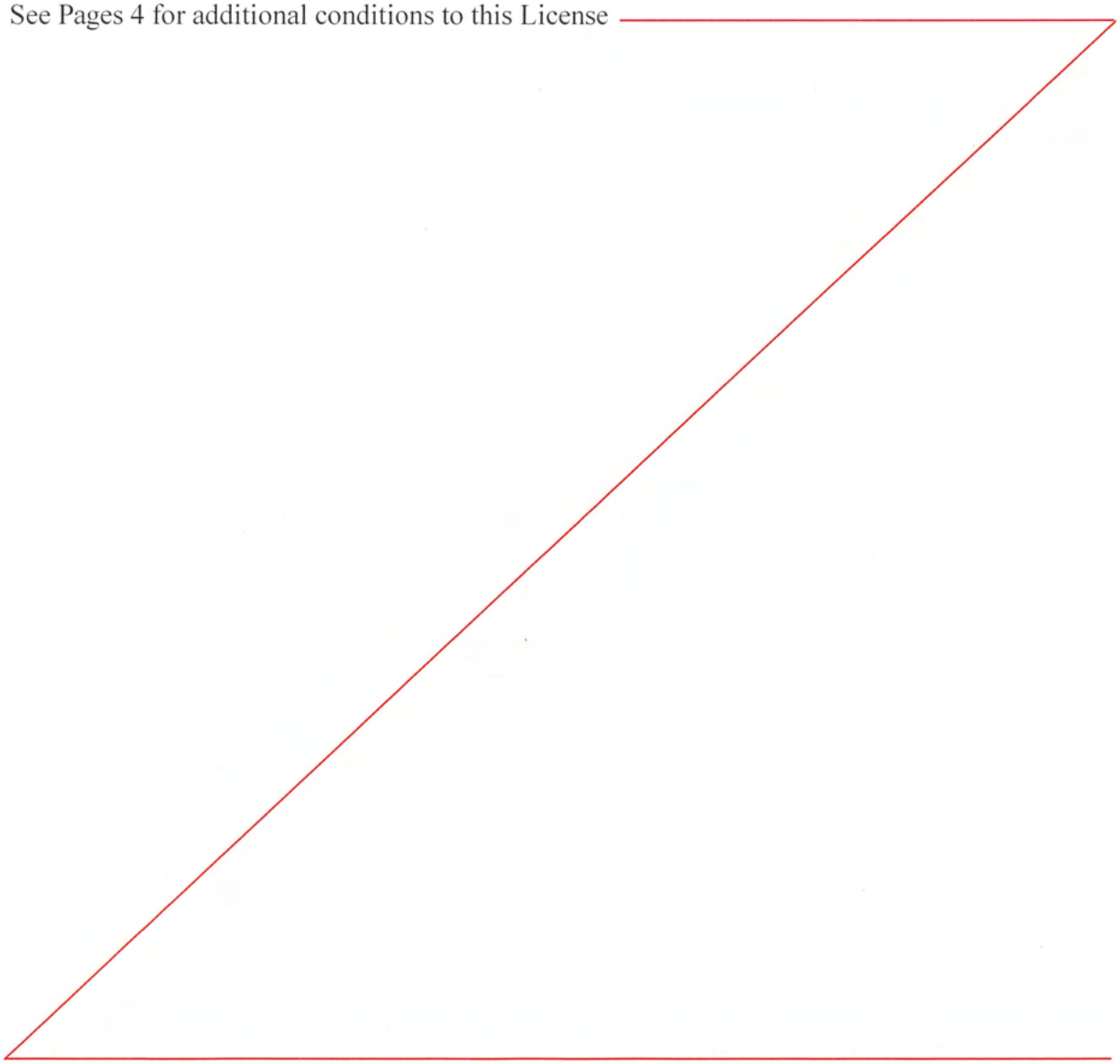
7. All work authorized herein shall be completed within five (5) years of the date of license issuance. Said construction period may be extended by the Department for one or more one year periods without public notice, provided that the Applicant submits to the Department thirty (30) days prior to the end of the construction period, a written request to extend the period and provides adequate

justification for said extension.

8. The Licensee shall request in writing that the Department issue a Certificate of Compliance within sixty (60) days completion of the licensed project, but in no event later than five (5) years from the

date of License issuance, or any extension thereof, in accordance with 310 CMR 9.19(1). The request shall be accompanied by a certification by a registered professional engineer licensed to do business in the Commonwealth that the project was completed in accordance with the plans, specifications, and conditions of this License.

See Pages 4 for additional conditions to this License



STANDARD WATERWAYS LICENSE CONDITIONS

1. Acceptance of this Waterways License shall constitute an agreement by the Licensee to conform with all terms and conditions stated herein.

2. This License is granted upon the express condition that any and all other applicable authorizations necessitated due to the provisions hereof shall be secured by the Licensee prior to the commencement of any activity or use authorized pursuant to this License.

3. Any change in use or any substantial structural alteration of any structure or fill authorized herein shall require the issuance by the Department of a new Waterways License in accordance with the provisions and procedures established in Chapter 91 of the Massachusetts General Laws. Any unauthorized substantial change in use or unauthorized substantial structural alteration of any structure or fill authorized herein shall render this Waterways License void.

4. This License shall be revocable by the Department for noncompliance with the terms and conditions set forth herein. This License may be revoked after the Department has given written notice of the alleged noncompliance to the Licensee and those persons who have filed a written request for such notice with the Department and afforded them a reasonable opportunity to correct said noncompliance. Failure to correct said noncompliance after the issuance of a written notice by the Department shall render this License void and the Commonwealth may proceed to remove or cause removal of any structure or fill authorized herein at the expense of the Licensee, its successors and assigns as an unauthorized and unlawful structure and/or fill.

5. The structures and/or fill authorized herein shall be maintained in good repair and in accordance with the terms and conditions stated herein and the details indicated on the accompanying license plans.

6. Nothing in this License shall be construed as authorizing encroachment in, on or over property not owned or controlled by the Licensee, except with the written consent of the owner or owners thereof. The Licensee stated that Massachusetts Department of Conservation and Recreation was the property owner at the time the application was submitted.

7. This License is granted subject to all applicable Federal, State, County, and Municipal laws, ordinances and regulations including but not limited to a valid final Order of Conditions issued pursuant to the Wetlands Protection Act, M.G.L. Chapter 131, §40.

8. This License is granted upon the express condition that the use of the structures and/or fill authorized hereby shall be in strict conformance with all applicable requirements and authorizations of the MassDEP.

9. This License authorizes structure(s) and/or fill on:

_____Private Tidelands - In accordance with the public easement that exists by law on Private Tidelands, the Licensee shall allow the public to use and to pass freely upon the area of the subject property lying between the high and low water marks, for the purposes of fishing, fowling, navigation, and the natural derivatives thereof.

X____Commonwealth Tidelands - The Licensee shall not restrict the public's right to use and to pass freely, for any lawful purpose, upon lands lying seaward of the low water mark and upon any other lands defined as Commonwealth Tidelands. Said lands are held in trust by the Commonwealth for the benefit of the public.

_____Great Pond of the Commonwealth - The Licensee shall not restrict the public's right to use and to pass freely upon lands lying seaward of the high water mark for any lawful purpose.

_____Navigable River or Stream - The Licensee shall not restrict the public's right to use and to pass freely, for any lawful purpose, in the waterway.

No restriction on the exercise of these public rights shall be imposed unless otherwise expressly provided in this License.

10. Unless otherwise expressly provided by this License, the Licensee shall not limit the hours of availability of any areas of the subject property designated for public passage, nor place any gates, fences, or other structures on such areas in a manner that would impede or discourage the free flow of pedestrian movement thereon.

The amount of tidewater displaced by the work hereby authorized has been ascertained by said Department, and compensation thereof has been made by the said -- Massachusetts Department of Conservation and Recreation -- by paying into the treasury of the Commonwealth -- (N/A) -- for each cubic yard so displaced, being the amount hereby assessed by said Department (N/A).

Nothing in this License shall be so construed as to impair the legal rights of any person.

This License shall be void unless the same and the accompanying Mylar Plans are recorded within the chain of title for the affected property within sixty (60) days from the date hereof, in the Registry of Deeds for the -- Southern District – of the County of -- Middlesex.

In witness whereas, said Department of Environmental Protection have hereunto set their hands this 28th day of February in the year 2025.

Commissioner _____
Bonnie Heiple

Department of Environmental Protection

Program Chief _____
Daniel J. Padien

THE COMMONWEALTH OF MASSACHUSETTS

This License is approved in consideration of the payment into the treasury of the Commonwealth by the said -- Massachusetts Department of Conservation and Recreation -- the further sum of -- (N/A) -- the amount determined by the Governor as a just and equitable charge for rights and privileges hereby granted in the land of the Commonwealth.

BOSTON,

Approved by the Governor.

_____
Maura T. Healey, Governor

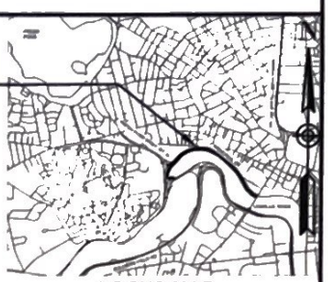
I CERTIFY THAT THIS PLAN, AS PREPARED, CONFORMS TO THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

Richard A. Azzalina 2/5/2025
PROFESSIONAL ENGINEER DATE

DRAWING INDEX

SHEET NO.	DESCRIPTION
1	COVER SHEET
2	LOCUS PLAN
3	EXISTING CONDITION PLAN - OVERLOOK 1
4	LOCUS PLAN - OVERLOOK 1
5	AUTHORIZATION AREAS OVERLOOK 1
6	EXISTING CONDITION PLAN - OVERLOOK 2
7	LOCUS PLAN OVERLOOK 2
8	AUTHORIZATION AREAS - OVERLOOK 2
9	OVERLOOK DECK PLAN
10	OVERLOOK SECTION
11	OVERLOOK PILE LOCATION PLAN
12	OVERLOOK 1 ELEVATION PLAN
13	OVERLOOK 2 ELEVATION PLAN

PROJECT LOCATION



LOCUS MAP
SCALE: 1" = 5000'

PLAN LEGEND

- ORDINARY HIGH WATER (OWH, EL. 2.2 NAVD88)
- FEMA FLOODPLAIN ZONE AE BOUNDARY
- PROPERTY LINE
- EXISTING EASEMENT LINE
- HISTORIC HIGH-WATER LINE
- LIMIT OF WORK TO BE AUTHORIZED

COMMONWEALTH OF MASSACHUSETTS
RICHARD A. AZZALINA
CIVIL
No. 40219
REGISTERED PROFESSIONAL ENGINEER

Richard A. Azzalina

PRIOR CHAPTER 91 AUTHORIZATION

AUTHORIZATION	LICENSEE	DATE
LICENSE 2263	CITY OF CAMBRIDGE	JULY 26, 1899
LICENSE 2264	CITY OF CAMBRIDGE	JULY 19, 1899
LICENSE 2451	CITY OF CAMBRIDGE	FEBRUARY 28, 1901
ACTS 1929 CHAP. 371	METROPOLITAN DISTRICT COMMISSION	JUNE 6, 1929

NOTES

1. EXISTING CONDITIONS DERIVED FROM AN ON-THE-GROUND INSTRUMENT SURVEY WHICH OCCURRED BETWEEN APRIL 2021 AND MAY 2021 AND AERIAL PHOTOGRAMETRY WHICH OCCURRED IN JANUARY 2019.
2. ELEVATIONS REFER TO NAVD88 DATUM.
3. FEMA MAP NUMBER 25017C0557E, ZONE AE, EFFECTIVE DATE: JUNE 4, 2010.
4. ORDINARY HIGH WATER (OHW) ELEVATION WAS DETERMINED BY UTILIZING RECORD PLANS FROM THE MASSDOT ANDERSON MEMORIAL BRIDGE REHABILITATION PROJECT (NO. 605517, PLAN SHEET 128 OF 184)

COVER SHEET
SHEET 1 OF 13
JANUARY 30, 2025

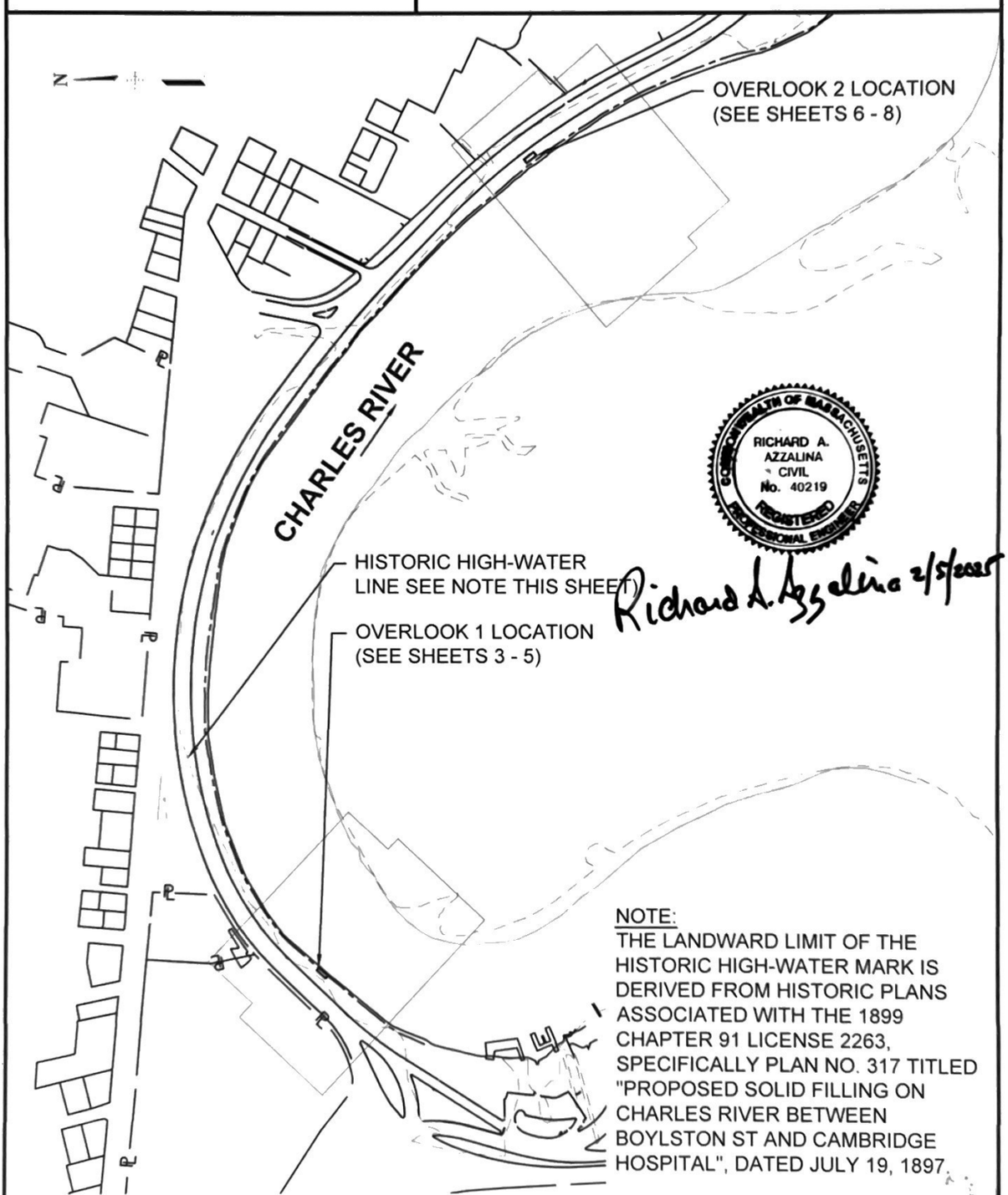
PLAN ACCOMPANYING PETITION OF MASSACHUSETTS DEPARTMENT OF CONSERVATION AND RECREATION TO CONSTRUCT AND MAINTAIN OVERLOOKS ADJACENT TO THE CHARLES RIVER IN THE CITY OF CAMBRIDGE, MASSACHUSETTS.

LICENSE PLAN NO. WW01-0000526
Approved by Department of Environmental Protection of Massachusetts
02/28/2025

I CERTIFY THAT THIS PLAN, AS PREPARED, CONFORMS TO THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

Richard A Azzalina 2/5/2025

NAME DATE



NOTE:
THE LANDWARD LIMIT OF THE HISTORIC HIGH-WATER MARK IS DERIVED FROM HISTORIC PLANS ASSOCIATED WITH THE 1899 CHAPTER 91 LICENSE 2263, SPECIFICALLY PLAN NO. 317 TITLED "PROPOSED SOLID FILLING ON CHARLES RIVER BETWEEN BOYLSTON ST AND CAMBRIDGE HOSPITAL", DATED JULY 19, 1897.

0 300' 600'

SCALE IN FEET
SCALE: 1"= 300'

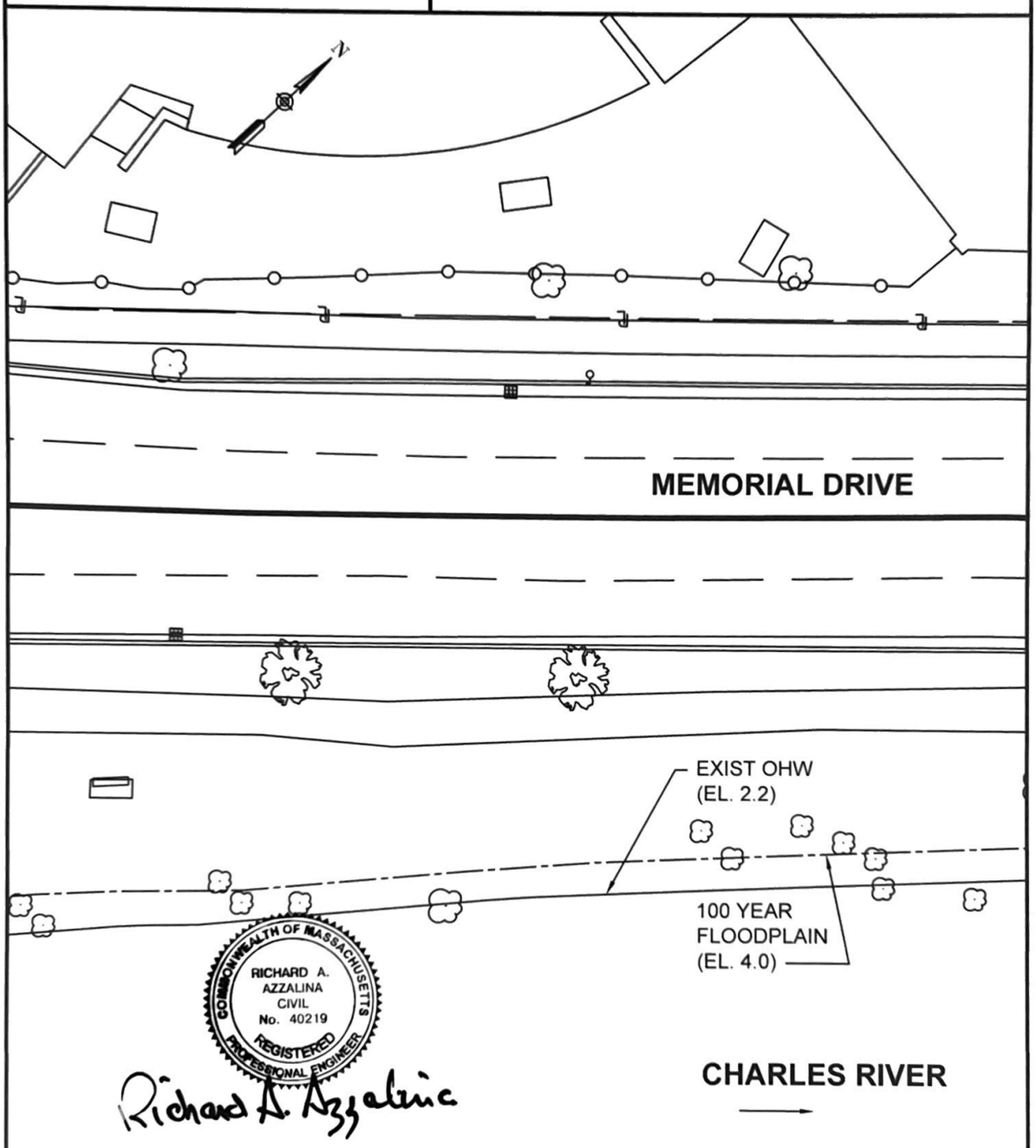
LOCUS PLAN
SHEET 2 OF 13
JANUARY 30, 2025

LICENSE PLAN NO. W01-0000526
Approved by Department of Environmental Protection
Date: 02/28/2025

I CERTIFY THAT THIS PLAN, AS PREPARED, CONFORMS TO THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

Richard A. Azzalina 2/5/2025

NAME DATE



COMMONWEALTH OF MASSACHUSETTS
RICHARD A. AZZALINA
CIVIL
No. 40219
REGISTERED PROFESSIONAL ENGINEER

Richard A. Azzalina

0 20' 40'

SCALE IN FEET
SCALE: 1"= 20'

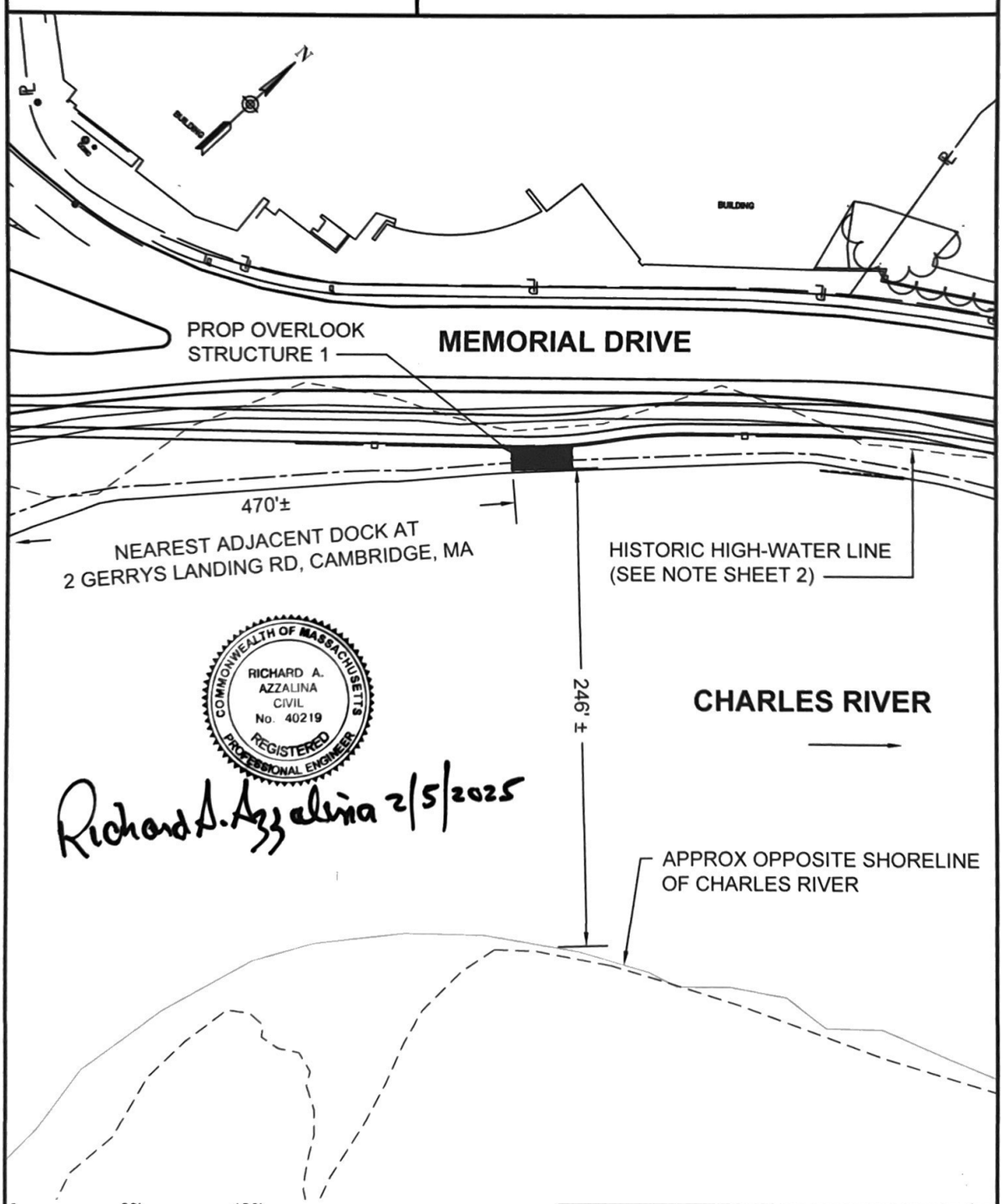
EXISTING CONDITION
PLAN - OVERLOOK 1
SHEET 3 OF 13
JANUARY 30, 2025

LICENSE PLAN NO. W01-000526
Approved by Department of Environmental Protection
Date: 02/28/2025

I CERTIFY THAT THIS PLAN, AS PREPARED, CONFORMS TO THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

Richard A Azzalina 2/5/2025

NAME DATE



COMMONWEALTH OF MASSACHUSETTS
RICHARD A. AZZALINA
CIVIL
No. 40219
REGISTERED PROFESSIONAL ENGINEER

Richard A. Azzalina 2/5/2025

0 60' 120'

SCALE IN FEET
SCALE: 1"= 60'

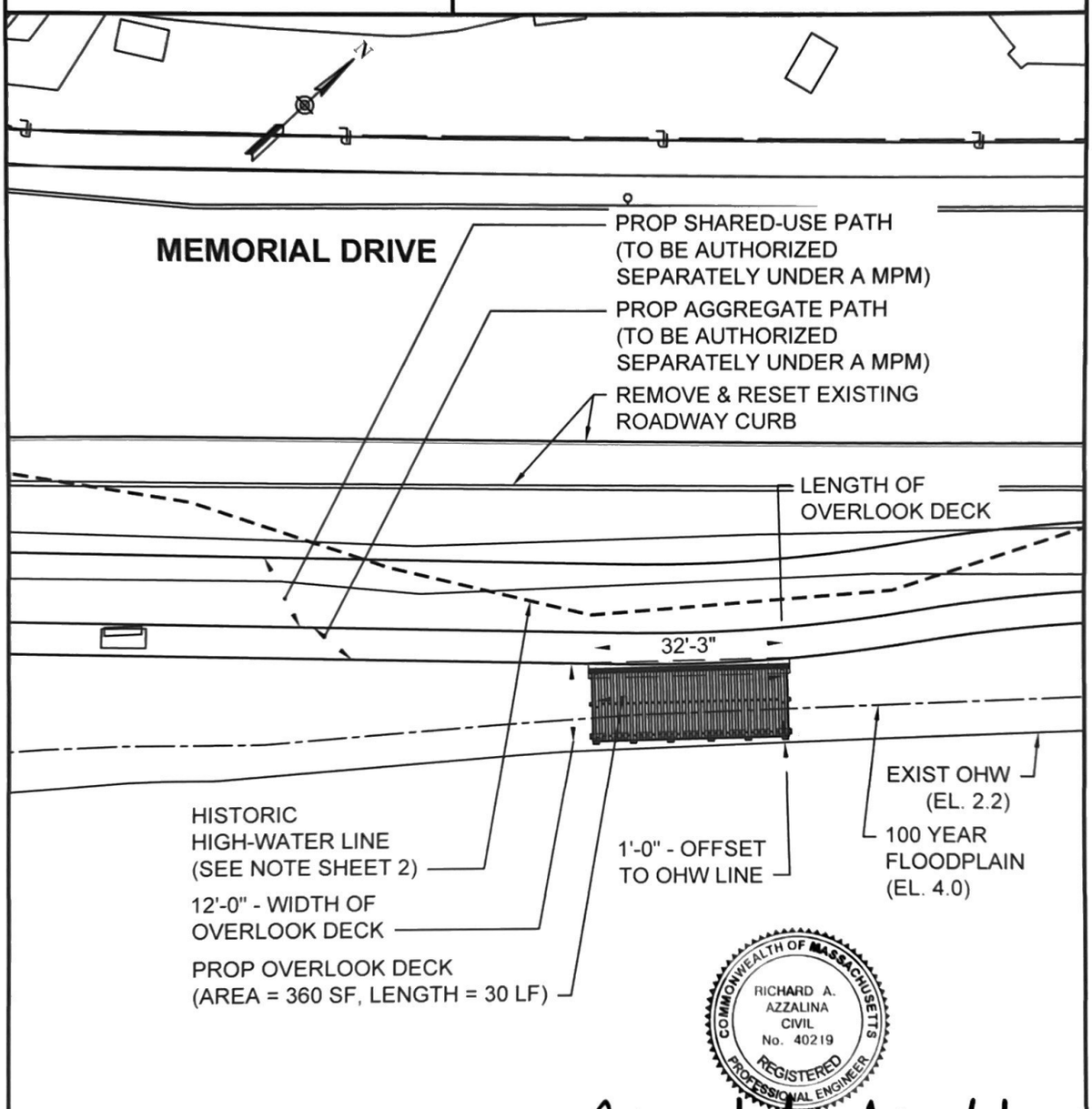
LOCUS PLAN - OVERLOOK 1
SHEET 4 OF 13
JANUARY 30, 2025

LICENSE PLAN NO. WW01-0000526
Approved by Department of Environmental Protection
Date: 02/28/2025

I CERTIFY THAT THIS PLAN, AS PREPARED, CONFORMS TO THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

Richard A. Azzalina 2/5/2025

NAME DATE



COMMONWEALTH OF MASSACHUSETTS
RICHARD A. AZZALINA
CIVIL
No. 40219
REGISTERED PROFESSIONAL ENGINEER

Richard A. Azzalina 2/5/2025

0 20' 40'

SCALE IN FEET
SCALE: 1"= 20'

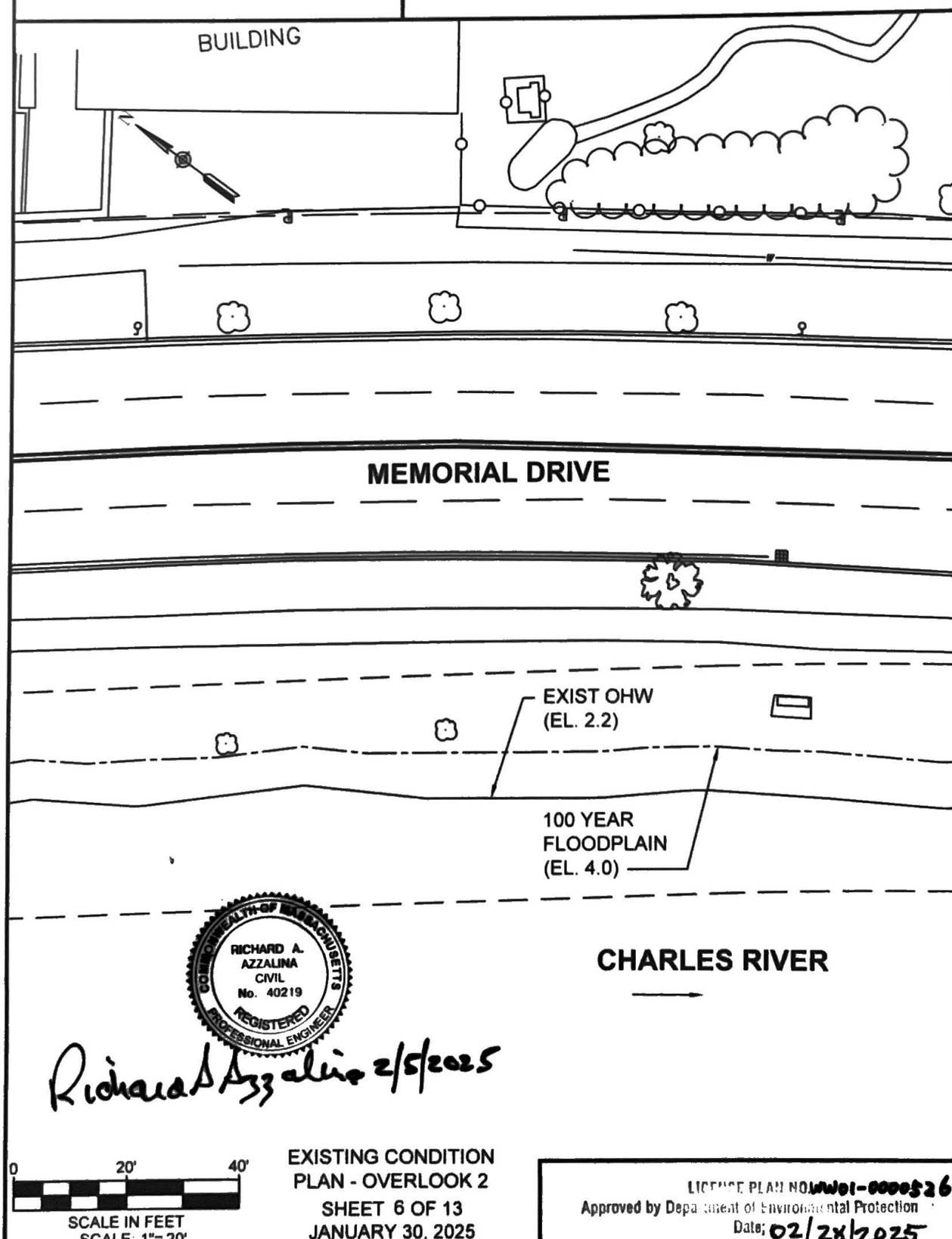
AUTHORIZATION AREAS
OVERLOOK 1
SHEET 5 OF 13
JANUARY 30, 2025

LICENSE PLAN NO. W001-0000526
Approved by Department of Environmental Protection
Date: 02/28/2025

I CERTIFY THAT THIS PLAN, AS PREPARED, CONFORMS TO THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

Richard A. Azzalina 2/5/2025

NAME DATE



COMMONWEALTH OF MASSACHUSETTS
RICHARD A. AZZALINA
CIVIL
No. 40219
REGISTERED PROFESSIONAL ENGINEER

Richard A. Azzalina 2/5/2025

0 20' 40'

SCALE IN FEET
SCALE: 1"= 20'

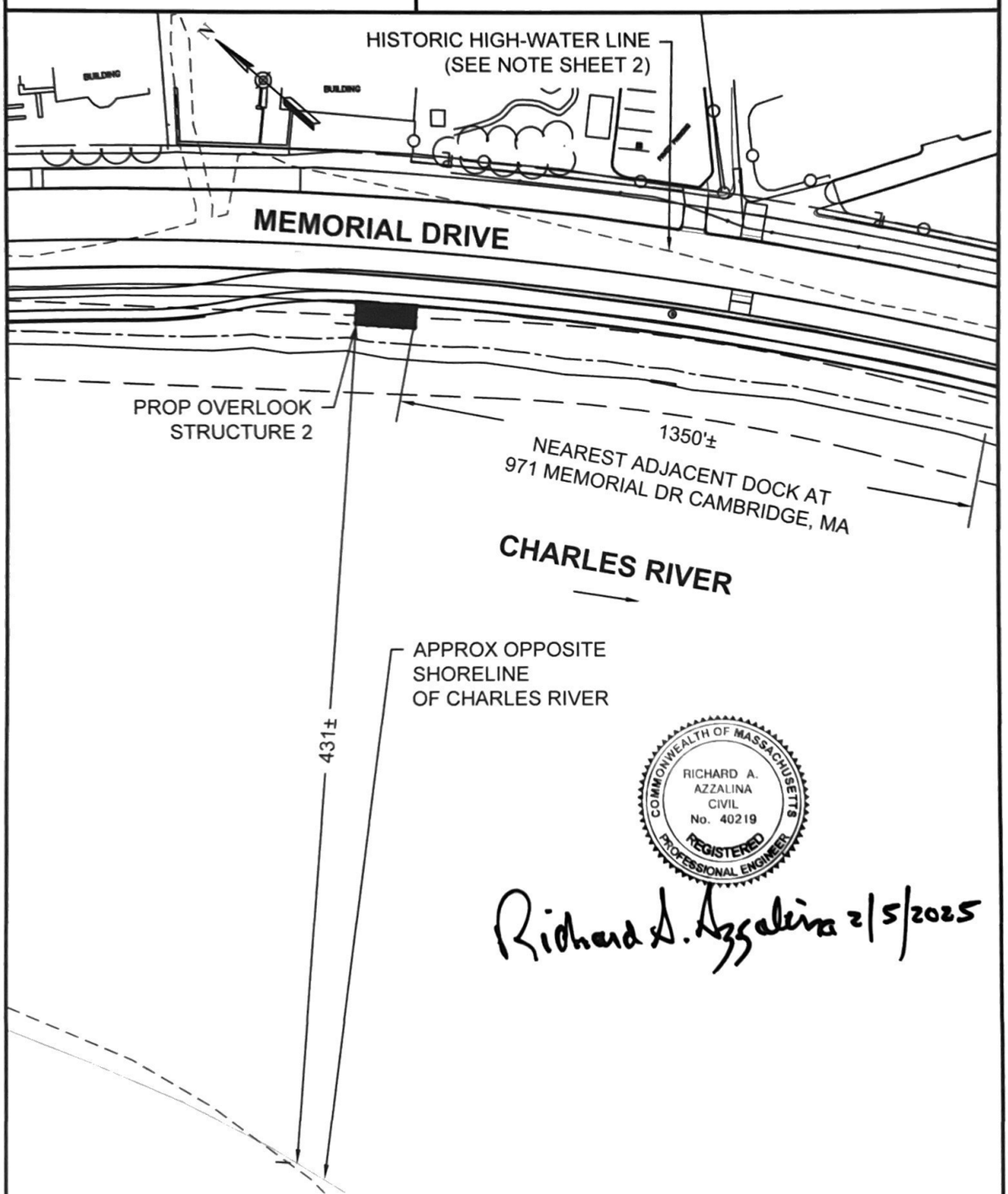
EXISTING CONDITION
PLAN - OVERLOOK 2
SHEET 6 OF 13
JANUARY 30, 2025

LICENSE PLAN NO. W01-0000526
Approved by Department of Environmental Protection
Date: 02/28/2025

I CERTIFY THAT THIS PLAN, AS PREPARED, CONFORMS TO THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

Richard A Azzalina 2/5/2025

NAME DATE



COMMONWEALTH OF MASSACHUSETTS
RICHARD A. AZZALINA
CIVIL
No. 40219
REGISTERED PROFESSIONAL ENGINEER

Richard A. Azzalina 2/5/2025

0 60' 120'

SCALE IN FEET
SCALE: 1"=60'

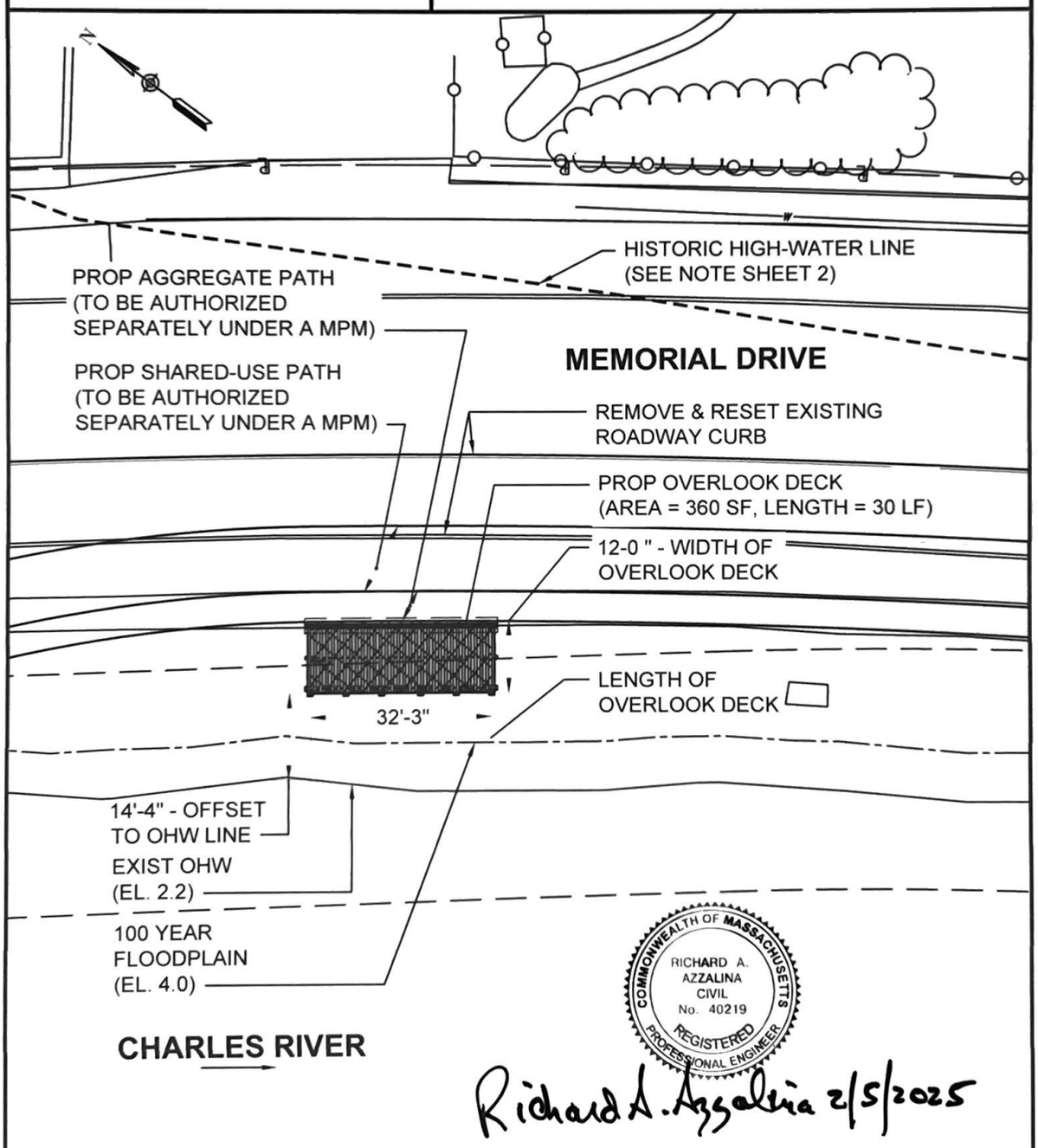
LOCUS PLAN OVERLOOK 2
SHEET 7 OF 13
JANUARY 30, 2025

LICENSE PLAN NO. WW01-0000526
Approved by Department of Environmental Protection
Date: 02/28/2025

I CERTIFY THAT THIS PLAN, AS PREPARED, CONFORMS TO THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

Richard A Azzalina 2/5/2025

NAME DATE



COMMONWEALTH OF MASSACHUSETTS
RICHARD A. AZZALINA
CIVIL
No. 40219
REGISTERED PROFESSIONAL ENGINEER

Richard A. Azzalina 2/5/2025

0 20' 40'

SCALE IN FEET
SCALE: 1"= 20'

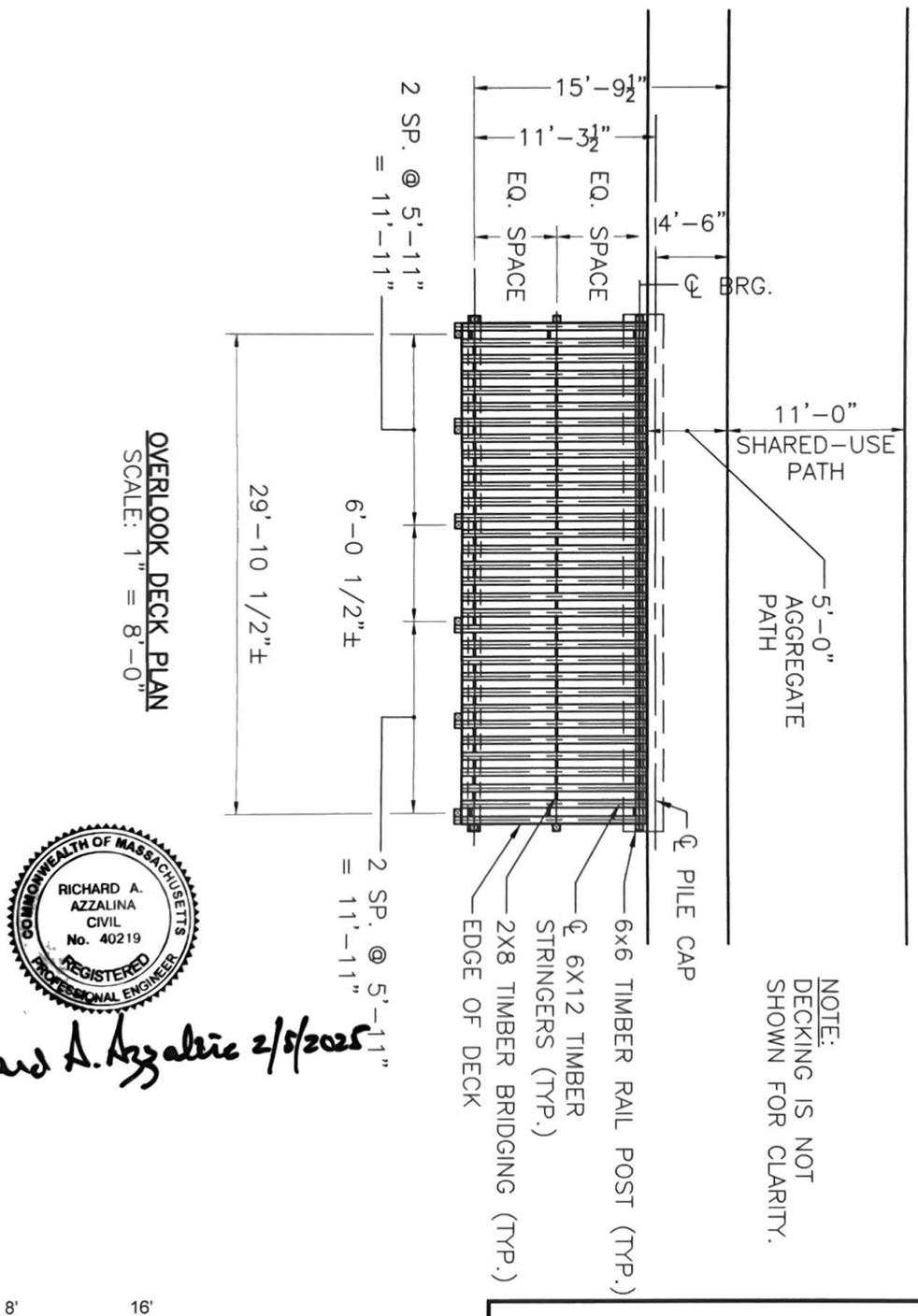
AUTHORIZATION AREAS - OVERLOOK 2
SHEET 8 OF 13
JANUARY 30, 2025

LICENSE PLAN NO. W801-000526
Approved by Department of Environmental Protection
Date: 02/28/2025

I CERTIFY THAT THIS PLAN, AS PREPARED, CONFORMS TO THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

Richard A. Azzalina 2/5/2025

NAME DATE



OVERLOOK DECK PLAN
SCALE: 1" = 8'-0"

COMMONWEALTH OF MASSACHUSETTS
RICHARD A. AZZALINA
CIVIL
No. 40219
REGISTERED PROFESSIONAL ENGINEER

Richard A. Azzalina 2/5/2025

0 8' 16'
SCALE IN FEET
SCALE: 1"= 8'

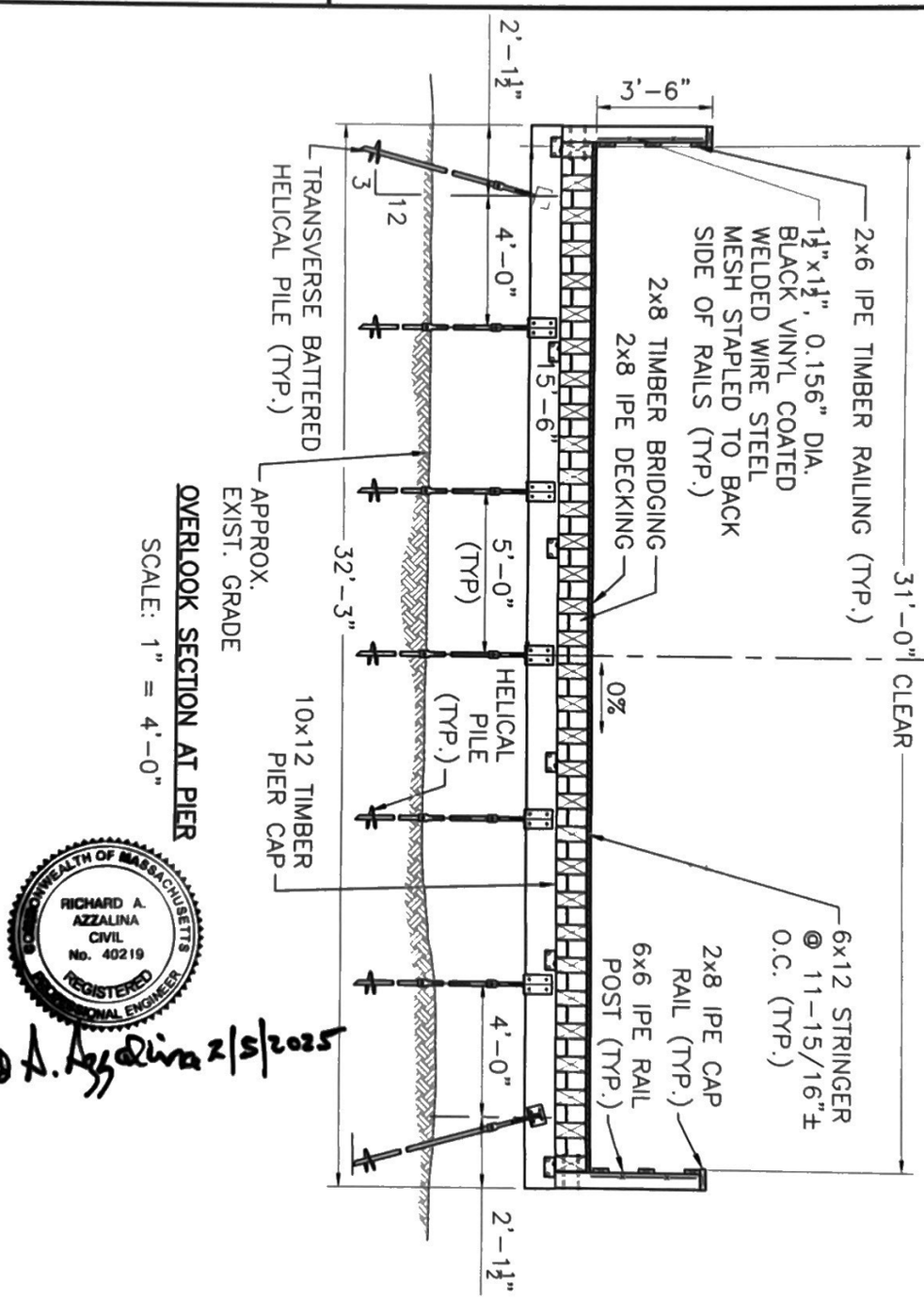
OVERLOOK DECK PLAN
SHEET 9 OF 13
JANUARY 30, 2025

LICENSE PLAN NO. WW01-0000526
Approved by Department of Environmental Protection
Date: 02/28/2025

I CERTIFY THAT THIS PLAN, AS PREPARED, CONFORMS TO THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

Richard A. Azzalina 2/5/2025

NAME DATE



OVERLOOK SECTION AT PIER

SCALE: 1" = 4'-0"

COMMONWEALTH OF MASSACHUSETTS
RICHARD A. AZZALINA
CIVIL
No. 40219
REGISTERED PROFESSIONAL ENGINEER

Richard A. Azzalina 2/5/2025

0 4' 8'

SCALE IN FEET
SCALE: 1"=4'

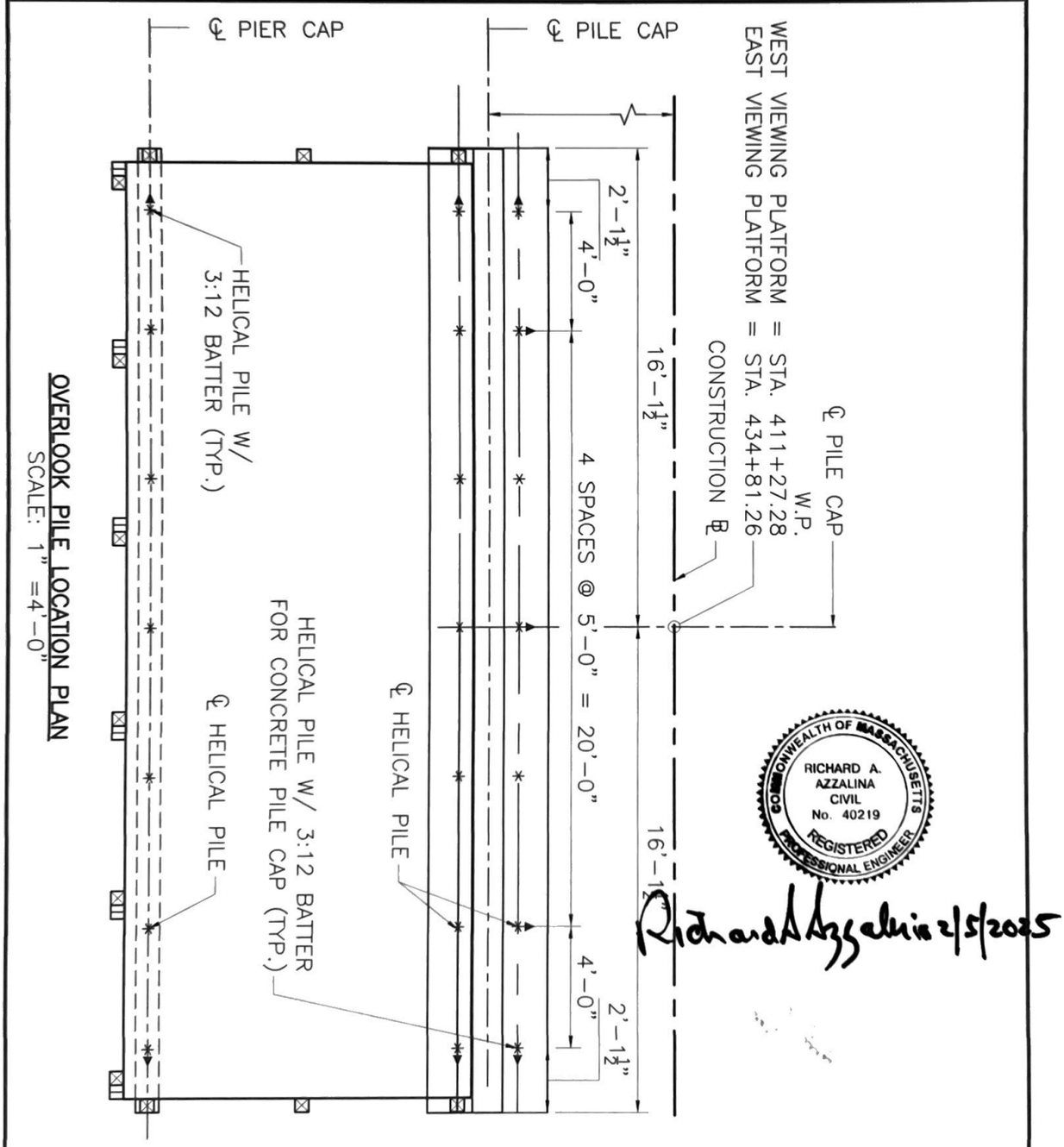
OVERLOOK SECTION
SHEET 10 OF 13
JANUARY 30, 2025

LICENSE PLAN NO. WW01-0005526
Approved by Department of Environmental Protection
Date: 02/28/2025

I CERTIFY THAT THIS PLAN, AS PREPARED, CONFORMS TO THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

Richard A Azzalina 2/5/2025

NAME DATE



OVERLOOK PILE LOCATION PLAN
SCALE: 1" =4'-0"

COMMONWEALTH OF MASSACHUSETTS
RICHARD A. AZZALINA
CIVIL
No. 40219
REGISTERED PROFESSIONAL ENGINEER

Richard A Azzalina 2/5/2025

0 4' 8'
SCALE IN FEET
SCALE: 1"=4'

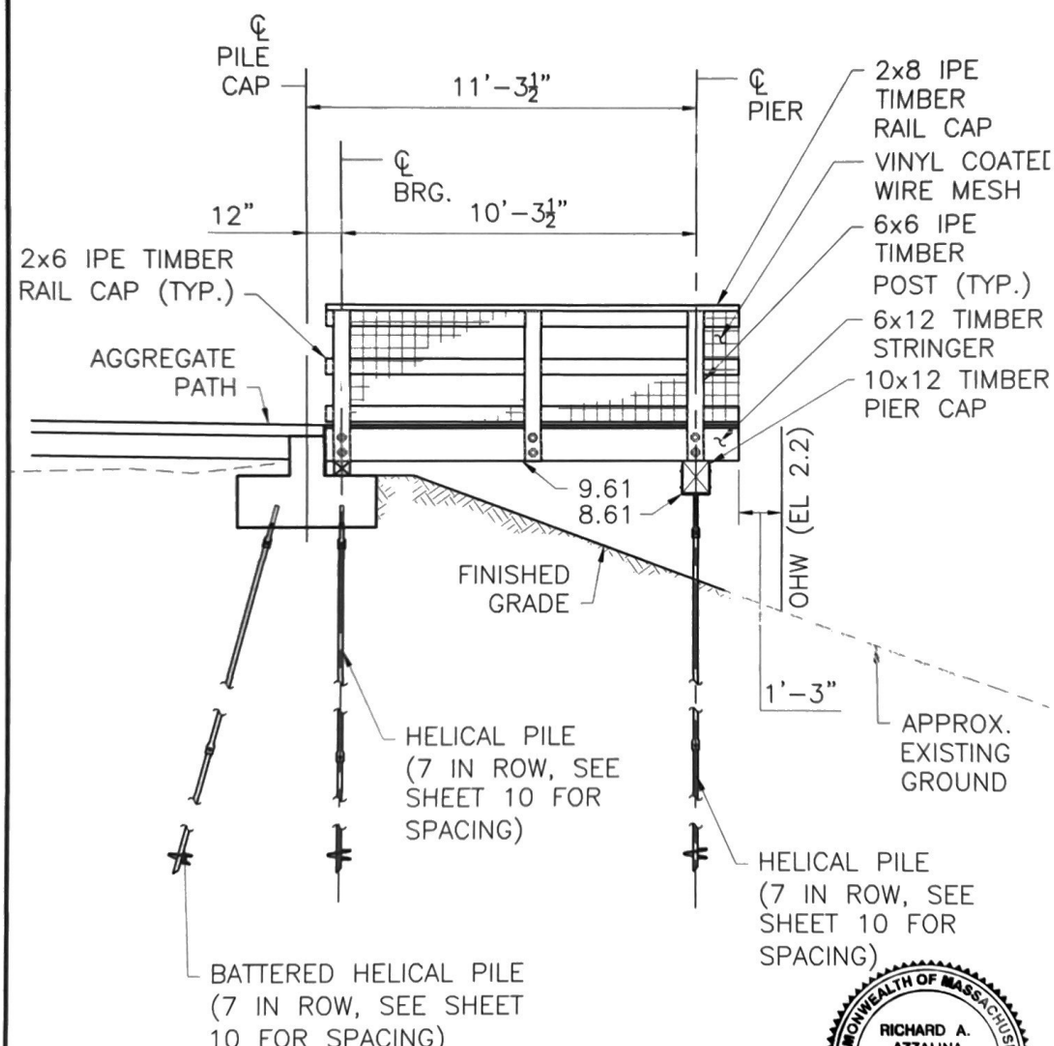
OVERLOOK PILE LOCATION PLAN
SHEET 11 OF 13
JANUARY 30, 2025

LICENSE PLAN NO. WW01-0000526
Approved by Department of Environmental Protection
Date: 02/28/2025

I CERTIFY THAT THIS PLAN, AS PREPARED, CONFORMS TO THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

Richard Azzalina 2/5/2025

NAME DATE



OVERLOOK 1 ELEVATION
SCALE: 1" = 4'-0"

COMMONWEALTH OF MASSACHUSETTS
RICHARD A. AZZALINA
CIVIL
No. 40219
REGISTERED PROFESSIONAL ENGINEER

Richard A. Azzalina 2/5/2025

0 4' 8'
SCALE IN FEET
SCALE: 1"=4'

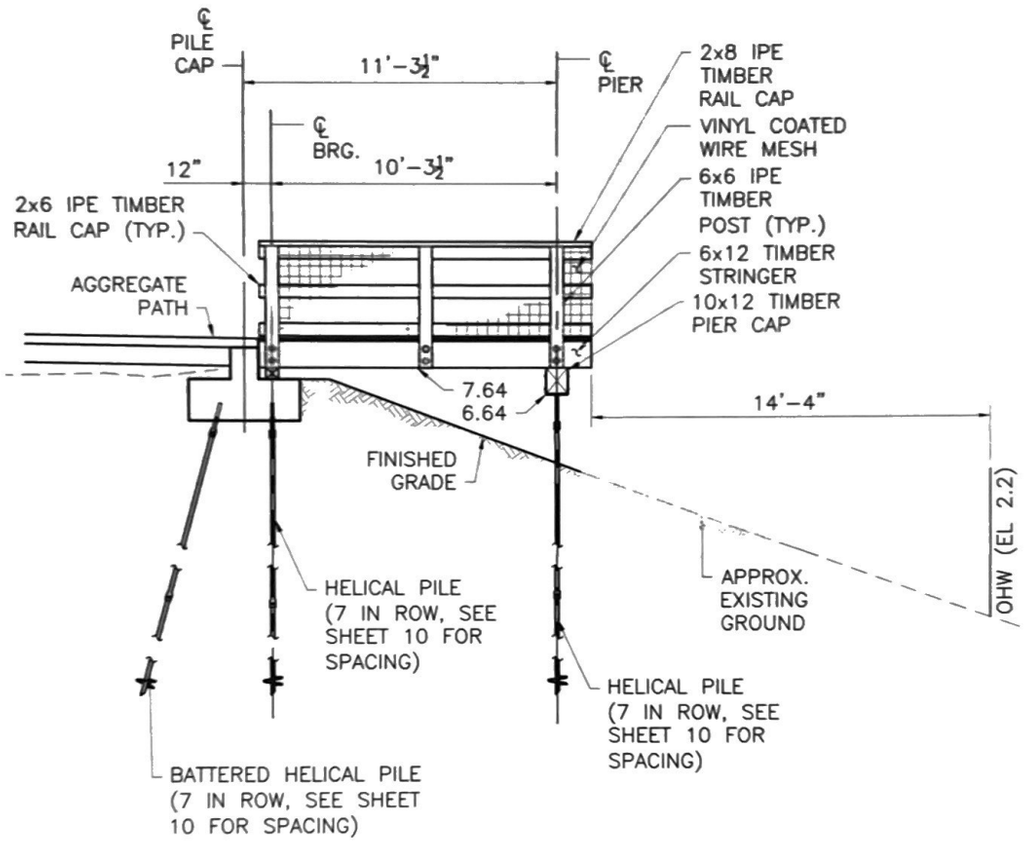
OVERLOOK 1 ELEVATION PLAN
SHEET 12 OF 13
JANUARY 30, 2025

LICENSE PLAN NO. WW01-0000526
Approved by Department of Environmental Protection
Date: 02/28/2025

I CERTIFY THAT THIS PLAN, AS PREPARED, CONFORMS TO THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

Richard A Azzalina 2/5/2025

NAME DATE



OVERLOOK 2 ELEVATION
SCALE: 1" = 5'-0"

COMMONWEALTH OF MASSACHUSETTS
RICHARD A. AZZALINA
CIVIL
No. 40219
REGISTERED PROFESSIONAL ENGINEER

Richard A Azzalina

0 5' 10'
SCALE IN FEET
SCALE: 1"= 5'

OVERLOOK 2 ELEVATION PLAN
SHEET 13 OF 13
JANUARY 30, 2025

LICENSE PLAN NO. WW01-0000526
Approved by Department of Environmental Protection
Date: 02/26/2025

MWRA 8(m) Permit #24-07-2264M

Terms and Conditions

MASSACHUSETTS WATER RESOURCES AUTHORITY

PERMIT

8m Permit # 24-07-2264M

16-Sep-24

MA Department of Conservation and
Recreation
10 Park Plaza Suite 6620
Boston, MA 02116

This Permit is subject to the 8(m) Permit Terms and Conditions, and the 8(m) Permit Special Terms and Conditions, if any, attached hereto and made a part hereof. Permittee agrees that it shall be bound by, and shall comply with, said Terms and Conditions.

The land is described as follows:

MWRA Section 183 (North Charles Relief Sewer) along Memorial Drive as depicted within "Memorial Drive - Phase III Cambridge, MA Construction Plans Part 7 of 9" dated 7/8/24.

You may use the land for the purpose of:

Reconstruction of a section of Memorial Drive from the Eliot St. Bridge to the intersection of JFK Street. Construction includes the proposed muti-use path and park amenities and proposed Overlook Structure near MWRA Section 183 between Sta. 108+48 and Sta. 78+27.

Approved as to Form:
Massachusetts Water Resources Authority

Christopher John
Law Division

Approved
Massachusetts Water Resources Authority

Deputy Chief OO, PP&P

This Permit is subject to the 8(m) Permit Terms and Conditions, and the 8(m) Permit Special Terms and Conditions, if any, attached hereto and made a part hereof. Permittee agrees that it shall be bound by, and shall comply with, said Terms and Conditions.

Permittee: Daniel Driscoll / Daniel Driscoll, DCR

Signature Print Name

This Permit shall have no effect until such time as the Authority issues the fully executed original of this Permit.

Massachusetts Water Resources Authority
2 Griffin Way
Chelsea, MA 02150
Attn: Wastewater Operations - Permitting Department

8(m) PERMIT TERMS AND CONDITIONS

1. Permittee shall be responsible to stay apprised of and comply with all applicable federal, state and local laws, rules, and orders including, but not limited to, guidelines and requirements for construction sites, and all supplements, amendments and/or changes thereto and notices thereof. Prior to commencing work pursuant to this Permit, Permittee shall have obtained all other required permits, written approval(s) and necessary authorizations to perform the work. Failure to comply with the terms stated herein shall render this Permit null and void by the Authority, and Permittee shall bear all responsibility, liability, damages and costs arising from the Permittee's noncompliance.

2. Permittee's use of the permitted land shall at no time interfere with the Authority's activities or operations on the permitted land. The Authority has the right to review and approve all of the Permittee's work including such plans and specifications, as the Authority deems necessary. Any proposed future work beyond the scope of this Permit shall have the prior written approval of the Authority.

3. To the fullest extent permitted by law, the Permittee shall indemnify, defend with counsel acceptable to the Authority, keep and save harmless the Authority and its board members, officers, representatives, contractors, agents, employees, successors, and assigns, in both their individual and official capacities, against all suits, claims, liabilities, damages, losses (including but not limited to loss of use resulting therefrom) and expenses, including but not limited to attorney's fees, caused by, arising out of or resulting from any work or activity under this Permit and/or act, omission, breach or default of the Permittee or of any contractor, subcontractor of vendor of the Permittee or anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder.

4. The granting of this Permit shall in no way interfere with the rights of the Authority to exercise its existing rights in or over the permitted land. Permittee acknowledges that the Authority, within its sole discretion, may enter upon the permitted land at any time in order to carry out inspections, maintenance, repairs, replacements, or other activities.

5. The Authority may revoke this Permit at any time. The sale or disposition of the permitted land by its owner will cause this Permit to terminate without further notice. Permittee shall give the Authority at least 72 hours notice before commencing the operations as pursuant herein. This Permit shall not be assigned or transferred.

6. No blasting, drilling or other activity that could in any way affect the integrity or operability of the Authority's property or use of the permitted land shall be permitted without express prior written approval of the Authority.

7. The Permittee shall remove, at its own expense, within six months of the date of written notice from the Authority, any or all conduits and appurtenances installed by the Permittee under this Permit if, in the Authority's sole discretion, such removal is necessary for the operation, maintenance or replacement of the Authority's infrastructure.

8. To the fullest extent permitted by law, and in consideration of the issuance of this Permit, Permittee hereby releases the Authority and its board members, officers, representatives, contractors, agents, employees, successors, and assigns, in both their individual and official capacities, from all suits, claims, liabilities, damages, losses (including but not limited to loss of use resulting therefrom) and expenses, including but not limited to attorney's fees, caused by, arising out of or resulting from any work or activity under this Permit and/or act, omission, breach or default of the Permittee or of any

contractor, subcontractor of vendor of the Permittee or anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder. This release includes, but is not limited to, all suits, claims, liabilities, damages (including, but not limited to, direct, indirect, and consequential damages, economic loss, and loss of profits) and losses which are attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property, including the loss of use resulting therefrom, together with all attorneys' fees, costs and expenses.

9. The Permittee shall conduct design, construction, and excavation in accordance with all federal, state and local safety regulations, including but not limited to, federal OSHA regulations (29 CFR 1926) and Massachusetts Department of Public Safety regulations (520 CMR 14.00). During construction, Permittee shall take appropriate sheeting and shoring measures to protect the integrity of the Authority's water and/or sewer mains. Permittee shall submit design plans stamped by a professional engineer licensed in Massachusetts to the Authority for approval prior to the start of construction.

10. The Permittee shall adjust any or all Authority frames and covers to grade within the limits of work in accordance with the plans referenced in this Permit. The Authority will provide the Permittee with new replacement Authority frames and covers that have been deemed unusable by the Authority.

11. If the Permittee is proposing to take borings and/or place test pits within the permitted land, the Permittee shall mark the proposed boring and test pit locations on the ground using paint and/or stakes and submit engineering documents to the Authority showing the proposed boring and test pit locations. Authority staff will review all boring and test pit locations at the site. Upon written clearance of the proposed boring and test pit locations by Authority staff and subject to Permittee providing the Authority with seventy-two (72) hours prior notice, Permittee may commence work at the site.

    The Permittee shall be responsible for the locations of proposed borings and test pits regardless of any act or omission of the Authority. The Permittee shall be responsible for repairing and/or replacing, at the Authority's election, the Authority's property or infrastructure, which is damaged as a result of the Permittee's, its contractors, agents, representatives, employees, and/or invitees activities pursuant to this Permit. The Permittee's obligations under this paragraph shall include payment to the Authority for all costs to repair all such damage caused to the Authority's property.

Permanent Solution with Conditions

Activity and Use Limitation (AUL)
2 Gerrys Landing Road, Cambridge, MA

RTN 3-27723

PERMANENT SOLUTION WITH CONDITIONS

2 Gerry's Landing Road
Cambridge, Massachusetts

RTN 3-27723

Prepared for:
Cambridge Boat Club
2 Gerry's Landing Road
Cambridge, Massachusetts 02138

Prepared by:
Stantec
400 Crown Colony Drive, Suite 200
Quincy, Massachusetts 02169

October 4, 2016

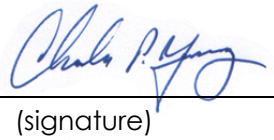
Sign-off Sheet

This document entitled PERMANENT SOLUTIONWITH CONDITIONS was prepared by Stantec Consulting Services Inc. ("Stantec") for the account of Cambridge Boat Club (the "Client"). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by 

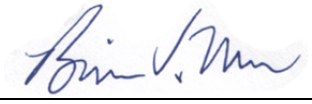
(signature)

Nathan Gardner

Reviewed by 

(signature)

Charles Young, LSP

Approved by 

(signature)

Brian Moran, PE, LSP

Table of Contents

EXECUTIVE SUMMARY I

1.0 INTRODUCTION 1.1

2.0 SITE INFORMATION 2.2
2.1 SITE ADDRESS & RELEASE TRACKING NUMBER 2.2
2.2 RELATED PERMANENT OR TEMPORARY SOLUTION STATEMENTS 2.2
2.3 ACTIVITY AND USE LIMITATION 2.2
2.4 ASSUMPTIONS OF CURRENT OR FUTURE USE 2.3
2.5 ACTIVE EXPOSURE PATHWAY ELIMINATION MITIGATION MEASURES 2.3
2.6 LICENSED SITE PROFESSIONAL OPINION 2.3
2.7 PERMANENT SOLUTION CERTIFICATION 2.3
2.8 UPPER CONCENTRATION LIMITS 2.4
2.9 ANALYTICAL METHODS CERTIFICATION 2.4
2.10 CATEGORY OF PERMANENT SOLUTION 2.4

3.0 DISPOSAL SITE LOCATION AND BOUNDARIES 3.5

4.0 CONCEPTUAL SITE MODEL 4.6

5.0 RESPONSE ACTIONS AND ASSESSMENT 5.7
5.1 RELEASE DESCRIPTION, DISCOVERY, AND REPORTING 5.7
5.2 CONTAMINANTS OF CONCERN 5.7
5.3 ASSESSMENT SUMMARY 5.7
5.4 REMEDIATION WASTE 5.10

6.0 DEMONSTRATION OF SOURCE CONTROL 6.11

7.0 REPRESENTATIVENESS EVALUATION AND DATA USABILITY ASSESSMENT 7.12
7.1 FIELD SCREENING 7.12
7.2 CLOSURE SAMPLING 7.12
7.3 TEMPORAL DATA 7.12
7.4 FIELD COMPLETENESS 7.12
7.5 DATA INCONSISTENCY 7.13
7.6 DATA NOT USED 7.13
7.7 DATA USABILITY 7.13

8.0 RISK CHARACTERIZATION 8.15
8.1 LIGHT NON-AQUEOUS PHASE LIQUIDS 8.15
8.1.1 Non-Stable NAPL versus NAPL with Micro-Scale Mobility 8.16
8.1.2 Multiple Lines of Evidence Approach 8.17
8.1.3 Recommended Simplified Approach 8.23
8.2 IDENTIFICATION OF SITE GROUNDWATER AND SOIL CATEGORIES 8.29
8.2.1 Groundwater Classification Criteria 8.29

8.2.2 Identification of Applicable Groundwater Categories 8.29
8.2.3 Soil Classification Criteria 8.29
8.2.4 Identification of Applicable Soil Categories 8.30
8.3 CHARACTERIZATION OF RISK OF HARM 8.30
8.3.1 Human Health 8.30
8.3.2 Safety 8.33
8.3.3 Public Welfare 8.33
8.3.4 Environment 8.34

9.0 FEASIBILTY TO ACHIEVE BACKGROUND 9.35
9.1 CONDITIONS OF CATEGORICAL FEASIBILITY 9.35
9.2 CONDITIONS OF CATEGORICAL INFEASIBILITY 9.36

10.0 POST-CLOSURE MONITORING 10.37

11.0 DOCUMENTATION OF PUBLIC NOTICE REQUIREMENTS 11.38

LIST OF TABLES

Table 1: Soil Analysis Summary: EPH and PAH
Table 2: Groundwater Analysis Summary: EPH
Table 3: Recovery Over Time in the Source Area (in text)
Table 4: LNAPL Recovery Volume in Well B-201 (OW) (in text)
Table 5: LNAPL Recovery Volume in Well Rw-2 (in text)
Table 6: EPCs for Soil In The Source Area (in text)
Table 7: Shortform Results (in text)

LIST OF FIGURES

Figure 1: Site Locus Map
Figure 2: MassGIS Map
Figure 3: Site Plan
Figure 4: LNAPL Thickness RW-2 (in text)
Figure 5: LNAPL Thickness B-201 (OW) (in text)
Figure 6: Recovery Decline Curve Analysis B-201 (OW) (in text)

LIST OF APPENDICES

Appendix A: Activity and Use Limitation
Appendix B: Laboratory Analytical Data
Appendix C: Gauging Logs
Appendix D: Shortforms
Appendix E: Waste Manifest
Appendix F: Public Involvement Letter

Executive Summary

Assessment performed at the Cambridge Boat Club to date indicates that a release of #2 fuel oil occurred from a crack in a fill pipe feeding the fuel storage tanks located in the boiler room below the on-site structure. As a result, persistent free-phase fuel oil is present in two wells in the immediate release area below the former fill pipe. Laboratory analytical data indicates that concentrations of petroleum in soil are generally limited to locations where oil initially migrated, and only two locations exceed Massachusetts regulatory standards. Groundwater data from six monitoring wells at the Site indicate that groundwater outside of the immediate release area has not been impacted.

Remedial actions to remove or reduce the presence of free-phase oil were performed in the release area. The thickness of free-phase oil in groundwater below the former fill pipe was initially measured at approximately 11 inches. After the completion of six recovery events using a vacuum truck, the thickness of free-phase oil has been reduced considerably to an average of 4.5 inches in the two wells during the last two rounds of gauging (April, 2014 and May, 2015). Further passive recovery of oil was performed for a year following the vacuum extractions.

The initial remedial goal of reducing oil to a thickness of 0.5 inches could not be achieved, based on the amount of time and cost associated with recovery operations. It has been documented that similar-type sites are generally difficult to remediate due to the asymptotic recovery rate of free-phase oil. However, changes to Massachusetts cleanup regulations in June of 2014 allowed for closure via a Permanent Solution with Conditions, since the free-phase oil present at the Site has been demonstrated as stable. A deed restriction has been implemented to restrict future use and construction activities in the small portion of the property impacted by the release.

1.0 INTRODUCTION

Stantec Consulting Services Inc. (Stantec) formerly Fay, Spofford, and Thorndike, LLC [FST] and Norfolk Ram Group, LLC [Norfolk]) has prepared this Permanent Closure with Conditions pursuant to 310 CMR 40.0000 (the Massachusetts Contingency Plan [MCP]), for 2 Gerry's Landing Road in Cambridge, Massachusetts (the Site).

The Site is the location of a release of fuel oil to soil and groundwater. The release was discovered in 2008 when visual and olfactory evidence of fuel oil was observed in soil and groundwater at the southwestern corner of the building. Norfolk submitted to the Massachusetts Department of Environmental Protection (MassDEP) a Phase II Comprehensive Site Assessment, Phase III Remedial Action Plan, Release Abatement Measure (RAM) Completion, and Class C-2 Response Action Outcome (RAO) dated June 1, 2012. Changes to the MCP in June of 2014 allowed for closure via a Permanent Solution with Conditions, since light non-aqueous phase liquid (LNAPL) at the Site is considered stable and has micro-scale mobility. An Activity and Use Limitation (AUL) has been implemented to restrict future use and serve as notification of the presence of LNAPL in a small area below the front entrance of the building.

Stantec began working toward a Permanent Solution when draft regulations were released that allowed for closure of release sites with stable NAPL that exhibited micro-scale mobility. Once Stantec determined that this release could conform to the requirements for closure under the proposed regulatory changes, Stantec performed additional assessment and well gauging in April of 2014. Between 2014 and 2015, FST and Cambridge Boat Club worked with the property owner (DCR) to secure approval to close out the release whcih requires an Activity and Use Limitation (AUL). When DCR was conceptually agreeable to the conditions, Stantec performed a final round of well gauging in May of 2015. Stantec then prepared a draft closure report and draft AUL in early July of 2015 for review by all parties, which finally resulted in executed AUL documents in September 2016. The sampling and gauging data on which this report relies was current at the time of preparation of this report. It is Stantec's opinion that the results and conclusions of this report remain valid. This report documents through a 'lines of evidence' approach that the remaining NAPL at the Site is stable, and does not present significant risk.

The site location is illustrated on the Site Locus Map included as Figure 1. The property is developed with a two-story structure with an open-air boat storage area. The boat storage area is below grade on the western side of the building, and opens to the bank of the Charles River on the eastern side.

PERMANENT SOLUTION
WITH CONDITIONS

Introduction
October 4, 2016

Licensed Site Professional:

Brian V. Moran, P.E., LSP
Stantec Consulting Services Inc.
400 Crown Colony Drive, Suite 200
Quincy, Massachusetts 02169
(617) 786-7960

License Number: 7351

2.0 SITE INFORMATION

2.1 SITE ADDRESS & RELEASE TRACKING NUMBER

Pursuant to 310 CMR 40.1056(1)(a), 40.1056(1)(b) and 40.1056(1)(c), *the site or Disposal Site name, address, DEP RTN, type of permanent solution, and method used to characterize the risk of harm posed by the Disposal Site* is provided on the BWSC-104 form being submitted electronically with this report, and are also provided below:

Disposal Site Name:	Cambridge Boat Club
Responsible Party:	Cambridge Boat Club
Disposal Site Address:	2 Gerry's Landing Road, Cambridge, Massachusetts 02138
Release Tracking Number(s):	3-27723
Permanent Solution type:	Permanent Solution with Conditions
Risk Characterization Methods:	Method 1

2.2 RELATED PERMANENT OR TEMPORARY SOLUTION STATEMENTS

Pursuant to 310 CMR 40.1056(1)(d), *the relationship of the Permanent Solution Statement to any other Permanent or Temporary Solution Statements that have been filed for the disposal site, if applicable, together with a statement as to whether any additional response actions are needed for any other portions of the disposal site* are provided below.

There are no other Permanent or Temporary Solution Statements related to the Site. Additional response actions are not required for any other portion of the Disposal Site.

2.3 ACTIVITY AND USE LIMITATION

Pursuant to 310 CMR 40.1056(1)(e), *indication as to whether the Permanent Solution includes the implementation of an AUL, and if so, the type of AUL implemented at the disposal site* is provided below.

An AUL has been implemented at this Site. The purpose of the AUL is to inform future property owners and construction and utility workers of the presence of residual fuel oil in soil and to prescribe actions that must be followed when encountering this residual contamination. The AUL also limits future uses of the property where residual oil may pose a risk for unrestricted use. These future uses include the use of the property for a residence, daycare facility, school, or

nursery, and prohibits the growing of fruits and vegetables for human consumption. A copy of the AUL is included in Appendix A.

2.4 ASSUMPTIONS OF CURRENT OR FUTURE USE

Pursuant to 310 CMR 40.1056(1)(f), *indication as to whether the Permanent Solution is based upon assumptions about the current or future site activities, uses or conditions that do not require an Activity and Use Limitation pursuant to 310 CMR 40.10132(c) and a description of those assumptions* is provided below.

The Permanent Solution with Conditions is based on the assumption that the current use as a boathouse will be the future use. An AUL has been implemented that does not allow redevelopment of the property for certain uses.

2.5 ACTIVE EXPOSURE PATHWAY ELIMINATION MITIGATION MEASURES

Pursuant to 310 CMR 40.1056(1)(g), *indication as to whether the Permanent Solution is based upon the effective operation of one or more Active Exposure Pathway Elimination Mitigation Measures pursuant to 310 CMR 40.07501025* is provided below.

This Permanent Solution is not based on the operation of any Active Exposure Pathway Elimination Mitigation Measures.

2.6 LICENSED SITE PROFESSIONAL OPINION

Pursuant to 310 CMR 40.1056(1)(h), *an opinion from a Licensed Site Professional as to whether the requirements of the applicable category of Permanent Solution specified in 310 CMR 40.1000 have been met* is provided below.

The requirements of a Permanent Solution with Conditions have been met at the Disposal Site. The licensed site professional (LSP) seal and signature are provided in Section G of the Permanent Solution Statement Transmittal Form (BWSC-104), being submitted via eDEP with this report.

2.7 PERMANENT SOLUTION CERTIFICATION

Pursuant to 310 CMR 40.1056(1)(i), *a certification of the Permanent Solution Statement and all documents submitted with the Permanent Solution Statement, as required by 310 CMR 40.0009* is being submitted concurrently with this report. The certification is provided in the Permanent Solution Statement Transmittal Form (BWSC-104), being submitted via eDEP along with this report.

2.8 UPPER CONCENTRATION LIMITS

Pursuant to 310 CMR 40.1056(1)(j), *indication as to whether oil and/or hazardous material exceed one or more applicable UCLs in soil or groundwater, as described at 310 CMR 40.0996* is provided below.

Concentrations of oil and/or hazardous material (OHM) in soil or groundwater do not exceed applicable upper concentration limits (UCLs).

2.9 ANALYTICAL METHODS CERTIFICATION

Pursuant to 310 CMR 40.1056(1)(k), *indication as to whether the analytical data used to support the Permanent Solution was generated pursuant to the Department's Compendium of Analytical Methods (CAM)* is provided below.

All analytical data collected by FST and Norfolk used to support this Permanent Solution Statement was generated pursuant to CAM. A representativeness evaluation and data usability assessment pursuant to 310 CMR 40.1056(2)(k) is provided in Section 7.0.

2.10 CATEGORY OF PERMANENT SOLUTION

Pursuant to 310 CMR 40.1030, Permanent or Temporary Solutions are categorized as Permanent Solutions with No Conditions, Permanent Solutions with Conditions and Temporary Solutions.

This Permanent Solution with Conditions is categorized as such pursuant to 310 CMR 40.1041(2) because:

(a) the Site poses No Significant Risk;
(b) all Substantial Hazards posed by the disposal site have been eliminated;
(c) an AUL is required to maintain a level of No Significant Risk;
(d) concentrations of oil and/or hazardous material do not exceed UCLs

3.0 DISPOSAL SITE LOCATION AND BOUNDARIES

Pursuant to 310 CMR 40.1056(2)(a) *a clear and accurate description of the location of the site, in the case of a threat of release, or the location and boundaries of the disposal site or portion of disposal site to which the Permanent Solution applies that includes the location of areas characterized as Background relative to the disposal site boundaries. Such description shall reference, to the extent practicable, the location of the site, or location and boundaries of the disposal site or portion thereof relative to permanent or semi-permanent landmarks, location coordinates, and/or surveyed boundaries* is presented below.

The Disposal Site is located at 2 Gerry's Landing Road in West Cambridge. It is located on a portion of the property owned by the Massachusetts Department of Conservation and Recreation (DCR) that borders the Charles River. The geographic location of the Site and surrounding area are depicted on Figure 1 and the Disposal Site boundaries are depicted on Figure 3.

4.0 CONCEPTUAL SITE MODEL

Pursuant to 310 CMR 40.1056(2)(b) *a succinct summary of the Conceptual Site Model* is presented below.

The Site is a boating club that uses fuel oil to heat the first-floor activity rooms. During renovations to the structure in the late 1990s, one of two fill pipes for the aboveground storage tanks (ASTs) was damaged prior to completion of renovations (according to a forensic examination). Subsequent filling of the ASTs through the damaged oil fill pipe contributed to a release of fuel oil that may have occurred over the span of 10 years (until the discovery of the release in May of 2008). The release was primarily contained in the immediate area of the fill pipe due to the structural limitations posed by the foundation walls and concrete piers extending laterally from the foundation. It was initially believed that fuel oil had migrated through crushed stone and gravel used for the renovation and backfill of the structures foundation walls. A refined conceptual model for the migration of fuel oil was established once Norfolk performed assessment along the western foundation wall. This assessment indicated that no gravel was present in proximity to the foundation wall; instead, backfill consisting of peat and silt was encountered, and little to no petroleum contamination was detected in soil at the depth of the water table within two feet of the foundation wall. Furthermore, fuel oil has not been observed at the southwestern corner of the building in several years. The refined model suggests that a limited volume of oil followed a preferential pathway in between the foundation wall and soil backfill. The majority of fuel oil remained confined to the immediate area below the AST fill pipe, and has been constrained by foundation walls, tight soil, and hydraulic control.

5.0 RESPONSE ACTIONS AND ASSESSMENT

Pursuant to 310 CMR 40.1056(2)(d) *a demonstration that response actions have been taken to adequately assess and, if necessary, control the subsurface migration of OHM remaining at the disposal site as specified in 310 CMR 40.1003(6)(a)* is presented below.

5.1 RELEASE DESCRIPTION, DISCOVERY, AND REPORTING

According to the Phase I Initial Site Investigation Report (Phase I) prepared by McPhail Associates, Inc. of Cambridge, Massachsetts (McPhail) dated May 28, 2009, the release was initially discovered in 2008 by personnel at the Cambridge Boat Club when they observed stained soil along the foundation wall at the southwestern corner of the building. According to the Phase I report, Cambridge Boat Club personnel also observed staining in the vicinity of the boiler room, which is located near the northwestern corner of the building. One of two fill pipes was reported to have failed a tightness test prior to McPhail's involvement.

Cambridge Boat Club requested that McPhail inspect the ASTs and associated fill pipes. McPhail observed stained soil in a hand-excavated trench at the southwest corner of the building, but did not observe evidence for a release in the boiler room where the ASTs and fill pipes were located. Based on these observations, McPhail concluded that the conditions represented a threat of release, and recommended that the Cambridge Boat Club notify the MassDEP of a threat of release requiring two-hour notification. Cambridge Boat Club notified the MassDEP on May 28, 2008, and the MassDEP assigned release tracking number (RTN) 3-27723 to the Site.

5.2 CONTAMINANTS OF CONCERN

The contaminant of concern (CoC) is No. 2 fuel oil.

5.3 ASSESSMENT SUMMARY

The MassDEP approved immediate response action (IRA) activities, which included capping the AST fill pipe, removing soil from the area along the trench in the southwest corner of the building, and placing absorbent materials on the water exposed in the trench. McPhail performed a subsurface investigation by excavating twenty-six (26) test pits in order to assess the extent of the release in the vicinity of the boiler room and the trench at the southwest corner of the building. Analytical results of five soil samples submitted for extractable petroleum hydrocarbons (EPH) and volatile petroleum hydrocarbons (VPH) indicated that concentrations of petroleum were largely non-detect, and most detections were below the applicable S-1/GW-2/3 Method 1 Risk Standards. The only soil sample where EPH and VPH exceeded Method 1 Risk Standards was located in a shallow test pit near the southwest corner of the building.

On March 10, 2009, McPhail installed five groundwater monitoring wells (SB-201 (OW) through SB-205 (OW)), and submitted another five soil samples for EPH analysis. Only the sample from immediately adjacent to the fill pipes contained EPH fractions and analytes above the applicable Method 1 Risk Standards.

McPhail performed "bi-weekly to monthly" inspections of absorbent materials and continued to monitor for the presence of LNAPL. McPhail submitted an IRA Completion report dated March 24, 2009, and concluded that significant migration of contamination had not been observed in nine months. However, subsequent inspections in April and May 2009 indicated the presence of up to six inches of petroleum LNAPL in a monitoring well located near the release origin. McPhail provided several recommendations for remedial options, including major soil excavation and groundwater pumping, minor soil excavation and LNAPL bailing, and in-situ chemical oxidation (ISCO).

Norfolk was hired in September, 2010. Norfolk submitted a RAM plan dated January 5, 2011 outlining a two-phase approach that was developed to eliminate residual LNAPL present as well as to reduce dissolved-phase petroleum in groundwater and residual fuel oil in soil. The initial phase of remediation was to consist of surfactant-enhanced removal of LNAPL followed by the second stage which utilized ISCO to chemically degrade residual petroleum.

Norfolk installed nine (9) recovery wells along the western side of the on-site building, and also installed a groundwater monitoring well on April 8, 2011. The recovery wells were strategically placed within alcoves of subsurface piers extending from the foundation in order to capture oil confined by the piers. Due to the presence of underground utilities (electric, communications, and water), the configuration of concrete piers, and an enlarged boat storage space below the area near the fill pipes, Norfolk was only able to install two additional wells immediately adjacent to the release point (RW-2 and RW-3). Norfolk observed fill, organic silt, and peat in borings adjacent to the release area, which was consistent with previous findings.

Norfolk submitted five soil samples for EPH analysis, and results indicated that while EPH and polycyclic aromatic hydrocarbon (PAH) fractions common to both fuel oil and urban fill were detected above laboratory reporting limits, none exceeded applicable S-1/GW-2/3 Method 1 Risk Standards except benzo (a) pyrene (Table 1). Norfolk's subsurface investigation led Norfolk to conclude that:

> *the low permeability of the soil, the low headspace, and the low concentrations of EPH fractions indicate that the release did not migrate in a conventional manner… The low permeability of the silt, peat, and fill have contained much of the NAPL in the small area within an inside corner of the foundation of the building where the release occurred.*

This subsurface characterization, coupled with data from LNAPL gauging over a one-month period that showed LNAPL recurring only within the release area convinced Norfolk to change the remedial approach. Norfolk submitted a RAM Status Report and Modification dated June 8, 2011 which proposed a modification of the remedial approach toward physical removal of LNAPL via vacuum extraction as opposed to the original plan of recirculating surfactants and performing ISCO treatments. Norfolk determined that the low porosity and permeability of soil at the site would have prohibited adequate distribution of the surfactant and oxidant. Furthermore, the high organic content of the peat would have produced an unacceptably high additional oxidant demand for the oxidizer, again greatly decreasing the effectiveness of the original approach. In addition, the high recharge rate of free-phase oil during manual bailing implied that a large volume of oil could be recovered through the use of high-capacity pumping.

Norfolk oversaw six vacuum extraction events between May 13, 2011 and December 16, 2011. Each of the first five extractions was performed about three weeks apart. During the first event, over 290 gallons of water and oil were recovered from the release area. Subsequent measurement by the disposal contractor indicated that approximately 75 percent of the liquid recovered was oil (approximately 219 gallons). Between 500 and 1,000 gallons of oil and water were recovered during each of the following five extractions, but only between one and two percent of the recovered liquid was oil (10 to 15 gallons each event). Although the subsequent five events did not yield significant amounts of recoverable oil, Norfolk continued extracting water in order to draw down the water table and stress the aquifer to encourage LNAPL migration towards the recovery wells.

Since the December extraction event showed that an extended hiatus in vacuum extraction did not yield higher oil recovery, Norfolk explored other options for recovering small amounts of oil over long a timeframe. Although LNAPL thickness in the release area decreased from approximately 10 inches to between three and five inches after the vacuum extraction events, the remedial goal of reducing LNAPL to a thickness of half an inch (the regulatory limit at the time) was deemed not economically feasible or timely using the extraction method. In July of 2012, Norfolk installed a passive LNAPL recovery bailer in a well within the release area. Between July 2012 and July 2013, Norfolk recovered oil from B-201 (OW) and RW-2 using both the bailer (continuous, passive recovery) and a peristaltic pump (during monthly gauging visits). In July 2013, the bailer was removed from service due to damage to the hydrophobic element. Norfolk continued monthly visits to perform gauging and oil recovery using the peristaltic pump until late December, 2013 when Norfolk decided that proposed changes to the MCP would allow for Permanent Closure of this Site.

FST (who had acquired Norfolk in March, 2014) performed groundwater sampling at the Site on April 25, 2014 in anticipation of preparing the Permanent Closure report once the MassDEP enacted changes to the MCP (which were promulgated on June 20, 2014). FST worked with the

responsible party and the property owner (DCR) to address any issues associated with implementing an AUL as a necessary requirement to achieve a Permanent Closure. FST was acquired by Stantec in November of 2015. Stantec continued to work with Cambridge Boat Club and DCR to finalize the Permanent Solution and AUL.

5.4 REMEDIATION WASTE

Documentation of remediation waste from the vacuum extraction events and a drums of spent absorbents was provided in the Response Action Outcome (RAO) dated June 1, 2012. This included a total of 4,130 gallons of oil and water mixture (containing approximately 278 gallons of oil) recovered from the Site through vacuum extraction, and a 55-gallon drum containing spent absorbent materials and a small amount of oil-stained soil that was removed from the trench at the southwestern corner of the building.

NAPL recovered subsequent to the vacuum extraction events, which includes recovery from the passive bailer and NAPL removed from wells during gauging events, was stored in a five-gallon container in the furnace room. FST contracted Trident Environmental Group, LLC of Marlborough, Massachusetts (Trident) to remove and dispose of the container. The five-gallon container contained approximately three gallons of oil, which was disposed as a 55-gallon drum of oily solids. The disposal manifest is attached in Appendix E.

6.0 DEMONSTRATION OF SOURCE CONTROL

Pursuant to 310 CMR 40.1056(2)(c), *a demonstration that all Sources of OHM Contamination have been eliminated or controlled as specified in 310 CMR 40.1003(5)(a) and (b) at the Disposal Site is provided below. According to 310 CMR 40.1003(5)(a) and (b) a Permanent or Temporary Solution shall not be achieved unless and until response actions are taken to adequately identify and address Sources of OHM Contamination at the disposal site. Such response actions shall ensure for a Permanent or Temporary Solution, all unpermitted releases of OHM to the environment are eliminated; and for a Permanent Solution, all Sources of OHM Contamination are eliminated, or if they are not eliminated, they are eliminated to the extent feasible and they are controlled*.

No leaking storage tanks, vessels, drums, or other containers remain at the Site. The source of the CoCs at the Site was a leak from an AST fill pipe. The damaged pipe was removed and replaced. It is Stantec's opinion that no uncontrolled sources remain at the Site.

7.0 REPRESENTATIVENESS EVALUATION AND DATA USABILITY ASSESSMENT

The following presents a discussion of the Site information used to support the Permanent Solution as required by 310 CMR 40.1056(2)(k) and incorporates the guidance provided in MassDEP Policy WSC-07-350. It provides an evaluation and demonstration of the adequacy of the spatial and temporal data sets used to support the Permanent Solution and makes conclusions on the accuracy, precision, and the sensitivity of the data used.

7.1 FIELD SCREENING

Field screening relied upon a PID to measure TOVs, as well as visual and olfactory evidence to delineate soil impacts at the disposal site. Comparisons of visual, olfactory, and PID data with analytical data indicate that the screening data roughly correlates with the analytical data.

7.2 CLOSURE SAMPLING

Numerous soil and groundwater samples adequately represent the vertical and horizontal extent residual petroleum in soil associated with the Disposal Site. This Permanent Closure relies significantly on LNAPL gauging data, which was performed at least quarterly between 2009 and 2013, and monthly between July of 2012 and December of 2013. As discussed in Section 8.0, this gauging frequency was adequate to provide a line of evidence to achieve permanent closure of this release.

7.3 TEMPORAL DATA

Soil impacts from contaminants of concern are not expected to vary significantly over time. Temporal data for groundwater consists of three rounds of groundwater samples between 2011 and 2014, and indicates that petroleum has not impacted groundwater quality outside of the release area. Therefore evaluation of temporal data for groundwater is not applicable.

As discussed in Section 8.0, frequent well gauging and a lines of evidence approach indicates that LNAPL thickness in groundwater monitoring wells and recovery wells in the release area is stable and/or decreasing.

7.4 FIELD COMPLETENESS

Given the very small area of the impacted area of the disposal site, an adequate quantity of test pits, soil borings, and groundwater monitoring wells were completed to delineate the disposal area. Based on the information obtained from these methodologies, FST and Norfolk were able to delineate fully the extent of contaminants of concern. In Stantec's opinion, the

number of soil samples submitted for laboratory analysis was appropriate given the area of the disposal site.

7.5 DATA INCONSISTENCY

No inconsistent data was identified. Visual and olfactory observations and soil field screening data were well correlated.

7.6 DATA NOT USED

All analytical data collected from the Disposal Site was used to support this Permanent Solution.

7.7 DATA USABILITY

The methods utilized (visual and olfactory observations, PID field screening, and laboratory analysis) are appropriate for the Site. Based on the Representativeness Evaluation, the analytical data quality of all the samples has been reviewed. The analytical data provided in support of this Permanent Solution have met the method quality control requirements and performance standards for "Presumptive Certainty" as described in CAM VII A, Section 2.0 (a), (b), (c), and (d) or have been evaluated as comparable to CAM requirements. The validity and defensibility of the analytical data used to support the findings of the Permanent Solution for this disposal site with respect to accuracy, precision, and completeness pursuant to 310 CMR 40.1056(2)(k) have therefore been satisfied.

It is Stantec's opinion that the sampling locations at the Site are spatially representative and complete for the release. FST relied on a total of five soil samples collected by Norfolk and 10 soil samples collected by McPhail. FST and Norfolk collected three rounds of groundwater samples, approximately three years apart.

The samples of environmental media collected and analyzed by McPhail, Norfolk, and FST as part of the assessment activities meet the requirements for presumptive certainty as described in the 'Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data' (MassDEP, 2003). Furthermore, these data have been evaluated and meet the criteria for precision, accuracy, representativeness, comparability, completeness, and sensitivity (PARCCS) such that it is usable in support of the LSP opinion.

Laboratory non conformances for McPhail's samples are described below.

HTP-8 (0.5-1.5') collected June 13, 2008: Surrogate recovery was above the acceptable criteria, but since the data were non-detect, re-analysis was not required.

HTP-107 (0.5-1') collected July 22, 2008: Fell short of recommended 1:1 methanol:soil ratio. Has elevated detection limits due to dilution required by elevated concentrations of target

compounds in sample. Surrogate recovery was above the acceptable criteria, but the sample was not re-analyzed due to obvious interferences. All associated compounds are considered to have a potential bias.

B-201 (OW) (10-12') collected March 10, 2009: Elevated detection limits due to 5x dilution required by matrix interferences encountered during the concentration of the sample. Surrogate recovery was outside the acceptance criteria; however the sample was not re-extracted due to coelution with obvious interferences.

It is Stantec's opinion that the laboratory data generated is an accurate representation of Site conditions and that the laboratory non-conformances do not change the conclusions of this report. MCP Analytical Method Report certification forms and summaries of any non-conformances relating to quality control samples and/or sample analysis/matrix are also included in the laboratory reports submitted in the McPhail Phase I Report.

Analytical data generated by Spectrum Analytical, Inc. of Agawam, Massachusetts (Spectrum) noted only one non-conformance for the following sample:

B-205 (OW) collected April 25, 2014: Elevated Reporting Limits due to limited sample volume.

8.0 RISK CHARACTERIZATION

Pursuant to 310 CMR 40.1056(1)(c), *except where the concentrations of oil and hazardous material are consistent with or have been reduced to Background or where a threat of release has been abated, the Method(s) (Methods 1, 2 or 3) used to characterize the risk of harm posed by the disposal site to health, safety, public welfare and the environment, pursuant to 310 CMR 40.0900* is presented below. Furthermore, pursuant to 310 CMR 40.1056(2)(f), *information supporting the conclusion that a level of No Significant Risk has been achieved or exists* is presented below, and pursuant to 310 CMR 40.1056(2)(e), *where NAPL is or has been present, a demonstration that response actions have been taken to adequately assess and if necessary control NAPL mobility and meet the requirements of 310 CMR 40.1003(7)(a)* is presented below.

8.1 LIGHT NON-AQUEOUS PHASE LIQUIDS

This risk characterization focuses on the presence of LNAPL since LNAPL is the primary driver of risk at the Site. The discussion regarding LNAPL will conform to regulations in the MCP and reference MassDEP's Policy WSC-16-450 *LNAPL and the MCP: Guidance for Site Assessment and Closure*.

Pursuant to 310 CMR 40.1003(7), *a Permanent or Temporary Solution shall not be achieved at a disposal site where NAPL is or was visibly present at levels requiring notification under the provisions of 310 CMR 40.0300 unless and until response actions are taken to adequately assess the nature, extent, and mobility of the NAPL, and, where necessary, remedial actions are taken to adequately contain or remove such NAPL. Such response actions shall ensure:*

(a) for a Permanent Solution:

1. Non-stable NAPL is not present under current site conditions and for the foreseeable future; and

2. all NAPL with Micro-scale Mobility is removed if and to the extent feasible based upon consideration of CSM principles

Since LNAPL remains in a monitoring well at the Site in excess of one-eighth inch thickness, this section will provide documentation that shows Norfolk and FST "adequately assessed the nature, extent, and mobility of the LNAPL, and the remedial actions taken to adequately contain or remove such LNAPL that ensured non-stable LNAPL is not present under current site conditions and for the foreseeable future; and all LNAPL with micro-scale mobility was removed to the extent feasible."

8.1.1 Non-Stable NAPL versus NAPL with Micro-Scale Mobility

While previous versions of the MCP attempted to address exposure concerns to LNAPL through an Upper Concentration Limit, the June, 2014 MCP addresses the presence of LNAPL at a release site with a new approach. This new approach eliminated the half-inch Upper Concentration Limit, and instead concentrates on LNAPL movement and recoverability. Pursuant to 310 CMR 40.0006:

> **Non-Stable NAPL**: a NAPL with a footprint that is expanding laterally or vertically by: (a) migrating along or within a preferred flow path; (b) discharging or periodically discharging to a building, utility, drinking water supply well, or surface water body; or (c) spreading as a bulk fluid through or from subsurface strata.
>
> **NAPL with Micro-Scale Mobility**: a NAPL with a footprint that is not expanding, but which is visibly present in the subsurface in sufficient quantities to migrate or potentially migrate as a separate phase over a short distance and visibility impact an excavation, boring, or monitoring well.

Based on assessment and remedial work performed at the Site, the LNAPL present is not non-stable, but does have micro-scale mobility. This is substantiated by several observations:

- LNAPL that was initially present along the foundation wall, at RW-5, and at RW-3 has significantly diminished, which suggests that LNAPL extent has decreased and is not migrating along a preferred flow path
- LNAPL has not been observed in any downgradient monitoring well or on the water surface in the Charles River
- LNAPL thickness at the source area has decreased from approximately 10 inches to an average of 4.5 inches in the two wells (RW-2 and B-201 OW) during the last two monitoring rounds, which indicates that the LNAPL is not spreading as a bulk fluid
- Dissolved-phase petroleum related to fuel oil has not been detected above laboratory reporting limits in any on-site monitoring well, which indicates that even dissolved-phase petroleum has not migrated from the source area

Pursuant to Section 3.0 of the MassDEP policy, a Permanent Solution cannot be achieved at sites with non-stable NAPL. A Permanent Solution *can* be achieved at a site with micro-scale mobility, given that the NAPL was removed to the extent feasible and an AUL is implemented. As noted above, NAPL at the Site is characterized as having micro-scale mobility. Therefore, the risk characterization below is presented in support of a Permanent Solution with Conditions.

8.1.2 Multiple Lines of Evidence Approach

Due to variability and complexity of LNAPL sites, the MassDEP policy recommends a "lines of evidence" evaluation of LNAPL. This approach allows an LSP to assess LNAPL behavior for MCP-specific purposes to quantify exposure and risk.

Release date and volume:
The MassDEP policy indicates that most LNAPL releases reach a state of macro-scale stability within one to two years of the termination of the release. This release likely started in the late 1990s and was terminated in 2008 when the broken fill pipe was discovered and removed. The majority of assessment work was completed between 2011 and 2013, at which time the termination of the release was three to five years prior. This timeframe places the release age between "new" and "old," according to the policy (section 4.1.1). At the time of this writing, the release is considered "old," and no change from post-remedial assessment has been observed as of the final gauging round (May 20, 2015). The volume of fuel oil released is unknown.

LNAPL type:
The #2 fuel oil released at the Site is less viscous than oils such as #6, and more viscous than materials such as gasoline. Therefore, the fuel oil released at this site has a relatively intermediate range of mobility compared to other LNAPL.

Soil type:
Fine-grained soils have lower permeability, greater pore-entry pressure, and higher residual saturation values than coarse-grained soils. Therefore, fine-grained soils limit LNAPL mobility. Soils at the Site were documented by both McPhail and Norfolk to be fill containing silt and peat surrounding the building. Native materials lateral to and below the fill were silt, sand, and peat. Norfolk characterized the permeability as "low" in the Phase II and Class C-2 RAO report dated June 1, 2012:

> *The geologic materials underlying the Site consist of sand, silt, and peat. Therefore, the geologic materials at the Site generally have a low permeability. At several locations, the low permeability of the organic silt and peat prohibited percolation of water into the recovery wells for hours after installation. During times when the water table was at a low relative elevation, Norfolk observed slow recharge in groundwater monitoring wells.*

Furthermore, Norfolk changed the original remedial approach from ISCO to vacuum extraction in the June 8, 2011 RAM Status Report 1 and RAM Modification due to the low permeability of on-site soil:

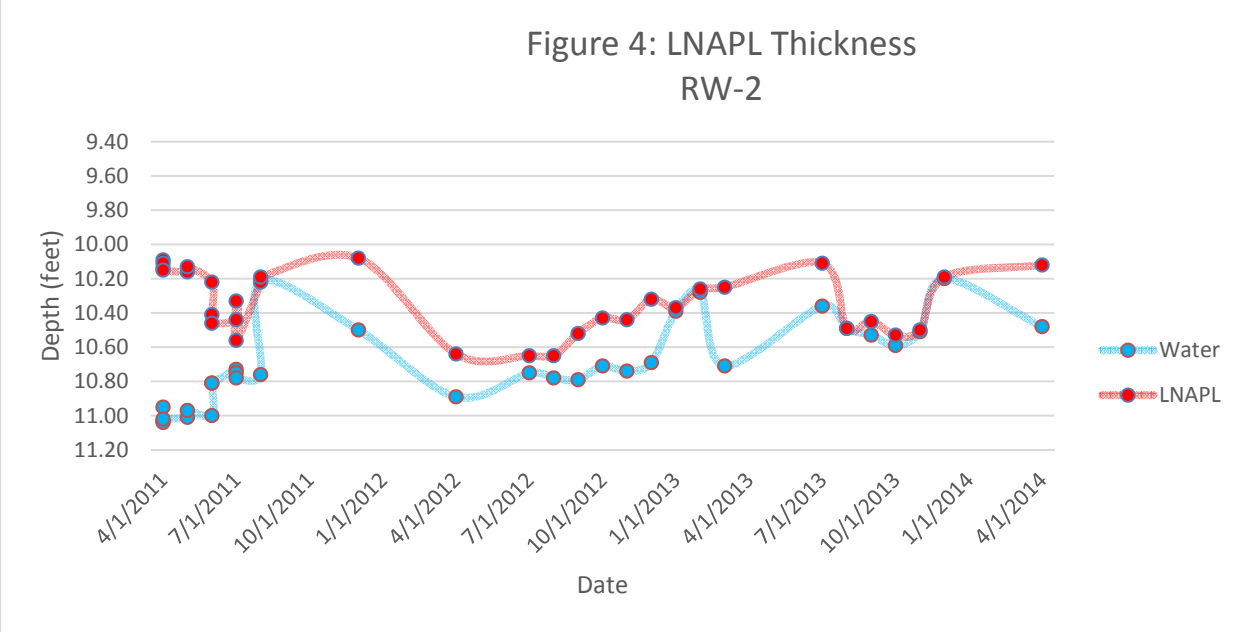
> *The previous RAM plan dated January 5, 2011 is being modified to address a change of condition (low permeable soil) identified during the installation of injection wells on April 8, 2011. Norfolk identified dense silt and peat present as fill along the western foundation wall where fuel oil has been trapped following its release from a break in the former fill pipe. … The findings of Norfolk's assessment to date suggests that the majority of the oil released remains in the immediate vicinity of the former fill pipes, held in place by the configuration of two foundation walls, and the very low permeability of soil.*
>
> *The plan to use surfactants and chemical oxidation to treat the fuel oil required a permeable soil matrix for both hydraulic control, and to assure that both the surfactant and oxidizer could be injected in sufficient volume. The low porosity and permeability of soil at the site will prohibit adequate distribution of these remedial solutions, rendering the treatment ineffective for this type of soil.*
>
> *The prior conceptual site model of the release was based on NAPL occupying the pore space within a layer of gravel on the west side of the structure's foundation. Recent assessment has determined that soils immediately adjacent to the foundation are composed of silt and peat, some of which may be urban fill. Due to the high natural organic content and the low permeability observed in on-site soils, Norfolk plans to change the original plan of recirculating surfactant and performing ISCO treatments to placing more emphasis on the physical removal of NAPL through the use of a vacuum truck.*

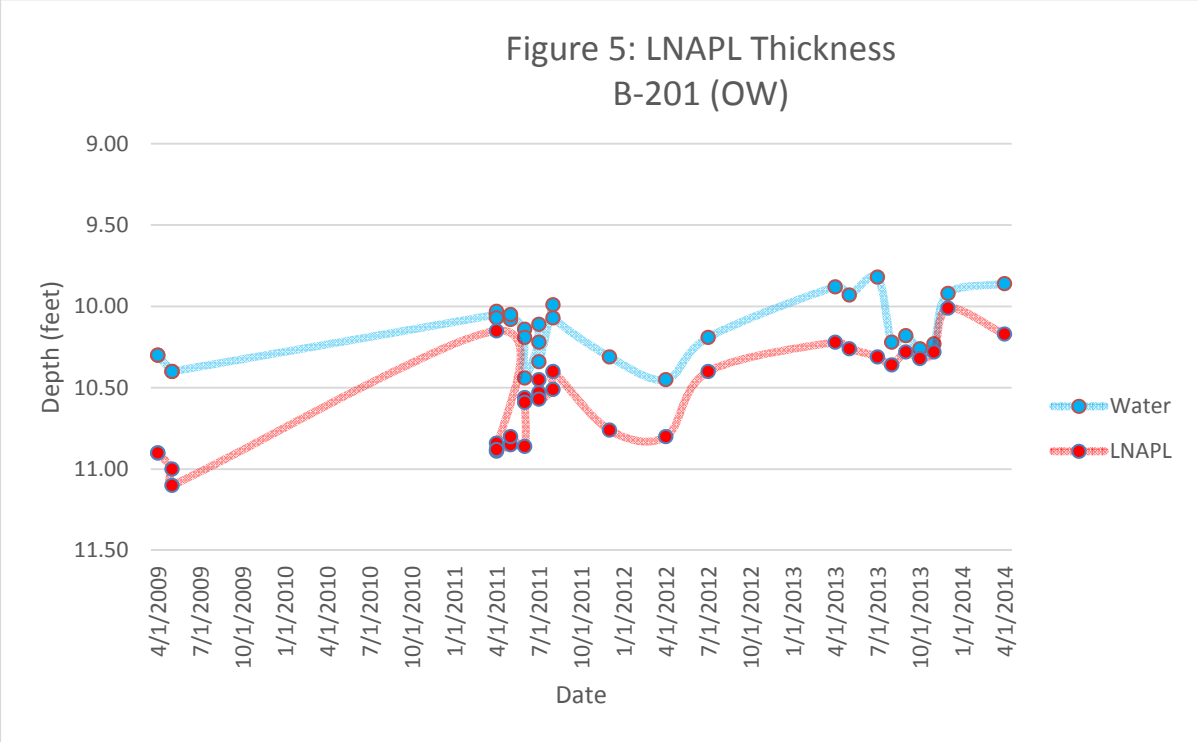
Soil concentration values:
Figure 3 in the MassDEP policy indicates that site soil data that falls between the soil saturation concentration (C_{sat}, or approximately 100 mg/kg TPH) and LNAPL residual saturation (C_{res}, or approximately 10,000 mg/kg TPH) suggests the presence of "immobile LNAPL." While this figure presents generic information, Table 1 in the MassDEP policy lists theoretical and measured C_{sat} and C_{res}, respectively for specific soil types and specific contaminants. This is more of a site-specific approach, and may indicate more accurate values. In the case of this Site, where the contaminant of concern is fuel oil with fine grained soil types (silt to fine sand), the listed C_{sat} value is 18 mg/kg and the listed C_{res} value is 51,429 mg/kg.

While most samples contained EPH fractions and target PAHs below laboratory reporting limits, even the sample with the highest value for all detected EPH fractions and targets together is less than 5,000 mg/kg. Since this value is far below either of the published C_{res} values, this line of evidence suggests that a) LNAPL is present at the Site, and b) it is not Non-Stable (it is LNAPL with Micro-Scale Mobility).

Product Thickness Measurements (Spatial and Temporal):
The MassDEP policy indicates that a reliable indicator of LNAPL mobility is the use of properly constructed and spaced monitoring wells to define the LNAPL plume (or "footprint") and demonstrate that the plume is not expanding. In order to do this, the policy suggests that quarterly sampling/gauging of the wells be conducted over a two-year period that include events during the seasonal water-table low and high elevations.

In 2011, Norfolk supplemented McPhail's existing monitoring well network of four monitoring wells (one was destroyed) with nine recovery wells and one monitoring well. Norfolk subsequently installed an additional monitoring well between the building and the Charles River. Norfolk gauged all monitoring and recovery wells at the Site at least quarterly between April 2011 and July 2012. Norfolk then began a monthly gauging program that started in July 2012 and lasted until December 2013. Over the course of this monitoring (and concurrent remediation efforts), LNAPL thickness in recovery wells within the release area decreased by half (Figures 4 and 5), and occurrence of measurable LNAPL at RW-3 (adjacent to the release area) and RW-5 (along the foundation wall) decreased significantly in frequency and thickness (Appendix C).





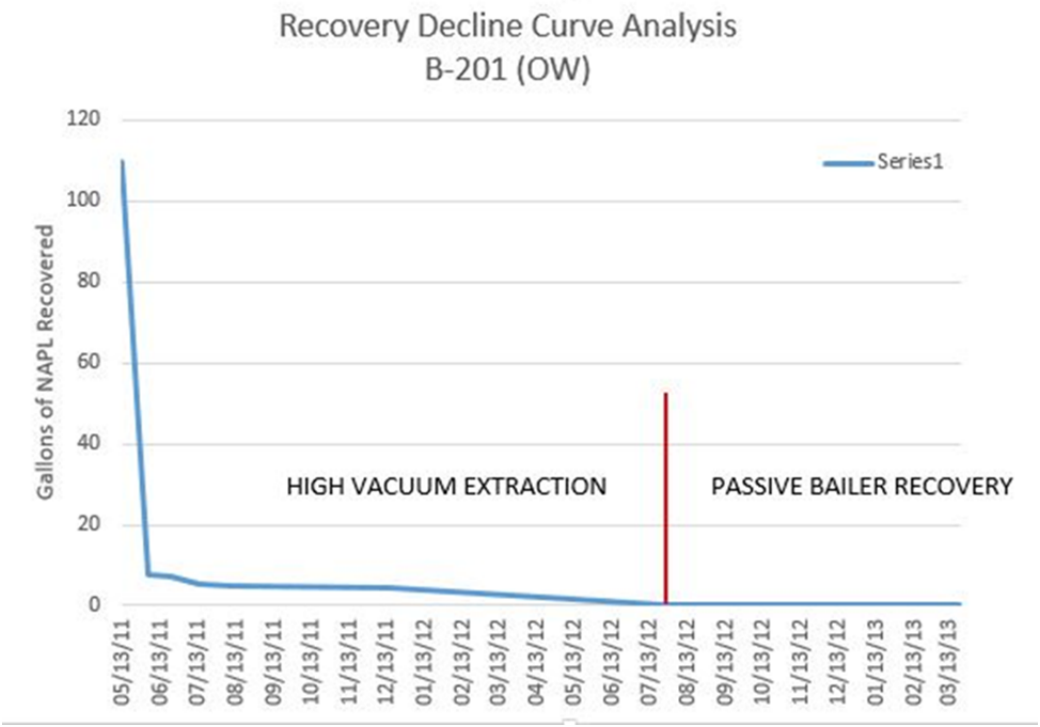
These data indicate that the LNAPL at the Site is not only stable, but the plume footprint is actually decreasing over time.

Pore Entry Pressure Correlations:
According to the MassDEP policy, pore-entry pressure can be expressed as an equivalent height (or thickness within a monitoring well) of LNAPL that is necessary to force LNAPL through soil pores. Pore-entry pressure increases as grain size decreases, and the exceedance of this pressure for a given soil type indicates the potential for LNAPL migration. While no pore-entry pressure modeling has been performed at this Site, FST reviewed the Golder (2008) paper as referenced by the MassDEP policy. Section 4.4.4 of the Golder report recommends "approximate thresholds for LNAPL thickness in wells" to define mobility potential. For a soil type classified as silty sand with greater than 10% fine material (similar to soil at the Site), the thickness of LNAPL in a well that would promote mobility would be 0.3 meters (0.98 feet). When Norfolk began working on this Site, thicknesses of LNAPL in wells within the release area were just below this value. Current monitoring indicates that LNAPL thickness is nearly half. While this generic value is not site specific and geologic materials at the Site are not homogenous, it is yet another line of evidence that suggests soil at the Site hinders mobility of LNAPL.

Recovery Decline Analysis:
FST performed a decline curve analysis for recovery of LNAPL from monitoring well B-201 (OW) (Figure 6). The data set for this analysis comes from both the high-extraction vacuum recovery events (recovery volume in gallons estimated via an assay by the subcontractor) and the subsequent passive collection by a skimming bailer (recovery volume measured in inches and then converted to gallons) installed in the well once the vacuum remediation events were completed. The decline curve analysis shown on Figure 6 shows an asymptotic curve; from the first vacuum recovery where approximately 110 gallons of LNAPL was recovered from B-201 (OW), to weekly or bi-weekly emptying of the skimmer where less than 0.1 gallons of LNAPL were recovered.

While the data set used for B-201 (OW) utilize two different collection methods, the resulting graph bears out field observations that LNAPL recovery significantly decreased after the first vacuum extraction event.

Figure 6



This is also corroborated by Norfolk's observations regarding recovery in well RW-2 (adjacent to B-201 [OW]). As stated in the RAM Status Report #1 and RAM Modification dated June 8, 2011:

> *April 11, 2011: Norfolk pumped 4.5 gallons of NAPL from RW-2. NAPL recharged as fast as it could be removed, and Norfolk measured a maximum drawdown of 0.07 feet.*

Norfolk also noted that 5.0 gallons and 7.5 gallons of LNAPL were removed from RW-2 on April 14, 2011 and April 21, 2011, respectively. All three of these recovery events were performed prior to the first vacuum extraction event on May 13, 2011. Similar to B-201 (OW), recovery rates from RW-2 decreased significantly after the first extraction event.

Table 3 is a matrix of recovery volume by date and method for both B-201 (OW) and RW-2. B-201 (OW) shows a clear asymptotic decline in recovery volume from the first extraction even to the end of passive recovery operations. RW-2 also shows a clear asymptotic decline in recovery, although it should be noted that recovery using a peristaltic pump was performed in a matter of minutes, whereas the vacuum extraction events generally lasted for several hours. Therefore, the recovery of 4.5 gallons by vacuum extraction over a period of several hours in December of 2011 shows a significant decrease in recoverable LNAPL as compared to the recovery of 4.5 gallons by peristaltic pump in a matter of minutes in April of 2011.

Table 3: Recovery of LNAPL over Time in the Source Area

Date	# days between events	Method	B-201 (OW) Recovery (gal)	RW-2 recovery (gal)
4/11/2011	0	Peristaltic pump	0.5	4.5
4/14/2011	3		n/a	5.0
4/21/2011	7		1.5	7.5
5/13/2011	0	Vacuum extraction	109.5	109.5
6/03/2011	21		7.5	7.5
6/22/2011	19		7.0	7.0
7/14/2011	22		5.5	5.5
8/10/2011	27		5.0	5.0
12/16/2011	128		4.5	4.5
7/24/2012-3/22/2013	15*	Passive bailer	0.02*	
4/16/2013-7/14/2013	11*			0.03*

* - Average over that time period

Note that the recovery volume by vacuum extraction for each well shown is approximated by dividing the total volume recovered (estimated by contractor assay) by two. Field observations prior to vacuum extraction events indicate that more LNAPL was generally recovered from RW-2 than B-201 (OW), although recovery efforts at that time were focused on RW-2.

8.1.3 Recommended Simplified Approach

The MassDEP policy presents a "Recommended Simplified Approach" for assessing and addressing oil and waste-oil LNAPL mobility and recoverability. This step-by-step approach includes characterization methods, presence of LNAPL, presence of mobile LNAPL, characterization of mobile LNAPL (as stable or non-stable), feasibility of removing or containing mobile LNAPL, timing of cessation of recovery operations, and achieving a Permanent Solution.

The Simplified Approach is not applicable to this Site since greater than five inches of NAPL has been documented in several monitoring wells. According to Section 5.6 of the MassDEP policy, "it is not possible to conclude that it is infeasible to recover LNAPL at sites where the maximum LNAPL thickness is greater than 5 inches." Stantec is including this discussion of the Simplified Approach as another 'line of evidence' that documents that while more than five inches of NAPL has been observed at the Site, it is—in fact—infeasible to recover it.

Characterization Methods and Level of Effort
This section of the simplified approach includes the following requirements:

Site history: the Site was developed in the 1940s for use as a boathouse, and has been used as such since. Past storage and use of petroleum products include fuel oil for heating of the main floors of the building. No previous spills or releases of petroleum have been reported.

Well installation and construction: all wells at the Site have been constructed with screens across the water-table fluctuation zone, and were developed after installation. All monitoring wells at the Site are two-inches in diameter.

LNAPL thickness measurements: measurements were made using the same model oil/water interface probe in order to maintain consistency. Water table elevations were observed to ensure the well construction was appropriate. Any LNAPL detected in on-site monitoring or recovery wells during gauging events was removed from the well.

Spacing of wells: well spacing within the release area meets the 15 to 30-foot criteria set forth in the MassDEP policy. Due to restraints posed by utilities, foundation walls, and accessibility limitations within the boat-storage area, there are no wells immediately downgradient of the release area. The downgradient compliance well is located approximately 50 feet from the wells within the release area.

Periodic well gauging: if non-stable LNAPL is present, wells within the network must be gauged on a monthly basis for two years. If stable LNAPL is present, wells must be gauged on a quarterly basis for one year. As described in Section 8.1.2, Norfolk gauged all monitoring and recovery wells at the Site at least quarterly

between April 2011 and July 2012. Norfolk then began a monthly gauging program that started in July 2012 and lasted until December 2013. These data indicate that the LNAPL at the Site is not only stable, but the LNAPL plume footprint is actually decreasing over time. Therefore, the remedial work at the Site caused the plume to become stable and the year and a half of monthly gauging data between July 2012 and December 2013 more meets the gauging requirement for stable LNAPL.

C_{res} metrics: as discussed in Section 8.1.2, C_{res} metrics were based on the summation of fractions and target analytes from MassDEP EPH method results.

Determining Whether LNAPL is Present
As discussed in Section 8.1.2, total petroleum concentrations have been measured in soil greater than 100 mg/kg. Furthermore, free-phase liquid has been observed in several monitoring and/or recovery wells at the Site. LNAPL is present at the Site.

Determining Whether Micro-scale Mobile LNAPL is Present
LNAPL has been observed in monitoring wells at the Site. Therefore, LNAPL with micro-scale mobility is present at the Site.

Determining Whether Mobile LNAPL at a Site is Non-stable
The release was first discovered in 2008 due to the presence of LNAPL following preferred flow paths and occurring as a sheen or free-phase oil on water along the edge of the on-site building. At that time, the LNAPL was classified as Non-stable. Once remedial work was initiated, Norfolk demonstrated that LNAPL thickness and extent had in fact shrunk. Norfolk never observed evidence of the release discharging to surface water, into the building, or into utility structures. Similarly, Stantec does not have reason to believe that LNAPL is present within a preferred flow path.

As presented in the pore-entry pressure discussion in Section 8.1.2, the Golder (2008) report indicates that for fine-grained soils (silty sand), an LNAPL thickness of 0.3 meters may indicate the presence of non-stable LNAPL. Section 4.4.4 of the Golder report is summarized in the MassDEP policy as Table 2: Stability Action Levels. As discussed above, LNAPL thickness in wells within the release area never reached 0.3 meters (0.98 feet), and furthermore have decreased significantly since.

Pursuant to the MassDEP policy, Norfolk and FST also inspected potential subsurface receptors (especially including areas where LNAPL had been observed in 2008) for the presence of LNAPL. No evidence of LNAPL was observed.

The MassDEP policy indicates that "upon completion of this one-year monthly monitoring program, it may be concluded under the Simplified Approach that there is no current indication of Non-stable LNAPL if:

- subsurface LNAPL was not observed to be migrating along or within a preferred flow path;
- subsurface LNAPL did not discharge into a building, utility, drinking water well, or surface water body; and
- observed LNAPL thickness levels did not consistently or significantly increase in downgradient monitoring wells"

Norfolk and FST did not observe any of these conditions. Therefore, it is Stantec's opinion that Non-stable LNAPL is not present at the Site.

Determining the Feasibility of Removing LNAPL
According to the MassDEP policy:

> Under the terms of this Simplified Approach, it is not possible to conclude that it is infeasible to recover LNAPL at sites where the maximum LNAPL thickness level is greater than 5 inches.

LNAPL gauging has been performed continuously (up to 40 events total) between 2009 and 2015. High-vacuum extraction remediation events were completed on December 16, 2011. Between July of 2012 and December of 2013, Norfolk performed monthly monitoring (21 gauging events) to determine the stability of LNAPL in the source area. Over that time, LNAPL thickness only slightly exceeded five inches (0.42 feet) on three occasions:

> RW-2 on March 22, 2013 (0.46 feet)
> B-201 (OW) on July 26, 2013 (0.49 feet)
> RW-2 on May 20, 2015 (0.48 feet)

The average LNAPL thickness over that time in RW-2 is approximately 2.3 inches (0.19 feet), and approximately 2.9 inches (0.24 feet) in B-201 (OW).

Furthermore, the asymptotic recovery rate (which reached 2.5 to 3.5 ounces every two weeks using the passive bailer) demonstrates that passive recovery is infeasible based on the cost and time of operation. Significant recovery from additional operation of any method is not feasible.

Furthermore, according to the MassDEP policy:

> the continued operation of a conventional LNAPL recovery system can be deemed infeasible

when at least one of three conditions are met:

- subsequent to the initiation of LNAPL recovery operations, the LNAPL transmissivity value in all recovery wells as determined by using the well testing methods described in ASTM 2856 and referenced in Section 6.0 is shown to be less than 0.8 ft2/day; or
- the total volume of LNAPL recovered at a site is less than one gallon in any three month period; or
- a decline curve analysis of at least 12 months of cumulative LNAPL recovery data demonstrates an asymptotic condition.

The total amount of LNAPL recovered from wells within the release area did not exceed one gallon in any three-month period since the passive collection bailer was installed (Tables 4 and 5). Although the period in between each time when the bailer was checked and emptied varied from one week to up to three weeks, only a maximum of several ounces were collected. Furthermore, as shown in Figure 6 above, a decline curve analysis for LNAPL recovery exhibits an asymptotic condition.

Table 4: LNAPL Recovery Volume in Well B-201 (OW)

Date	Recovered LNAPL (gallons)	Date	Recovered LNAPL (gallons)
04/11/11	0.5	12/14/12	0.01
04/21/11	1.5	12/19/12	< 0.01
05/13/11	109.5*	12/24/12	0.01
06/03/11	7.5*	01/13/13	0.01
06/22/11	7.0*	01/25/13	< 0.01
07/14/11	5.5*	01/30/13	< 0.01
08/10/11	5.0*	02/26/13	0.02
12/16/11	4.5*	03/13/13	0.01
04/16/12	0.06	03/22/13	0.01
07/18/12	0.03	04/24/13	0.06
07/24/12	0.01	05/20/13	0.05
08/30/12	0.03	07/26/13	0.08
09/25/12	< 0.01	08/29/13	0.02
10/23/12	0.20	09/26/13	0.02
11/04/12	0.02	10/30/13	< 0.01
11/17/12	0.02	11/26/13	< 0.01
11/18/12	< 0.01	12/27/13	0.01
11/26/12	< 0.01	04/25/14	0.05
12/07/12	0.02		

* NAPL recovered by vacuum truck; volume recovered is an estimate based on subcontractor assay (remaining recovery events are from passive bailer)
Remaining values reflect NAPL collected with passive bailer or peristaltic pump
0.01 gallons = 1.28 ounces

Table 5: LNAPL Recovery Volume in Well RW-2

Date	Recovered LNAPL (gallons)	Date	Recovered LNAPL (gallons)
04/11/11	4.5†	02/26/13	< 0.01
04/14/11	5.0†	03/22/13	0.08
04/21/11	7.5†	04/16/13	0.01
05/13/11	109.5*	04/24/13	< 0.01
06/03/11	7.5*	04/28/13	0.01
06/22/11	7.0*	05/11/13	0.06
07/14/11	5.5*	05/20/13	0.02
08/10/11	5.0*	06/04/13	0.05
12/16/11	4.5*	06/18/13	0.06
04/16/12	0.04	06/26/13	0.02
07/18/12	0.02	07/14/13	0.03
08/30/12	0.02	07/26/13	0.04
09/25/12	0.04	09/26/13	0.01
10/23/12	0.05	10/30/13	0.01
11/26/12	0.05	11/26/13	< 0.01
12/19/12	0.06	12/27/13	< 0.01
01/25/13	< 0.01	04/25/14	0.06

* NAPL recovered by vacuum truck; volume recovered is an estimate based on subcontractor assay (remaining recovery events are from passive bailer)
Remaining values reflect NAPL collected with passive bailer or peristaltic pump
0.01 gallons = 1.28 ounces

Simplified Approach: Achieving a Permanent Solution
According to the MassDEP policy, an LNAPL site can achieve a Permanent Solution if:

- Non-Stable LNAPL was never or is no longer present;
- LNAPL with micro-scale mobility has been removed if and to the extent feasible, and;
- all other MCP requirements and standards have been met, including those related to Source Elimination or Control, Migration Control, site characterization and risk assessment.

Section 8.1 of this report has documented that Non-stable LNAPL is not present at the Site, and that LNAPL has been removed to the extent feasible. The remaining portion of the risk characterization in Section 8.0 of this report will demonstrate that the remaining requirements and standards have been met.

8.2 IDENTIFICATION OF SITE GROUNDWATER AND SOIL CATEGORIES

The soil and groundwater categories are identified below.

8.2.1 Groundwater Classification Criteria

Pursuant to 310 CMR 40.0932, groundwater classification is based on several factors including the current or potential use as a drinking water source, proximity to buildings, and ecological risks.

8.2.2 Identification of Applicable Groundwater Categories

The Site is not located within a current or potential drinking-water source area; therefore, the GW-1 groundwater classification is not applicable to the Site.

The disposal Site is located within 30 feet of an occupied building, and groundwater was encountered less than 15 feet below grade. Therefore the GW-2 groundwater classification is applicable to the disposal Site.

As outlined above, the GW-3 classification is applicable to all of the groundwater located within the boundaries of the Commonwealth of Massachusetts. Therefore, Method 1 GW-3 Groundwater Standards are applicable to the Site.

8.2.3 Soil Classification Criteria

Frequency of Use

Frequency of use indicates how often a receptor makes use of, or has access to, a Site. The frequency is classified as either high, low, or not present based upon the specific criteria described in 310 CMR 40.0933(4)(a).

The frequency for adults and children at the Site is considered high, based on the boathouse usage for adults and children.

Intensity of Use

The intensity of use is based upon the activities and uses that occur at a Site. The intensity of use is classified as either high or low. Pursuant to 310 CMR 40.0933(4)(b), Site activities and uses which have the potential to disturb soil, and result in either direct contact with the soil itself or inhalation of soil-derived dust, shall be characterized as high intensity use activities. Examples of such activities include gardening, digging, and recreational sports. Passive activities, which do not disturb the soil, such as walking, shall be characterized as low intensity use activities.

The release area is covered by a concrete walkway, and much of the Site is covered by the on-site building, landscaping, and gravel. Furthermore, there are no high-intensity activities performed on un-paved portions of the Site; most of the on-site activity is limited to inside the boathouse building and on the docks. Therefore, the intensity of use is considered low.

Accessibility

Soils are classified as accessible, potentially accessible, or isolated based upon the depth to OHM impact and the presence of impervious material (i.e. asphalt or concrete), if any. Pursuant to 310 CMR 40.0933(4)(c) impacted soils located within the first 3 feet of the surface in an unpaved area would be considered accessible. Soils from 3 to 15 feet below grade in unpaved areas, or soils from less than 3 feet below grade in paved areas, would be considered potentially accessible. Soils greater than 15 feet below grade or beneath the footprint of a building would be considered isolated.

While some petroleum-impacted soil exists at the Site, much of it is located below concrete and asphalt walkways, below landscaping, or against the building foundation. McPhail documented several isolated areas where petroleum was detected in soil at shallow depths (less than three feet), but it is covered by gravel within the boat storage area under the building. Therefore, impacted soil at the Site is classified as potentially accessible or isolated.

8.2.4 Identification of Applicable Soil Categories

Pursuant to 310 CMR 40.0933, based on the high frequency and low intensity of use by both adults and children, the appropriate soil classification for potentially accessible soil at the Site is S-2, and the classification for isolated soil is S-3. While petroleum-impacted soil is limited to soil classified as potentially accessible or isolated, soil results were compared to S-1 Method 1 Risk Standards during assessment activities in order to characterize risk for unrestricted future use.

8.3 CHARACTERIZATION OF RISK OF HARM

Risk of Harm from OHM at the Site that is not covered by the regulations governing the presence of LNAPL is presented below.

8.3.1 Human Health

Soil Exposure Pathway

Possible pathways of exposure to soil at the Site are by dermal contact and by ingestion/inhalation of dust particles. Possible receptors are boat-club members, visitors, trespassers, and construction workers.

Soil Exposure Points

OHM in soil at the Site that exceed any applicable Method 1 Risk Standards is limited to two sample locations—one directly below the release area (B-201 [OW]) and one in a test pit at the corner of the building where oil was observed in 2008 (HTP-107). Soil exposure for residual petroleum that does not exceed Method 1 Risk Standards is limited to areas located below concrete and asphalt walkways, below landscaping, or against the building foundation.

Soil Exposure Point Concentrations

Pursuant to 310 CMR 40.0006, the exposure point concentration (EPC) means the concentration in a specific medium, which a human or environmental receptor may contact at an exposure point. All detected #2 fuel oil constituents (EPH) are considered contaminants of concern. Soil exposure points are defined by the combination of the soil classification and the horizontal and vertical distribution of OHM in soil.

Stantec calculated EPCs for soils both side-wide and for soil immediately within the release area (Table 6). The site-wide EPCs are included in Table 1, and do not exceed any applicable S-1/GW-2/3 Method 1 Risk Standards. EPCs calculated for the four samples collected within the release area (two samples from B-201 [OW] and one each from RW-1 and RW-3) also do not exceed any applicable S-1/GW-2/3 Method 1 Risk Standards.

Table 6: EPCs for Soil in the Source Area

Sample ID:	***B-201 (OW)***	***B-201 (OW)***	***RW-1***	***RW-3***	***EPC***	***Method 1 Risk Standard****
Interval (feet)	10-12	14-16	8.0-14.0	8.0-14.0		
Date Collected	3/10/2009	3/10/2009	4/8/2011	4/8/2011		
EPH Fractions						
C9-C18 Aliphatic	**1,570**	19.2	< 13.1	138	433	*1,000*
C19-C36 Aliphatic	504	12.2	< 13.1	43.5	142	*3,000*
C11-C22 Aromatic	**2,150**	29.4	77.2	213	617	*1,000*
EPH Analytes						
Naphthalene	12.7	< 0.565	< 0.437	0.533	3.43	*40*
2-Methylnaphthalene	51.6	< 0.565	< 0.437	2.06	13.54	*80*
Acenaphthene	5.14	< 0.565	0.601	0.453	1.62	*1,000*
Phenanthrene	13.3	< 0.565	6.22	3	5.70	*500*

Stantec further addressed risk under a Method 3 Risk Characterization using the MassDEP Shortforms for residential, construction worker, and trespasser scenarios (Shortform versions 10-12, Vlookup version v0315). Stantec utilized the highest soil concentrations for the EPH fractions and four diesel PAHs detected in soil at the release area as a conservative assessment. Results of the Method 3 indicate that a level of No Significant Risk exists for all receptors. The Shortform results are presented in the following table (Table 7), and the Shortforms are attached in Appendix D.

Table 7: Shortform Results

Shortform	Chronic HI	Subchronic HI	HI
Residential	4.1E-01	1.6E-01	n/a
Trespasser	2.7E-02	9.5E-03	n/a
Construction Worker	n/a	n/a	4.3E-02

Groundwater Exposure Pathway

Possible pathways of exposure to petroleum in groundwater are by ingestion of groundwater and by inhalation of volatilized petroleum vapors. Possible anticipated future receptors are boat-club members and visitors.

Groundwater Exposure Points

Groundwater at the Disposal Site is not a source of drinking water, and the Site and surrounding properties are serviced by the municipal water supply. Therefore, the exposure pathway for ingestion of groundwater is incomplete. Furthermore, all contaminants of concern are below laboratory reporting limits in groundwater.

Air Exposure Pathway

A potential exposure pathway to indoor air is by inhalation of volatilized petroleum from residual petroleum in soil and groundwater. Possible anticipated future receptors are boat-club members, visitors, and construction workers.

Air Exposure Points

Little to no contamination exists below the footprint of the building. Concentrations of EPH are present in soil above Method 1 Risk Standards at one location, just below the floor adjacent to the southern wall of the boat bays. Concentrations of EPH in groundwater are below applicable GW-2 Method 1 Standards across the entire site. Furthermore, the boat storage area below the building has a gravel floor (not concrete), and is open to outside air and is highly ventilated, both of which prevent buildup of any potential vapors. Therefore, the potential for vaporization of petroleum from environmental media into indoor air is incomplete for current site use.

An evaluation of the potential for a complete vapor pathway for future unrestricted use has not been evaluated at this time. However, Stantec implemented an AUL to provide notice to future owners and construction and utility workers of the presence of contaminants. The AUL assures that measures can be taken to mitigate potential future exposure, and also limit future uses of the property. The AUL would serve as notice for any changes to Site conditions that would create a pathway for petroleum vapors to indoor air.

A condition of No Significant Risk shall be considered maintained as long as the conditions specified in the AUL are met.

8.3.2 Safety

Pursuant to 310 CMR 40.0960(3) *a level of no significant risk to safety exists or has been achieved if the conditions at the Disposal Site which are related to a release of oil and/or hazardous material do not currently and will not in the foreseeable future pose a threat of physical harm or bodily injury to people. Such release-related conditions may include, but are not limited to:*

> *(a) the presence of rusted or corroded drums or containers, open pits, lagoons or other dangerous structures;*
> *(b) any threat of fire or explosion, including the presence of explosive vapors resulting from a release of oil and/or hazardous material: and*
> *(c) any uncontained materials which exhibit the characteristics of corrosivity, reactivity, or flammability described at 310 CMR 40.0347*.

None of these conditions exists at the Disposal Site. *Therefore, a Condition of No Significant Risk to safety currently exists at the Site*.

8.3.3 Public Welfare

Pursuant to 310 CMR 40.0994, *there are two purposes for conducting a characterization of risk to public welfare: (a) to identify and evaluate nuisance conditions which may be localized, and (b) to identify and evaluate significant community effects*. A Condition of No Significant Risk of harm to public welfare exists or has been achieved if:

- No community in the vicinity of the Disposal Site experiences significant adverse impacts to public welfare, considering such factors as the existence of nuisance conditions, loss of property value, unilateral restriction of the use of another person's property, and any monetary or non-pecuniary costs not otherwise considered in the characterization of risk of harm to health, safety and the environment, but which may accrue due to the degradation of public or private resources directly attributable to the release of OHM; and

- The concentration of OHM detected in the Disposal Site natural soil and groundwater does not exceed the UCLs as listed in 310 CMR 40.0996(7).

The community in the vicinity of the Disposal Site will not experience significant adverse impacts to public welfare, and concentrations of OHM in soil and groundwater do not exceed UCLs.

Therefore, a Condition of No Significant Risk of harm to public welfare currently exists at the Site.

8.3.4 Environment

Pursuant to 310 CMR 40.0995 *the characterization of risk of harm to the environment shall be conducted for all current and reasonably foreseeable site activities and uses. Characterization of the risk of harm to the environment shall include an assessment of chemical data, potential contaminant migration pathways, and an evaluation of biota and habitats at and in the vicinity of the Disposal Site, as described in 310 CMR 40.0995(2), as well as through the application of Upper Concentration Limits, as described in 310 CMR 40.0995(5).*

The principal environmental receptor in the vicinity of the Site is the Charles River, which is located adjacent to the Site. While LNAPL is present within 75 feet of the river, well-gauging data show that the LNAPL plume is confined to the immediate release area. Norfolk and FST has never observed a sheen or other evidence of oil in the Charles River. Gauging data also shows that the LNAPL plume is shrinking. Furthermore, groundwater sampling data from monitoring wells across the Site (including two wells between the release area and the river) indicate that concentrations of CoCs are below laboratory reporting limits. Therefore, it is Stantec's opinion that a Condition of No Significant Risk of harm to the environment currently exists at the Site.

9.0 FEASIBILTY TO ACHIEVE BACKGROUND

Pursuant to 310 CMR 40.1056(2)(g) *information documenting the extent to which levels of oil and/or hazardous material in the environment have been reduced to Background, and/or the results of the feasibility evaluation conducted pursuant to 310 CMR 40.0860 demonstrating that the achievement of Background is not feasible* is provided below.

Pursuant to 310 CMR 40.0006, background is defined as *those levels of OHM that would exist in the absence of the disposal site of concern, including both Natural Background and Anthropogenic Background*. This feasibility of restoration to background evaluation was conducted consistent with the MassDEP's final policy: *Conducting Feasibility Evaluations Under the MCP*, #WSC-04-160 dated July 16, 2004. The above-mentioned policy outlines an approach which may be followed in order to ensure the "presumptive certainty" of feasibility evaluations.

The primary contaminant of concern at the Disposal Site is #2 fuel oil, which is considered a degradable (non-persistent) contaminant according to Table 9-1 in #WSC-04-160. Section 8.1.3 presents a discussion and multiple lines of evidence approach for documenting LNAPL present at the Site, and the feasibility to remove it. This section addresses the remaining petroleum-impacted soil at the Site, which includes small areas where EPH fractions and analytes were detected during McPhail's assessment. These locations are either below the structure or against the foundation walls.

Concentrations of contaminants in groundwater are below laboratory reporting limits, and are therefore considered to be at background.

9.1 CONDITIONS OF CATEGORICAL FEASIBILITY

Pursuant to the #WSC-04-160 Section 9.3.1, it is categorically feasible to remove small quantities of petroleum-contaminated soil. Specifically, for the purposes of achieving presumptive certainty, it is feasible to achieve background at a site where a condition of NSR has been reached, the remaining contamination is limited to 20 cubic yards or less of soil contamination solely impacted by petroleum products, and where such soil:

- is located less than three (3) feet below grade;
- is not covered by pavement or a permanent structure;
- is not located within a sensitive environment (e.g., wetlands); and
- is not located in an area where removal activities will substantially interrupt public service or threaten public safety.

Although the volume of soil containing residual petroleum impacts at the Site may not exceed 20 cubic yards and is located in some areas less than three feet below grade, it is generally located below the building footprint (HTP-2, HTP-8, HTP-107, HTP-201, and TP-203) below a

concrete-paved walkway (B-201 [OW], and RW-2), below a complex of subsurface utilities (RW-1), or against the foundation wall (RW-6). The remaining two soil samples that contain EPH (B-202 [OW] and RW-8), only contain EPH barely above laboratory reporting limits. Furthermore, every sample containing residual EPH is located within the buffer zone of the Charles River.

Therefore, based on the location in close proximity of the building, the location within the buffer zone of the Charles River, the generally low residual concentrations of EPH in soil, and additional financial burden of remediating to background conditions, it is not considered feasible to achieve or approach background for contaminants in soil.

9.2 CONDITIONS OF CATEGORICAL INFEASIBILITY

Pursuant to the #WSC-04-160 Section 9.3.2, for certain types of pollutants in certain types of environmental settings, remedial actions to achieve background may be considered to be categorically infeasible. These conditions include:

- excavations under permanent structures;
- interruption of public services or threat to public safety;
- remediation of degradable (non-persistent) contaminants; and
- remediation of persistent contaminants located in S-2 and S-3 soils.

Soil that contains concentrations of EPH above Method 1 Risk Standards (HTP-107 and B-201 [OW]) is located below permanent structures. Furthermore, since contaminants associated with this release are considered degradable, it is considered categorically infeasible to achieve or approach background for contaminants in soil at this Site.

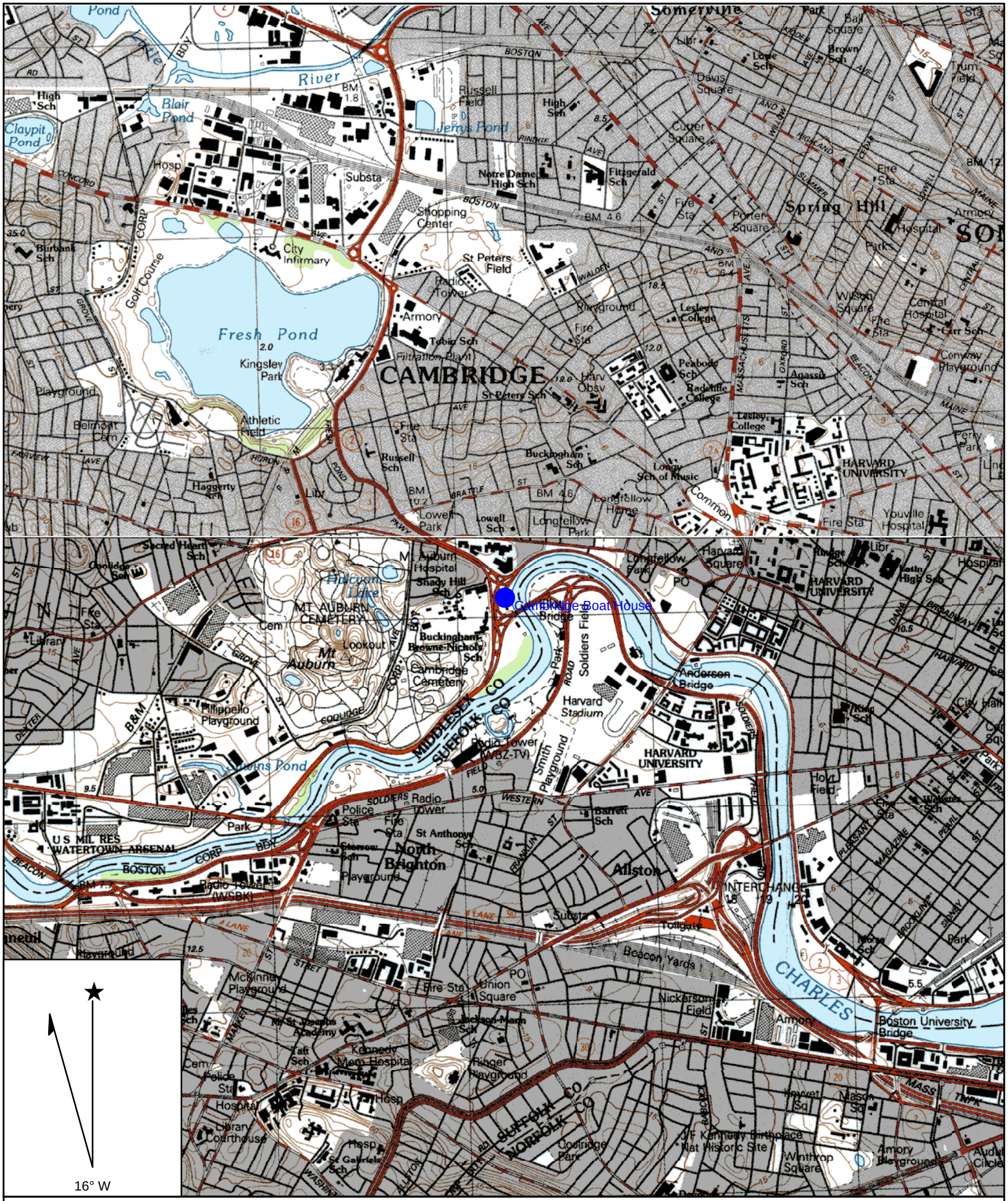
10.0 POST-CLOSURE MONITORING

Pursuant to 310 CMR 40.1056(2)(l), *a description of any operation, maintenance, and/or monitoring that will be required to confirm and/or maintain those conditions at the disposal site upon which the Permanent Solution is based* are provided below.

No post-closure monitoring is required to maintain the Permanent Solution and a Condition of No Significant Risk.

11.0 DOCUMENTATION OF PUBLIC NOTICE REQUIREMENTS

Public Involvement activities regarding this Permanent Solution with Conditions have been conducted pursuant to 310 CMR 40.1403. A letter has been sent to the City of Cambridge Mayor's Office and Cambridge Public Health Department. A copy of the letter is included in Appendix F.



Name: BOSTON SOUTH
Date: 11/9/2010
Scale: 1 inch equals 2000 feet

Location: 042° 22' 19.3" N 071° 08' 04.3" W
Caption: USGS Locus Map
Cambridge Boat House
Cambridge, MA

MassDEP - Bureau of Waste Site Cleanup

Phase 1 Site Assessment Map: 500 feet & 0.5 Mile Radii

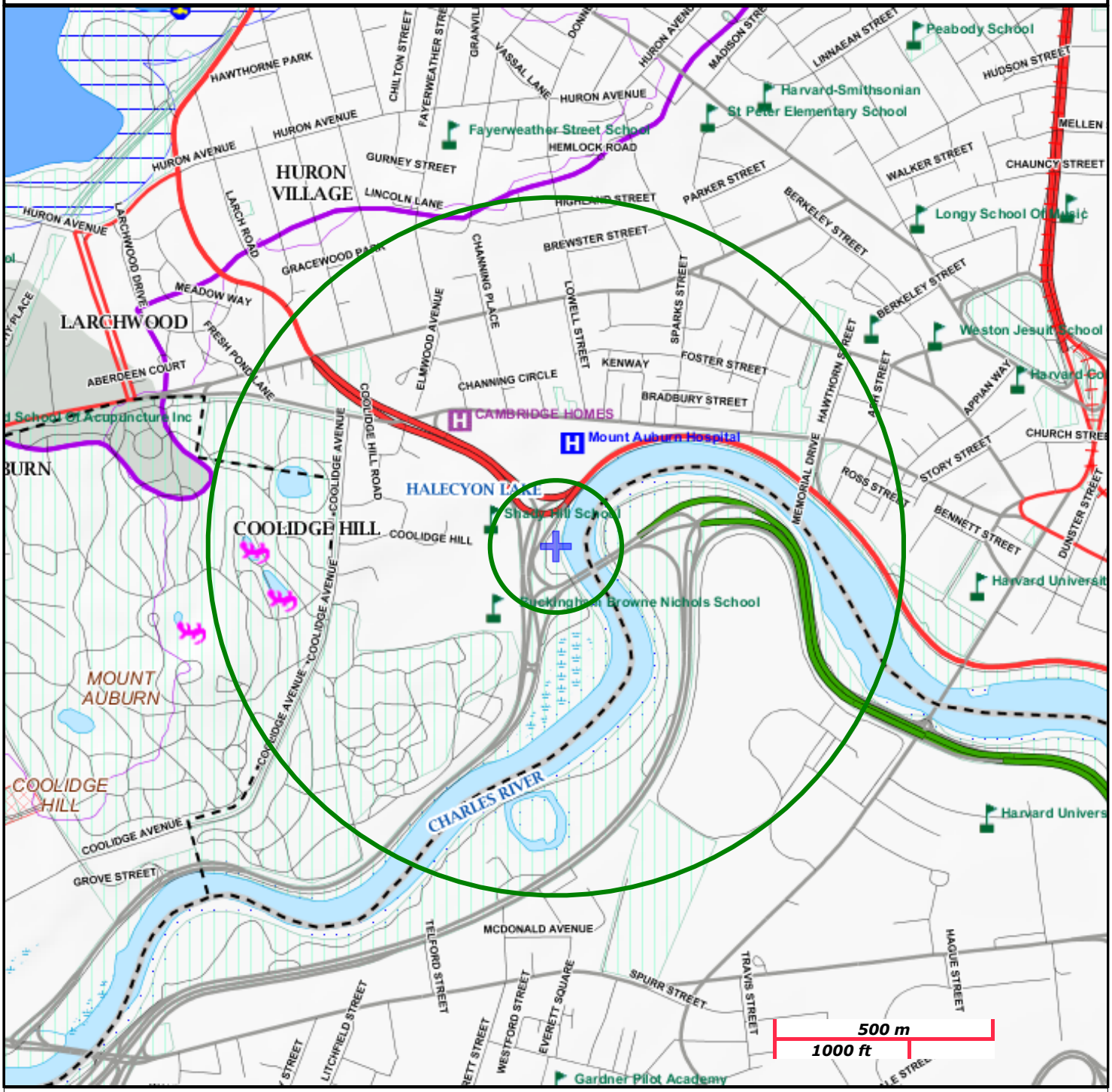
Site Information:

2 GERRYS LANDING CAMBRIDGE, MA

NAD83 UTM Meters:
4693310mN , 324304mE (Zone: 19)
April 28, 2015

The information shown is the best available at the date of printing. However, it may be incomplete. The responsible party and LSP are ultimately responsible for ascertaining the true conditions surrounding the site. Metadata for data layers shown on this map can be found at: http://www.mass.gov/mgis/.

MassDEP
Commonwealth of Massachusetts
Department of Environmental Protection



Roads: Limited Access, Divided, Other Hwy, Major Road, Minor Road, Track, Trail

Boundaries: Town, County, DEP Region; Train; Powerline; Pipeline; Aqueduct

Basins: Major, PWS; Streams: Perennial, Intermittent, Man Made Shore, Dam

Aquifers: Medium Yield, High Yield, EPA Sole Source

Non Potential Drinking Water Source Area: Medium, High (Yield)

PWS Protection Areas: Zone II, IWPA, Zone A

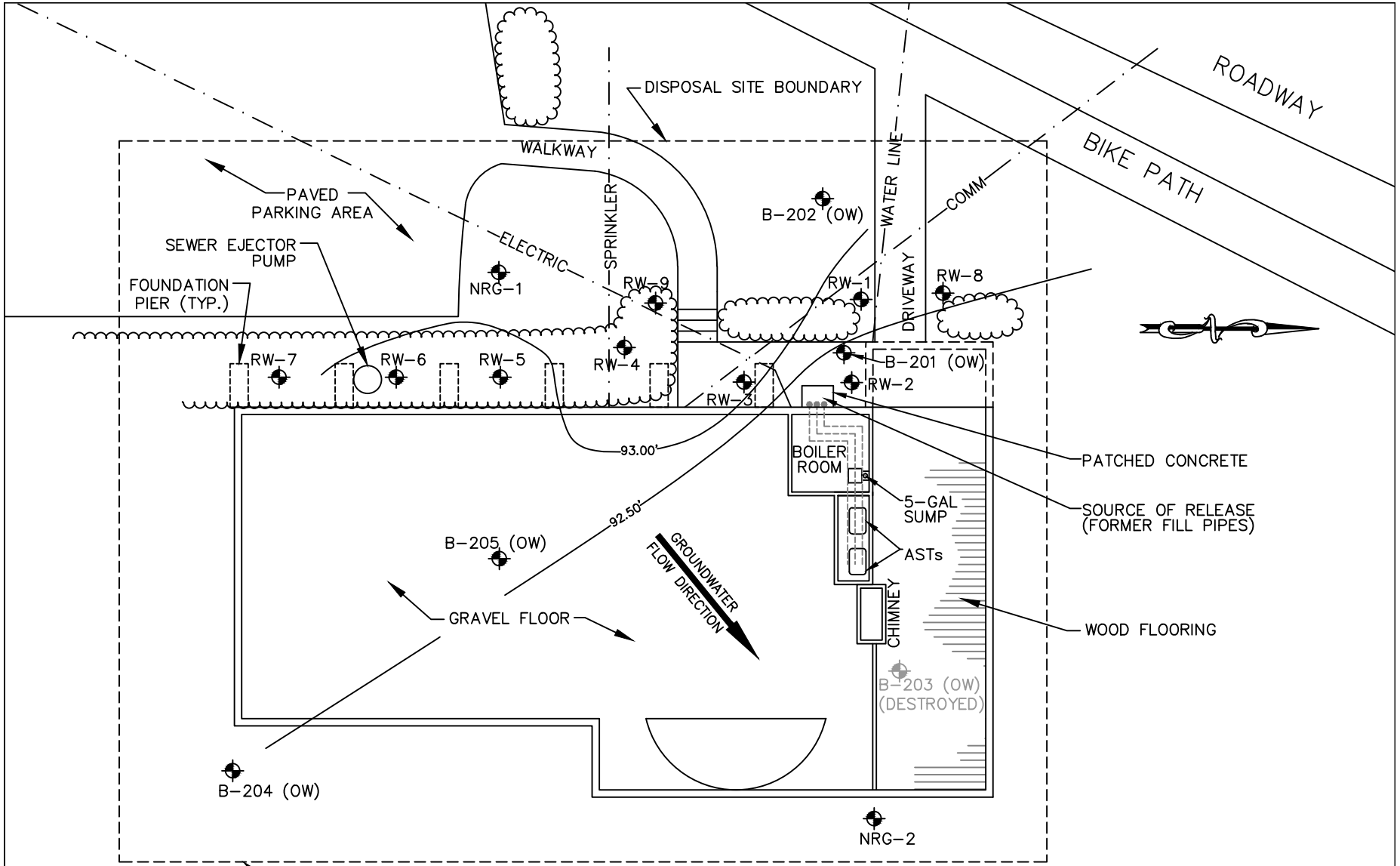
Hydrography: Open Water, PWS Reservoir, Tidal Flat

Wetlands: Freshwater, Saltwater, Cranberry Bog

FEMA 100yr Floodplain; Protected Open Space; ACEC

Est. Rare Wetland Wildlife Hab; Vernal Pool: Cert., Potential

Solid Waste Landfill; PWS: Com.GW,SW, Emerg.,Non-Com.



NORFOLK RAM
ENGINEERING SOLUTIONS FOR THE ENVIRONMENT
ONE ROBERTS ROAD
PLYMOUTH MA, 02360
PHONE - (508) 747-7900
FAX - (508) 747-3658
WWW.NORFOLKRAM.COM

TITLE:
FIGURE 3
SITE PLAN
GERRY'S LANDING
CAMBRIDGE, MASSACHUSETTS

PREPARED FOR:
CAMBRIDGE BOAT CLUB
GERRY'S LANDING
CAMBRIDGE, MASSACHUSETTS

SOURCE:

CHECKED BY:	N.C.G.
EDITED BY:	L.K.H.
DATE:	05/26/2011
DWG SCALE:	1" = 20'
NRG REF NUMBER:	1394.001.01
SHEET NO:	1 OF 1

REVISIONS

NO.	DATE	DESCRIPTION

TABLE 1
Soil Analysis Summary Table
Extractable Petroleum Hydrocarbons (EPH) and Polycyclic Aromatic Hydrocarbons (PAHs)
2 Gerry's Landing Road, Cambridge, MA
RTN 3-27723
(mg/kg dry)

Sample ID:	**HTP-2**	**HTP-6**	**HTP-8**	**HTP-13**	**HTP-107**	**HTP-201**	**HTP-203**	**B-201 (OW)**	**B-201 (OW)**	**B-202 (OW)**	**RW-1**	**RW-3**	**RW-6**	**RW-8**	**NRG-1**	**EPC**	*Method 1 Risk Standards*								
Interval (feet)	0.5-1	1.8-2.3	0.5-1.5	0.6-1	0.5-1	1	1	10-12	14-16	12-14	8.0-14.0	8.0-14.0	5.0-10.0	10.0-12.5	12.5-15.0		*S-1/GW-1*	*S-1/GW-2*	*S-1/GW-3*	*S-2/GW-1*	*S-2/GW-2*	*S-2/GW-3*	*S-3/GW-1*	*S-3/GW-2*	*S-3/GW-3*
Date Collected	6/13/2008	6/13/2008	6/13/2008	6/13/2008	7/22/2008	3/10/2009	3/10/2009	3/10/2009	3/10/2009	3/10/2009	4/8/2011	4/8/2011	4/8/2011	4/8/2011	4/8/2011										
EPH Fractions																									
C9-C18 Aliphatic	< 7.02	< 8.03	9.3	< 7.94	**1,400**	< 7.49	41.7	**1,570**	19.2	< 11.1	< 13.1	138	< 12.7	< 12.5	< 22.6	215	*1,000*	*1,000*	*1,000*	*3,000*	*3,000*	*3,000*	*5,000*	*5,000*	*5,000*
C19-C36 Aliphatic	9.71	< 8.03	22.1	< 7.94	408	< 7.49	30.8	504	12.2	14.2	< 13.1	43.5	< 12.7	< 12.5	< 22.6	77	*3,000*	*3,000*	*3,000*	*5,000*	*5,000*	*5,000*	*5,000*	*5,000*	*5,000*
C11-C22 Aromatic	< 7.02	< 8.03	31.5	< 7.94	**1,540**	8.65	75.5	**2,150**	29.4	17.7	77.2	213	59.1	61.4	< 22.6	306	*1,000*	*1,000*	*1,000*	*1,000*	*3,000*	*3,000*	*1,000*	*5,000*	*5,000*
EPH Analytes																									
Naphthalene	< 0.351	< 0.402	< 0.402	< 0.397	1.02	< 0.374	< 0.427	12.7	< 0.565	< 0.556	< 0.437	0.533	< 0.425	< 0.417	< 0.754	1.13	*4*	*20*	*500*	*4*	*20*	*1,000*	*4*	*20*	*3,000*
2-Methylnaphthalene	< 0.351	< 0.402	< 0.402	< 0.397	5.89	< 0.374	< 0.427	51.6	< 0.565	< 0.556	< 0.437	2.06	< 0.425	< 0.417	< 0.754	4.15	*0.7*	*80*	*300*	*1*	*80*	*500*	*1*	*80*	*500*
Acenaphthylene	< 0.351	< 0.402	< 0.402	< 0.397	0.689	< 0.374	< 0.427	< 2.25	< 0.565	< 0.556	< 0.437	< 0.431	< 0.425	< 0.417	< 0.754	0.32	*1*	*600*	*10*	*1*	*600*	*10*	*1*	*600*	*10*
Acenaphthene	< 0.351	< 0.402	< 0.402	< 0.397	1.23	< 0.374	< 0.427	5.14	< 0.565	< 0.556	0.601	0.453	< 0.425	< 0.417	< 0.754	0.66	*4*	*1,000*	*1,000*	*4*	*3,000*	*3,000*	*4*	*5,000*	*5,000*
Fluorene	< 0.351	< 0.402	< 0.402	< 0.397	4.62	< 0.374	< 0.427	5.2	< 0.565	< 0.556	0.628	0.529	< 0.425	< 0.417	< 0.754	0.90	*1,000*	*1,000*	*1,000*	*3,000*	*3,000*	*3,000*	*5,000*	*5,000*	*5,000*
Phenanthrene	< 0.351	< 0.402	< 0.402	< 0.397	< 0.358	< 0.374	1.14	13.3	< 0.565	< 0.556	6.22	3	2.23	2.03	< 0.754	2.00	*10*	*500*	*500*	*20*	*1,000*	*1,000*	*20*	*3,000*	*3,000*
Anthracene	< 0.351	< 0.402	< 0.402	< 0.397	< 0.358	< 0.374	< 0.427	2.26	< 0.565	< 0.556	1.61	0.69	0.539	0.435	< 0.754	0.52	*1,000*	*1,000*	*1,000*	*3,000*	*3,000*	*3,000*	*5,000*	*5,000*	*5,000*
Fluoranthene	< 0.351	< 0.402	1.05	< 0.397	0.527	< 0.374	1.42	7.33	< 0.565	< 0.556	7.98	3.16	3.11	2.87	< 0.754	1.94	*1,000*	*1,000*	*1,000*	*3,000*	*3,000*	*3,000*	*5,000*	*5,000*	*5,000*
Pyrene	< 0.351	< 0.402	0.84	< 0.397	1.57	< 0.374	1.31	8.54	< 0.565	< 0.556	6.84	3.07	2.82	2.87	< 0.754	1.97	*1,000*	*1,000*	*1,000*	*3,000*	*3,000*	*3,000*	*5,000*	*5,000*	*5,000*
Benzo (a) anthracene	< 0.351	< 0.402	0.701	< 0.397	< 0.358	< 0.374	0.749	3.26	< 0.565	< 0.556	3.54	1.6	1.56	1.61	< 0.754	0.99	*7*	*7*	*7*	*40*	*40*	*40*	*300*	*300*	*300*
Chrysene	< 0.351	< 0.402	0.735	< 0.397	< 0.358	< 0.374	0.878	3.66	< 0.565	< 0.556	3.73	1.67	1.71	1.63	< 0.754	1.06	*70*	*70*	*70*	*400*	*400*	*400*	*3,000*	*3,000*	*3,000*
Benzo (b) fluoranthene	< 0.351	< 0.402	0.653	< 0.397	< 0.358	< 0.374	0.626	2.4	< 0.565	< 0.556	2.48	1.12	1.36	1.28	< 0.754	0.79	*7*	*7*	*7*	*40*	*40*	*40*	*300*	*300*	*300*
Benzo (k) fluoranthene	< 0.351	< 0.402	0.545	< 0.397	< 0.358	< 0.374	0.705	2.76	< 0.565	< 0.556	3.38	1.62	1.38	1.51	< 0.754	0.92	*70*	*70*	*70*	*400*	*400*	*400*	*3,000*	*3,000*	*3,000*
Benzo (a) pyrene	< 0.351	< 0.402	0.603	< 0.397	< 0.358	< 0.374	0.748	**2.76**	< 0.565	< 0.556	**3.87**	1.87	1.87	1.92	< 0.754	1.03	*2*	*2*	*2*	*7*	*7*	*7*	*30*	*30*	*30*
Indeno (1,2,3-cd) pyrene	< 0.351	< 0.402	< 0.402	< 0.397	< 0.358	< 0.374	0.508	< 2.25	< 0.565	< 0.556	1.85	0.902	0.906	0.969	< 0.754	0.56	*7*	*7*	*7*	*40*	*40*	*40*	*300*	*300*	*300*
Dibenzo(a,h) anthracene	< 0.351	< 0.402	< 0.402	< 0.397	< 0.358	< 0.374	< 0.427	< 2.25	< 0.565	< 0.556	< 0.437	< 0.431	< 0.425	< 0.417	< 0.754	0.28	*0.7*	*0.7*	*0.7*	*4*	*4*	*4*	*30*	*30*	*30*
Benzo (g,h,i) perylene	< 0.351	< 0.402	< 0.402	< 0.397	< 0.358	< 0.374	0.5	< 2.25	< 0.565	< 0.556	1.99	1.04	0.988	1.04	< 0.754	0.58	*1,000*	*1,000*	*1,000*	*3,000*	*3,000*	*3,000*	*5,000*	*5,000*	*5,000*

2014 Method 1 Standard Ammendments
GW-2 = Method 1 Risk Standard for groundwater category 2
S-1 = Method 1 Risk Standard for soil category 1
< 5.0 = compound not detected above the laboratory detection limit of 5.0 mg/kg
Bold = compound exceeds applicable risk standard
EPC = Exposure Point Concentrations

TABLE 2
Groundwater Analytical Summary:
Extractable Petroleum Hydrocarbons (EPH)
Cambridge Boat Club, Cambridge Massachusetts
RTN 3-27723
(ug/L)

Sample ID:	RW-1			BW-202-OW			BW-204-OW			BW-205-OW			NRG-1			NRG-2		*Method 1 Risk Standards*	
Date Collected:	4/29/2011	4/16/2012	4/25/2014	4/29/2011	4/16/2012	4/25/2014	4/29/2011	4/16/2012	4/25/2014	4/29/2011	5/10/2012	4/25/2014	4/29/2011	4/16/2012	4/25/2014	4/16/2012	4/25/2014	*GW-2*	*GW-3*
EPH Fractions																			
C9-C18 Aliphatic	< 100	< 109	< 100	< 100	< 114	< 100	< 100	< 125	< 100	< 100	< 101	< 100	< 100	< 111	< 100	< 122	< 100	*5,000*	*50,000*
C19-C36 Aliphatic	< 100	< 109	< 100	< 100	< 114	< 100	< 100	< 125	< 100	< 100	< 101	< 100	< 100	< 111	< 100	< 122	< 100	*NA*	*50,000*
C11-C22 Aromatic	< 100	< 109	< 100	< 100	< 114	< 100	< 100	< 125	< 100	< 100	< 101	< 100	< 100	< 111	< 100	< 122	< 100	*50,000*	*5,000*
EPH Analytes																			
Naphthalene	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	*700*	*20,000*
2-Methylnaphthalene	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	*2,000*	*20,000*
Acenaphthylene	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	*10,000*	*40*
Acenaphthene	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	*NA*	*10,000*
Fluorene	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	*NA*	*40*
Phenanthrene	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	*NA*	*10,000*
Anthracene	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	*NA*	*30*
Fluoranthene	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	1.10	< 1.00	*NA*	*200*
Pyrene	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	1.20	< 1.00	*NA*	*20*
Benzo (a) anthracene	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	*NA*	*1,000*
Chrysene	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	*NA*	*70*
Benzo (b) fluoranthene	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	*NA*	*400*
Benzo (k) fluoranthene	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	*NA*	*100*
Benzo (a) pyrene	< 0.200	< 0.200	< 0.200	< 0.200	< 0.200	< 0.200	< 0.200	< 0.200	< 0.200	< 0.200	< 0.200	< 0.200	< 0.200	< 0.200	< 0.200	0.902	< 0.200	*NA*	*500*
Indeno (1,2,3-cd) pyrene	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	0.585	< 0.500	*NA*	*100*
Dibenzo(a,h) anthracene	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	*NA*	*40*
Benzo (g,h,i) perylene	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	*NA*	*20*

2014 Method 1 Standard Ammendments
GW-2 = Method 1 Risk Standard for groundwater category 2
< 5.0 = compound not detected above the laboratory detection limit of 5.0 ug/L
NA = not applicable

APPENDIX A

ACTIVITY AND USE LIMITATION

13 B

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Page: 1 of 13 09/23/2016 02:40 PM

Form 1075

Note: Pursuant to 310 CMR 40.1074(5), upon transfer of any interest in or a right to use the property or a portion thereof that is subject to this Notice of Activity and Use Limitation, the Notice of Activity and Use Limitation shall be incorporated either in full or by reference into all future deeds, easements, mortgages, leases, licenses, occupancy agreements or any other instrument of transfer. Within 30 days of so incorporating the Notice of Activity and Use Limitation in a deed that is recorded or registered, a copy of such deed shall be submitted to the Department of Environmental Protection.

NOTICE OF ACTIVITY AND USE LIMITATION

M.G.L. c. 21E, § 6 and 310 CMR 40.0000

Disposal Site Name: Cambridge Boat Club
DEP Release Tracking No.(s): 3-27723

This Notice of Activity and Use Limitation ("Notice") is made as of this 15th day of August, 2016, by The Commonwealth of Massachusetts, acting by and through the care and control of the Department of Conservation and Recreation, 251 Causeway Street, Boston, MA 02114, together with his/her/its/their successors and assigns (collectively "Owner").

WITNESSETH:

WHEREAS, The Commonwealth of Massachusetts, is the owner in fee simple of that certain parcel(s) of land located in Cambridge (Town/City), Middlesex County, Massachusetts with the buildings and improvements thereon, pursuant to a deed recorded with the Middlesex South Registry of Deeds in Book 2375, Page 536;

WHEREAS, said parcel(s) of land, which is more particularly bounded and described in Exhibit A, attached hereto and made a part hereof ("Property") is subject to this Notice of Activity and Use Limitation. The Property is shown on a plan recorded in the Middlesex South Registry of Deeds in Plan Book 1895, Plan 134;

WHEREAS, a portion of the Property ("Portion of the Property") is subject to this Notice of Activity and Use Limitation. The Portion of the Property is more particularly bounded and described in Exhibit A-1, attached hereto and made a part hereof. The Portion of the Property is shown on a plan recorded with the Middlesex South Registry of Deeds in Plan Book 2016, Plan 879, and/or on a sketch plan attached hereto and filed herewith for registration;

WHEREAS, the Portion of the Property comprises all of a disposal site as the result of a release of oil and/or hazardous material.

Exhibit B is a sketch plan showing the relationship of the Portion of the Property subject to this Notice of Activity and Use Limitation to the boundaries of said disposal site existing within the limits of the Property and to the extent such boundaries have been established. Exhibit B is attached hereto and made a part hereof; and

WHEREAS, one or more response actions have been selected for the Disposal Site in accordance with M.G.L. c. 21E ("Chapter 21E") and the Massachusetts Contingency Plan, 310 CMR 40.0000 ("MCP"). Said response actions are based upon (a) the restriction of human access to and contact with oil and/or hazardous material in soil and/or groundwater and/or (b) the restriction of certain activities occurring in, on, through, over or under the Portion of the Property. A description of the basis for such restrictions, and the oil and/or hazardous material release event(s) or site history that resulted in the contaminated media subject to the Notice of Activity and Use Limitation is attached hereto as Exhibit C and made a part hereof;

2 Gerrys Landing Cambridge

The Commonwealth of Massachusetts
C/o Department of Conservation and Recreation
251 Causeway Street
Boston, MA 02114

NOW, THEREFORE, notice is hereby given that the activity and use limitations set forth in this Notice of Activity and Use Limitation are as follows:

1. Activities and Uses Consistent with Maintaining No Significant Risk Conditions. The following Activities and Uses are consistent with maintaining a Permanent Solution and a condition of No Significant Risk and, as such, may occur on the Portion of the Property pursuant to 310 CMR 40.0000:

(i) All recreational uses consistent with the current use of the Property;

(ii) All commercial and industrial uses which are necessary or incidental;

(iii) Any other non-residential and non-agricultural uses;

(iv) Such other activities or uses which, in the Opinion of a Licensed Site Professional, shall present no greater risk of harm to health, safety, public welfare or the environment than the activities and uses set forth in this Paragraph; and

(v) Such other activities and uses not identified in Paragraph 2 as being Activities and Uses Inconsistent with maintaining No Significant Risk Conditions.

2. Activities and Uses Inconsistent with Maintaining No Significant Risk Conditions. The following Activities and Uses are inconsistent with maintaining a Permanent Solution and a condition of No Significant Risk pursuant to 310 CMR 40.0000, and, as such, may not occur on the Portion of the Property:

(i) Residential, school, nursery, or daycare facility; and

(ii) Agricultural uses of the property for growing fruits and vegetables for human consumption.

3. Obligations and Conditions. The following obligations and/or conditions are necessary and shall be undertaken and/or maintained at the Portion of the Property to maintain a Permanent Solution and a condition of No Significant Risk:

(i) Existing concrete pavement (concrete pad) as shown on the AUL sketch plan (Exhibit B) shall be maintained at the location of the former fill pipes where oil is present in monitoring wells. In the event the pavement cover is modified, altered, or removed, a pavement cover of equal protective function shall be reinstalled as soon as is practical to prevent changes in exposure;

(ii) A Health and Safety Plan must be prepared by a Certified Industrial Hygienist or other qualified individual sufficiently trained in worker health and safety requirements and implemented prior to the commencement of any activity which is likely to disturb petroleum-contaminated soil and groundwater located below the pavement or building within the AUL area. The Health and Safety Plan should be prepared in accordance with 310 CMR 40.0018, "Health and Safety Procedures" and should specify the type of personal protection (i.e., clothing, respirators), engineering controls, and environmental monitoring necessary to prevent worker exposures to petroleum-contaminated soil or groundwater through dermal contact, ingestion, and/or inhalation. Workers must be informed of the requirements of the Health and Safety Plan, and the plan must be available on-site throughout the course of the project; and

(iii) A Soil Management Plan must be prepared by an LSP and implemented prior to commencement of any activity which is likely to disturb contaminated soil and groundwater where located below the pavement or building within the Area of the AUL. The Soil Management Plan should be implemented in accordance with the requirements of 310 CMR 40.0030, "Management Procedures for Remediation Waste" and describe appropriate soil excavation, handling, storage, transport, and disposal procedures and include a description of the engineering controls and air monitoring procedures necessary to ensure that workers and receptors in the vicinity are not affected by fugitive dust and particulates. On-site workers must be informed of the Soil Management Plan, and the plan must be available on-site throughout the course of the project.

4. Proposed Changes in Activities and Uses. Any proposed changes in activities and uses at the Portion of the Property which may result in higher levels of exposure to oil and/or hazardous material than currently exist shall be evaluated by a Licensed Site Professional who shall render an Opinion, in accordance with 310 CMR 40.1080, as to whether the proposed are inconsistent with maintaining a Permanent Solution and a condition of No Significant Risk. Any and all requirements set forth in the Opinion to meet the objective of this Notice shall be satisfied before any such activity or use is commenced.

5. Violation of a Permanent or Temporary Solution. The activities, uses and/or exposures upon which this Notice is based shall not change at any time to cause a significant risk of harm to health, safety, public welfare, or the environment or to create substantial hazards due to exposure to oil and/or hazardous material without the prior evaluation by a Licensed Site Professional in accordance with 310 CMR 40.1080, and without additional response actions, if necessary, to maintain a condition of No Significant Risk.

If the activities, uses, and/or exposures upon which this Notice is based change without the prior evaluation and additional response actions determined to be necessary by a Licensed Site Professional in accordance with 310 CMR 40.1080, the owner or operator of the Portion of the Property subject to this Notice at the time that the activities, uses and/or exposures change, shall comply with the requirements set forth in 310 CMR 40.0020.

6. Incorporation Into Deeds, Mortgages, Leases, and Instruments of Transfer. This Notice shall be incorporated either in full or by reference into all future deeds, easements, mortgages, leases, licenses, occupancy agreements (not including short term revocable occupancy permits issued by DCR) or any other instrument of transfer, whereby an interest in and/or a right to use the Property or a portion thereof is conveyed in accordance with 310 CMR 40.1074(5).

Owner hereby authorizes and consents to the filing and recordation and/or registration of this Notice, said Notice to become effective when executed under seal by the undersigned Licensed Site Professional, and recorded and/or registered with the appropriate Registry(ies) of Deeds and/or Land Registration Office(s).

WITNESS the execution hereof under seal this 15th day of August, 2016.

Commissioner, DCR

Commonwealth of Massachusetts

COMMONWEALTH OF MASSACHUSETTS

Suffolk, ss August 15, 2016

On this 15 day of August, 2016, before me, the undersigned notary public, personally appeared Leo P. Roy (name of document signer), proved to me through satisfactory evidence of identification, which were Personal Knowledge, to be the person whose name is signed on the preceding or attached document, and acknowledged to me that (he) ~~(she)~~ signed it voluntarily for its stated purpose.

(as Commissioner for The Department of Conservation and Recreation, ~~(a)~~ (the) _____)

(official signature and seal of notary)

ARIANA L. JOHNSON
Notary Public
COMMONWEALTH OF MASSACHUSETTS
My Commission Expires
July 22, 2022

The undersigned Licensed Site Professional hereby certifies that in his Opinion this Notice of Activity and Use Limitation is consistent with a Permanent Solution and maintaining a condition of No Significant Risk.

Date: 9/20/2016

Brian V. Moran, P.E., L
[Licensed Site Professional SEAL]

COMMONWEALTH OF MASSACHUSETTS
BRIAN V. MORAN No. 7351
REGISTERED LICENSED SITE PROFESSIONAL

COMMONWEALTH OF MASSACHUSETTS

Norfolk, ss Sept. 20, 2016

On this 20 day of Sept., 2016 before me, the undersigned notary public, personally appeared Brian V. Moran (name of document signer), proved to me through satisfactory evidence of identification, which were MA License, to be the person whose name is signed on the preceding or attached document, and acknowledged to me that (he) (she) signed it voluntarily for its stated purpose.

(as LSP for Cambridge Boat Club, (a) (the) Client and Responsible Party)

(official signature and seal of notary)

Upon recording, return to:

The Commonwealth of Massachusetts
c/o Department of Conservation and Recreation
251 Causeway Street
Boston, MA 02114

EXHIBIT A

2 Gerry's Landing Road – parcel description

A certain parcel of land located on the westerly bank of the Charles River in the City of Cambridge, County of Middlesex, Commonwealth of Massachusetts, and shown on a plan entitled "Plan of Taking by the Metropolitan Park Commission for the Charles River Reservation, Cambridge Cemetery to Cambridge Hospital, Cambridge, Mass. Scale 100 feet to an inch. March 25, 1895. Olmstead, Olmstead & Eliot, Landscape Archt's" recorded at the Middlesex South District Registry of Deeds as Filed Plan no. 134. Said parcel of land being bounded as described in the deed of taking recorded at book 2375, page 536 as follows:

BEGINNING AT A POINT formed by the intersection of the line of mean high water mark on the left bank of the Charles River, with the Easterly boundary line of the Cambridge Cemetery belonging to the city of Cambridge thence running Northwesterly, nearly Northwest by said cemetery, Eighty (80) feet to a corner;

thence turning and running Northeasterly, by said Cemetery six hundred eight-seven and ten hundredths (687.10) feet to an angle;

thence more Easterly, three hundred one and seventy hundredths (301.70) feet to a stone bound by a bending or broken line;

thence more Northeasterly by a straight line eighty-nine (89) feet to a stone bound;

thence still more Northerly, by a straight line, to a stone bound;

thence Northwesterly, to a stone bound, again Northerly to a stone bound, then Northeasterly to a stone bound, all by said Cambridge Cemetery, two hundred twelve and ten hundredths (212.10) feet to land of estate of James G. Coolidge;

thence nearly Easterly by the same to a stone bound opposite the centre line of a ditch;

thence northeasterly by the same land one hundred thirty-seven and ninety-five hundredths (137.95) feet to a stake opposite the head of a ditch;

thence curving to the North and west on a radius of twenty-three hundred and ninety feet, seven hundred ten and forty hundredths (710.40) feet to a stake at land of said estate of Coolidge on the North side of a creek;

thence curving still more to the west, on a radius of eight hundred twenty-six and thirteen hundredths feet, Eight hundred thirteen (813) feet to a stake at land of said estate;

thence Northeasterly, at or nearly at a right angle thirty nine and six tenths (39.6) feet across a lane as shown on said plan to a stake;

thence Southeasterly at or nearly at a right angle, along land of said estate of said Coolidge two hundred sixty-five and eighty-five hundredths (265.85) feet to a stake;

thence still more Easterly Ninety-eight and twenty-five hundredths (98.25) feet to a stake at the Westerly corner of land belonging to the Cambridge Hospital;

thence Southeasterly, along said land one hundred sixteen and four tenths (116.4) feet a stake;

thence by a broken line, passing through three stone bounds as shown on said plan running along said Cambridge Hospital land, six hundred fifty-eight and five tenths (658.5) feet to a stake at the point formed by the intersection of mean high water line of said Charles River with said Southwesterly boundary line of said Cambridge Hospital land;

thence Southwesterly, Southerly, Southeasterly, Southerly, Southwesterly and Westerly, crossing the mouths of one creek and two coves and of several ditches, all as mean high water line runs or said left bank, twenty-eight hundred ninety five (2895) feet up stream, to the POINT OF BEGINNING. Also all thatch, lands and flats that lie adjacent to the parcel above described between said high water line and extreme low water mark in Charles River, and between the side lines of said described parcel, extended according to law to said low water mark.

EXHIBIT A-1

Activity and Use Limitation Area – parcel description

A certain parcel of land located on the southeasterly side of Gerry's Landing Road in the City of Cambridge, County of Middlesex, Commonwealth of Massachusetts, and shown on a plan entitled "Activity and Use Limitation Plan of Land in Cambridge, Mass.; (Middlesex County); Prepared for: Cambridge Boat Club; Scale: 1" = 20'; Date: June 18, 2015, Schofield Brothers LLC". Said parcel of land being bounded and described as follows:

Commencing at the southwest corner of the boathouse on the southeasterly side of Gerry's Landing Road; thence S 74° 54' 12" W a distance of 39.80 feet to the POINT OF BEGINNING; thence

N 08° 03' 20" E, and parallel to the wall of said boathouse, a distance of 128.00 feet to a point; thence

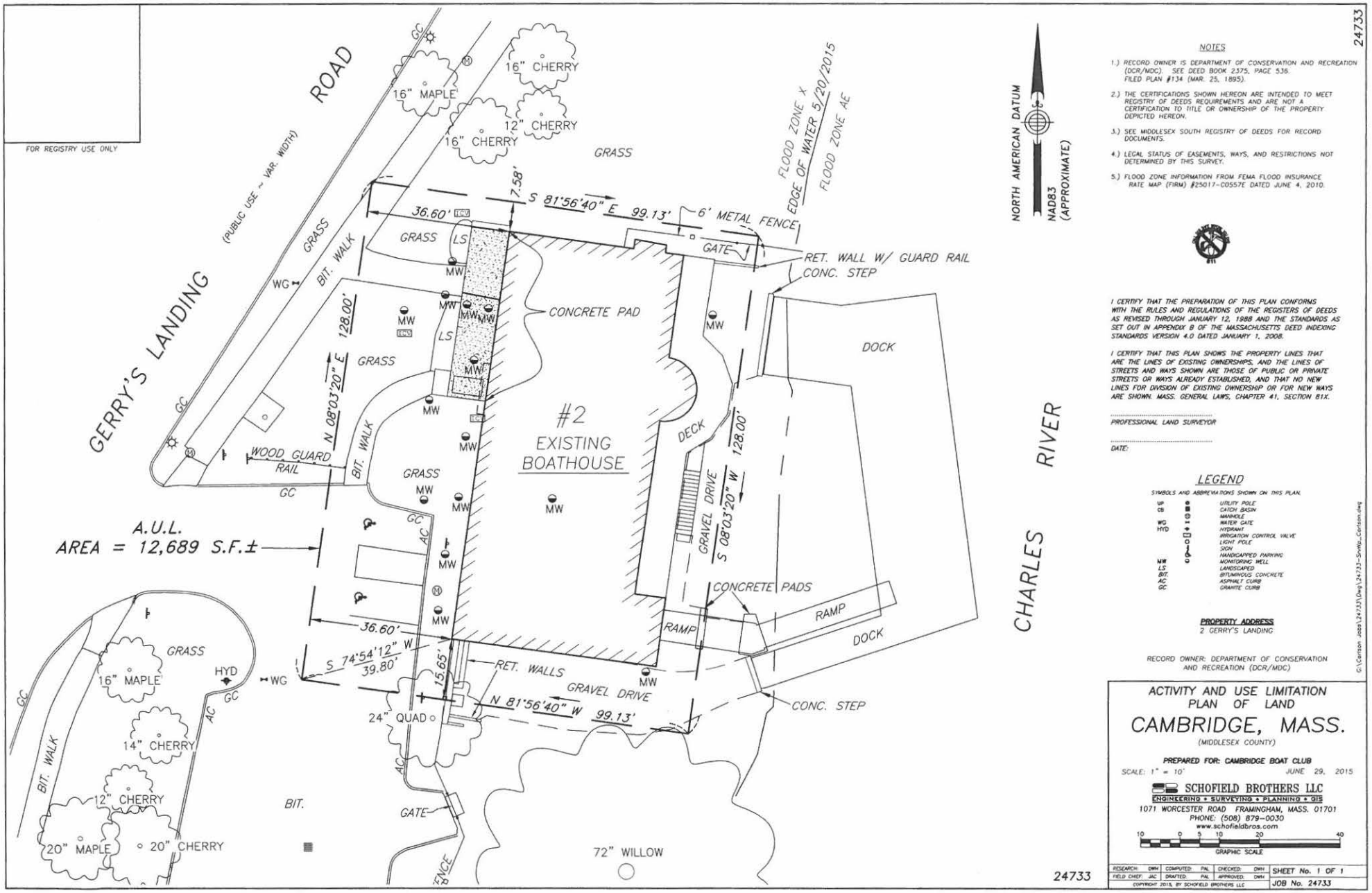
S 81° 56' 40" E a distance of 99.13 feet to a point; thence

S 08° 03' 20" W a distance of 128.00 feet to a point; thence

N 81° 56' 40" W a distance of 99.13 feet to the POINT OF BEGINNING.

The above described parcel of land contains an area of 12,689 square feet, more or less, according to said plan.

Exhibit B



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NOTES

1.) RECORD OWNER IS DEPARTMENT OF CONSERVATION AND RECREATION (DCR/MDC). SEE DEED BOOK 2375, PAGE 536. FILED PLAN #134 (MAR. 25, 1895).

2.) THE CERTIFICATIONS SHOWN HEREON ARE INTENDED TO MEET REGISTRY OF DEEDS REQUIREMENTS AND ARE NOT A CERTIFICATION TO TITLE OR OWNERSHIP OF THE PROPERTY DEPICTED HEREON.

3.) SEE MIDDLESEX SOUTH REGISTRY OF DEEDS FOR RECORD DOCUMENTS.

4.) LEGAL STATUS OF EASEMENTS, WAYS, AND RESTRICTIONS NOT DETERMINED BY THIS SURVEY.

5.) FLOOD ZONE INFORMATION FROM FEMA FLOOD INSURANCE RATE MAP (FIRM) #25017-C0557E DATED JUNE 4, 2010.

I CERTIFY THAT THE PREPARATION OF THIS PLAN CONFORMS WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS AS REVISED THROUGH JANUARY 12, 1988 AND THE STANDARDS AS SET OUT IN APPENDIX B OF THE MASSACHUSETTS DEED INDEXING STANDARDS VERSION 4.0 DATED JANUARY 1, 2008.

I CERTIFY THAT THIS PLAN SHOWS THE PROPERTY LINES THAT ARE THE LINES OF EXISTING OWNERSHIPS, AND THE LINES OF STREETS AND WAYS SHOWN ARE THOSE OF PUBLIC OR PRIVATE STREETS OR WAYS ALREADY ESTABLISHED, AND THAT NO NEW LINES FOR DIVISION OF EXISTING OWNERSHIP OR FOR NEW WAYS ARE SHOWN. MASS. GENERAL LAWS, CHAPTER 41, SECTION 81X.

PROFESSIONAL LAND SURVEYOR

DATE:

LEGEND

SYMBOLS AND ABBREVIATIONS SHOWN ON THIS PLAN.

UP	UTILITY POLE
CB	CATCH BASIN
	MANHOLE
WG	WATER GATE
HYD	HYDRANT
	IRRIGATION CONTROL VALVE
	LIGHT POLE
	SIGN
	HANDICAPPED PARKING
MW	MONITORING WELL
LS	LANDSCAPED
BIT.	BITUMINOUS CONCRETE
AC	ASPHALT CURB
GC	GRANITE CURB

PROPERTY ADDRESS
2 GERRY'S LANDING

RECORD OWNER: DEPARTMENT OF CONSERVATION AND RECREATION (DCR/MDC)

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ACTIVITY AND USE LIMITATION
PLAN OF LAND

CAMBRIDGE, MASS.

(MIDDLESEX COUNTY)

PREPARED FOR: CAMBRIDGE BOAT CLUB

SCALE: 1" = 10' JUNE 29, 2015

SCHOFIELD BROTHERS LLC
ENGINEERING • SURVEYING • PLANNING • GIS
1071 WORCESTER ROAD FRAMINGHAM, MASS. 01701
PHONE: (508) 879-0030
www.schofieldbros.com

10 0 5 10 20 40
GRAPHIC SCALE

RESEARCH: DWH	COMPUTED: PAL	CHECKED: DWH	SHEET No. 1 OF 1
FIELD CHEF: JAC	DRAFTED: PAL	APPROVED: DWH	JOB No. 24733

24733

EXHIBIT C of Form 1075

ACTIVITY AND USE LIMITATION
2 Gerry's Landing Road, Cambridge, MA
RTN 3-0229

Introduction
In accordance with the requirements of 310 CMR 40.1074, this Activity and Use Limitation (AUL) has been prepared to address the control of significant risk at 2 Gerry's Landing Road, Cambridge, MA, which encompasses the entire disposal site. The Massachusetts Department of Environmental Protection (DEP) has assigned this site Release Tracking Number (RTN) 3-27723.

At the time of the recording of the Notice of Activity and Use Limitation ("Notice") with the Middlesex South Registry of Deeds, the property is zoned as open space which is owned by the Massachusetts Department of Conservation and Recreation. The property is developed with one building used as a boat house. A legal metes and bounds description of the property and AUL area is attached as Appendix A and A-1 to this Notice. Exhibit B is a site sketch of the property subject to the Activity and Use Limitation.

Reason for Activity and Use Limitation
A release of No. 2 heating fuel oil was discovered in May 2008. The release originated from a leaking fill pipe which fed the above ground storage tanks (AST's) located in the boat storage area below the building. The volume of oil released is unknown and the duration of the leaking is suspected to have occurred over a period of ten years. The release resulted in an accumulation of oil adjacent to the foundation of the building, and fuel oil had migrated along the foundation wall before discharging to the ground surface at one location. At the source of the release next to the AST fill pipe, fuel oil has been present in groundwater monitoring wells at thickness originally up to ten inches.

Remedial actions were performed to remove fuel oil on the water table, and were successful at reducing the occurrence of fuel oil to just the location next to the fill pipe. However, over a period of several years of oil recovery the thickness of fuel oil present has remained at measureable levels although significantly reduced from the levels observed prior to remediation. A Phase II Comprehensive Site Investigation and Phase III Evaluation and Selection of Remedial Alternatives report was prepared in June 2012 and concluded that elimination of the measurable fuel oil in the well at the release origin was feasible but it may take a long time since the readily recoverable oil had already been eliminated. At that time the site was placed into a temporary closure with continued passive oil bailing as the selected remedial option until such time that a Permanent closure was achievable by eliminating the remaining oil present in the well.

Recently enacted changes in the regulations governing release site cleanup and alternatives for Permanent closure have provided an additional option for site closure where oil remains present on groundwater in a monitoring well after remedial actions have been conducted to remove the oil "to the extent feasible". On June 20, 2014 it became possible to achieve a Permanent closure where residual oil remains by evaluating the risk posed and concluding that a "significant risk" does not exist, and that the residual oil present does not pose a threat of migration beyond its existing location. A requirement of utilizing this closure option is that an Activity and use Limitation (AUL) must be filed on the property and recorded at the Registry of Deeds. The purpose is to inform future property owners and construction and utility workers of the presence of this residual oil and to prescribe actions that must be followed when encountering this residual contamination. The AUL also limits future uses of the property where residual oil may pose a risk for unrestricted use. These future uses include the use of the property for a residence, daycare facility, school, or nursery, and the prohibition on the growing of fruits and vegetables for human consumption.

The requirement for the AUL is related only to the presence of the residual oil in groundwater as the concentrations of oil in soil at this location do not exceed applicable risk standards.

Site History

The Site is located on the western bank of the Charles River. It is developed with a two-story building that has an open boat storage area (secured by sliding doors) on the ground level. The Cambridge Boat Club uses the Site for club activities and boat and equipment storage. It currently consists of office space and function rooms on the second floor, and no living space.

The property was originally a marsh and tidal flat prior to the boat house being moved to the Site in 1947 from Marsh Street, although the property may have been filled in the 1930s. The Site has been used by Cambridge Boat Club in generally the same capacity as today since 1947.

The boat house was renovated in the late 1990s when an addition was added to the northern side of the structure. At that time, the entire boat house was lifted off the foundation and a new foundation wall was installed on the western and northern sides of the structure. An additional boat storage bay was also added to the north side of the building, and a boiler room was built in the northwestern area of the boat storage area. The boiler room houses two (2) 330-gallon aboveground storage tanks (ASTs) in a concrete containment structure that was fed from the leaking AST fill pipe located at the front of the building.

The release was initially discovered in 2008 when personnel at the Cambridge Boat Club observed fuel-oil odors, stained soil, and a sheen on shallow groundwater at the southwest corner of the on-site building, as well as staining in the vicinity of the boiler room and aboveground storage tank (AST) fill pipes located near the northwestern corner of the building. Subsequent tests indicated that one of the AST fill pipes became cracked shortly after installation in the late 1990s. Limited assessment in 2008 by the previous consultant indicated that a threat of release was present, and a representative of Cambridge Boat Club notified the MA DEP of the two-hour reporting condition on May 28, 2008. The MA DEP issued release tracking number (RTN) 3-27723, and approved the performance of immediate response action (IRA) activities including the repair of the AST fill pipe and assessment of the release. Cambridge Boat Club implemented response actions that included capping the AST fill pipe, removing soil from the area along the trench in the southwest corner of the building, and placing absorbent materials on the water exposed in the trench.

The previous consultant assessed the release by excavating 26 test pits and installing five (5) groundwater monitoring wells. Subsequent laboratory analysis and assessment determined that concentrations of petroleum in soil only exceeded applicable Method 1 Risk Standards directly below the broken fill pipe, and fuel oil was only present on the water table in a small alcove of the foundation walls immediately below the broken fill pipe.

Fay, Spofford & Thorndike (FST), formerly Norfolk Ram Group, was hired to perform additional assessment including well gauging and the installation of nine (9) recovery wells and two (2) additional groundwater monitoring wells. FST performed six (6) groundwater extraction events using a vacuum truck from the wells in the immediate vicinity of the release area in order to reduce the thickness of fuel oil on the water table.

Prior to the groundwater extraction events, fuel oil thickness in the two wells in the immediate vicinity of the AST fill pipes averaged approximately ten (10) inches. Subsequent to the extractions, the fuel oil thickness dropped to an average of between three (3) and five (5) inches. While fuel oil thickness decreased significantly, the remedial goal of reducing the fuel oil to a thickness of half an inch (0.5") was deemed not economically feasible or timely using the extraction method.

FST submitted a Phase II Comprehensive Site Assessment, Phase III Remedial Action Plan, RAM Completion, and Class C-2 RAO dated June 1, 2012. The Class C RAO outlined the defining and enterprising steps to achieve Permanent Closure, which includes the implementation of a cost-effective passive bailer to recover oil, regular monitoring and collection of bailer

recovered oil, and monthly gauging of fuel oil thickness in the on-site wells to document oil thickness and trends.

Contaminants of Concern
Based on the above investigations by FST, the contaminants of concern (CoC's) for the Site are petroleum hydrocarbons in soil and groundwater associated with the fuel oil release identified in 2008.

As described above, subsurface investigations performed at the Site included twenty six (26) test pits, seven (7) soil boring/monitoring wells, and nine (9) recovery wells for the extraction of residual oil. Complete rounds of groundwater samples were collected in 2011, 2012, and 2014.

Horizontal and Vertical Extent of Oil in Soil
Initially, low concentrations of petroleum were identified at various locations in test pits and in two soil borings near the release origin. When the fuel oil release was first identified in 2008 it was due to oil migration along the foundation wall where oil had seeped to the ground surface where the foundation wall, the groundwater table, and the ground surface all met at the far end of the building. However, there have been only two locations where fuel oil has been identified in soil in excess of an applicable Method I cleanup standard; in a single shallow test pit near the far foundation wall, and in a soil boring/monitoring well located at the point of the release. The shallow groundwater table (only a few inches below the gravel surface of the storage area below the boat house) and the tight silty nature of the soil appears to have strongly influenced the migration pathway of the oil migration along the foundation wall, and the shallow distribution of oil initially observed. Oil observed above the Method I cleanup standard in boring B-201 (OW) where the release occurred was present at a depth of 10 to 12 feet below the ground surface. At this location the depth to water is approximately 10 feet below grade. Petroleum in soil at a depth of 14 to 16 feet below grade at this location was well below the Method I cleanup standard.

Soil borings performed in the vicinity of B-201 (OW) and along the foundation wall in 2011 in advance of remedial activities indicated only very low total organic vapor measurements and laboratory data confirmed that petroleum was generally non-detect or far below any applicable Method I cleanup standard.

An evaluation of the risk posed by the two locations where soil exceed the Method I cleanup standard utilizing the MADEP Risk ShortForms confirmed that these two locations do not exceed a condition of No Significant Risk. Therefore, a condition of No Significant Risk exists for petroleum in soil.

Horizontal and Vertical Extent of Oil in Groundwater
Three complete rounds of groundwater sampling have been conducted at the site since 2011. With the exception of the two wells installed adjacent to the fill pipe which have been used to gauge and extract oil, all site monitoring wells have been non-detect for petroleum. Prior to the six vacuum extraction events conducted between May and August 2011 some oil had been observed in two recovery wells along the foundation wall where the oil appears to have migrated in 2008. Since that time measurable oil has generally not been observed at thicknesses greater than 0.5 inches, which indicates the success of the vacuum extracts in controlling the extent of oil migration and the volume of residual oil present at the site.

Residual fuel oil remains present in the two wells installed adjacent to the former fill pipes where the release occurred. Since remedial actions to reduce this separate phase oil in these wells were initiated in June 2011, the thickness of oil at this location has been reduced from a constant 10 inches of oil, to a varying thickness of between one to four inches. The last series of monthly measurements made in late 2013 indicated oil at only one inch thickness. Measureable oil greater than 0.5 inches in thickness has generally not been observed in any other recovery wells, and no monitoring wells have contained dissolved petroleum above laboratory detection limits.

Remedial actions conducted in 2011 and continued passive and manual bailing and gauging through 2013 have resulted in a reduction of petroleum present in wells at the source of the release. Petroleum has not migrated since the initial release and no dissolved petroleum contaminants have been identified in monitoring wells at other locations at the site, including monitoring wells located within 10 feet of the former fill pipes.

Contaminant Concentrations
The following are the *maximum concentrations* for contaminants present in soil that exceed Method I Risk Standards:

Soil, exceeding S-1 Method I Risk Standards (in parts per million, mg/kg):

EPH		
C9-C18 aliphatic	1,570 mg/kg	B-201(OW) 10-12 feet
C11-C22 aromatic	2,150 mg/kg	B-201(OW) 10-12 feet
C9-C18 aliphatic	1,400 mg/kg	HTP 107 0.5 – 1.0 feet
C11-C22 aromatic	1,540 mg/kg	HTP 107 0.5 – 1.0 feet

Groundwater, equal to or exceeding GW-2 or GW-3 Method I Risk Standards (in parts per billion, µg/l):

No groundwater measured in site monitoring wells has exceeded applicable GW-2 or GW-3 Method I Risk Standards. However, groundwater at the source of the release has contained fuel oil in the recovery well at a thickness of up to 10 inches.

The following are the maximum thicknesses of oil measured in site recovery wells along the foundation wall since the release was first identified in May 2008:

Recovery Well	Max Oil Thickness (Pre-remediation)	Avg Thickness in 2013 (monthly data)
B-201(OW)	10.2 inches	2.76 inches
RW-2	11.3 inches	2.04 inches
RW-5	9.1 inches	0.24 inches
RW-3	0.72 inches	0.00 inches

Implementation of Activity and Use Limitation
Achievement of a Permanent Solution with Conditions for the site requires the implementation of an Activity and Use Limitation (AUL) where oil is present to provide notice to future owners and construction and utility workers of the presence of fuel oil to which these persons may come into contact. The AUL is intended to assure that the property owner can take measures to manage potential future exposure to the oil, and to require appropriate health and safety measures for utility and construction workers who may come into contact with residual petroleum at the site.

A Method 3 Risk Characterization was performed for the current commercial use of the property including risk to construction workers. A condition of No Significant Risk was determined to exist, now and in the future, with the implementation of an Activity and Use Limitation.

The future intended use of the property is its present non-residential recreational use. A condition of No Significant Risk shall be considered maintained so long as the conditions specified in the Activity and Use Limitation are met.

Date: 9/20/2016

COMMONWEALTH OF MASSACHUSETTS
BRIAN V. MORAN No. 7351
REGISTERED LICENSED SITE PROFESSIONAL

Brian V. Moran, LSP #7351

SEP 23 2016

COMMONWEALTH OF MASSACHUSETTS.
MIDDLESEX S.S. _____
SOUTH DIST. REGISTRY OF DEEDS
CAMBRIDGE, MA
I HEREBY CERTIFY THE FOREGOING
IS A TRUE COPY OF A PAPER
RECORDED IN BOOK 68074
PAGE 335

REGISTER

APPENDIX B

LABORATORY ANALYTICAL DATA

Report Date:
08-May-14 15:28

☑ Final Report
☐ Re-Issued Report
☐ Revised Report

SPECTRUM ANALYTICAL, INC.
Featuring
HANIBAL TECHNOLOGY

Laboratory Report

Fay, Spofford & Thorndike
One Roberts Road
Plymouth, MA 02360
Attn: Charles Young

Project: CBC-Cambridge, MA
Project #: 1394.001.01 (GC-014)

Laboratory ID	Client Sample ID	Matrix	Date Sampled	Date Received
SB88437-01	NRG-1	Ground Water	25-Apr-14 09:00	25-Apr-14 16:50
SB88437-02	NRG-2	Ground Water	25-Apr-14 11:30	25-Apr-14 16:50
SB88437-03	RW-1	Ground Water	25-Apr-14 09:30	25-Apr-14 16:50
SB88437-04	B-202 (OW)	Ground Water	25-Apr-14 08:00	25-Apr-14 16:50
SB88437-05	B-204 (OW)	Ground Water	25-Apr-14 10:30	25-Apr-14 16:50
SB88437-06	B-205 (OW)	Ground Water	25-Apr-14 13:15	25-Apr-14 16:50

I attest that the information contained within the report has been reviewed for accuracy and checked against the quality control requirements for each method. These results relate only to the sample(s) as received.
All applicable NELAC requirements have been met.

Massachusetts # M-MA138/MA1110
Connecticut # PH-0777
Florida # E87600/E87936
Maine # MA138
New Hampshire # 2538
New Jersey # MA011/MA012
New York # 11393/11840
Pennsylvania # 68-04426/68-02924
Rhode Island # 98
USDA # S-51435

Authorized by:

Nicole Leja
Laboratory Director

Spectrum Analytical holds certification in the State of Massachusetts for the analytes as indicated with an X in the "Cert." column within this report. Please note that the State of Massachusetts does not offer certification for all analytes. Please refer to our website for specific certification holdings in each state.
Please note that this report contains 19 pages of analytical data plus Chain of Custody document(s). When the Laboratory Report is indicated as revised, this report supersedes any previously dated reports for the laboratory ID(s) referenced above. Where this report identifies subcontracted analyses, copies of the subcontractor's test report are available upon request. This report may not be reproduced, except in full, without written approval from Spectrum Analytical, Inc.

Spectrum Analytical, Inc. is a NELAC accredited laboratory organization and meets NELAC testing standards. Use of the NELAC logo however does not insure that Spectrum is currently accredited for the specific method or analyte indicated. Please refer to our "Quality" web page at www.spectrum-analytical.com for a full listing of our current certifications and fields of accreditation. States in which Spectrum Analytical, Inc. holds NELAC certification are New York, New Hampshire, New Jersey, Pennsylvania and Florida. All analytical work for Volatile Organic and Air analysis are transferred to and conducted at our 830 Silver Street location (NY-11840, NJ-MA012, PA-68-04426 and FL-E87936).

Please contact the Laboratory or Technical Director at 800-789-9115 with any questions regarding the data contained in this laboratory report.

The following outlines the condition of all EPH samples contained within this report upon laboratory receipt.

Matrices	Ground Water
Containers	✓ Satisfactory
Aqueous Preservative	N/A ✓ pH≤2 pH>2 pH adjusted to <2 in lab
Temperature	✓ Received on ice Received at 4 ± 2 ºC ✓ Other: 1.6ºC

Were all QA/QC procedures followed as required by the EPH method? *Yes*
Were any significant modifications made to the EPH method as specified in Section 11.3? *No*
Were all performance/acceptance standards for required QA/QC procedures achieved? *Yes*

I attest that based upon my inquiry of those individuals immediately responsible for obtaining the information, the material contained in this report is, to the best of my knowledge and belief, accurate and complete.

Authorized by:

Nicole Leja
Laboratory Director

MassDEP Analytical Protocol Certification Form

Laboratory Name: Spectrum Analytical, Inc.	**Project #:** 1394.001.01 (GC-014)
Project Location: CBC-Cambridge, MA	**RTN:**
This form provides certifications for the following data set:	SB88437-01 through SB88437-06
Matrices: Ground Water	

CAM Protocol

8260 VOC CAM II A	7470/7471 Hg CAM III B	MassDEP VPH CAM IV A	8081 Pesticides CAM V B	7196 Hex Cr CAM VI B	MassDEP APH CAM IX A
8270 SVOC CAM II B	7010 Metals CAM III C	✓ MassDEP EPH CAM IV B	8151 Herbicides CAM V C	8330 Explosives CAM VIII A	TO-15 VOC CAM IX B
6010 Metals CAM III A	6020 Metals CAM III D	8082 PCB CAM V A	9012 Total Cyanide/PAC CAM VI A	9014 Total Cyanide/PAC CAM VI A	6860 Perchlorate CAM VIII B

Affirmative responses to questions A through F are required for "Presumptive Certainty" status

A	Were all samples received in a condition consistent with those described on the Chain of Custody, properly preserved (including temperature) in the field or laboratory, and prepared/analyzed within method holding times?	✓ Yes No
B	Were the analytical method(s) and all associated QC requirements specified in the selected CAM protocol(s) followed?	✓ Yes No
C	Were all required corrective actions and analytical response actions specified in the selected CAM protocol(s) implemented for all identified performance standard non-conformances?	✓ Yes No
D	Does the laboratory report comply with all the reporting requirements specified in CAM VII A, "Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"?	✓ Yes No
E	a. VPH, EPH, and APH Methods only: Was each method conducted without significant modification(s)? b. APH and TO-15 Methods only: Was the complete analyte list reported for each method?	✓ Yes No Yes No
F	Were all applicable CAM protocol QC and performance standard non-conformances identified and evaluated in a laboratory narrative (including all "No" responses to questions A through E)?	✓ Yes No

Responses to questions G, H and I below are required for "Presumptive Certainty" status

G	Were the reporting limits at or below all CAM reporting limits specified in the selected CAM protocol(s)?	✓ Yes No

<u>Data User Note:</u> Data that achieve "Presumptive Certainty" status may not necessarily meet the data usability and representativeness requirements described in 310 CMR 40. 1056 (2)(k) and WSC-07-350.

H	Were all QC performance standards specified in the CAM protocol(s) achieved?	✓ Yes No
I	Were results reported for the complete analyte list specified in the selected CAM protocol(s)?	✓ Yes No

All negative responses are addressed in a case narrative on the cover page of this report.

I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.

Nicole Leja
Laboratory Director
Date: 5/8/2014

CASE NARRATIVE:

Data has been reported to the RDL. This report excludes estimated concentrations detected below the RDL and above the MDL (J-Flag).

The samples were received 1.6 degrees Celsius, please refer to the Chain of Custody for details specific to temperature upon receipt. An infrared thermometer with a tolerance of +/- 1.0 degrees Celsius was used immediately upon receipt of the samples.

If a Matrix Spike (MS), Matrix Spike Duplicate (MSD) or Duplicate (DUP) was not requested on the Chain of Custody, method criteria may have been fulfilled with a source sample not of this Sample Delivery Group.

MADEP has published a list of analytical methods (CAM) which provides a series of recommended protocols for the acquisition, analysis and reporting of analytical data in support of MCP decisions. "Presumptive Certainty" can be established only for those methods published by the MADEP in the MCP CAM. The compounds and/or elements reported were specifically requested by the client on the Chain of Custody and in some cases may not include the full analyte list as defined in the method. Regulatory limits may not be achieved if specific method and/or technique was not requested on the Chain of Custody.

According to WSC-CAM 5/2009 Rev.1, Table 11 A-1, recovery for some VOC analytes have been deemed potentially difficult. Although they may still be within the recommended recovery range, a range has been set based on historical control limits.

Some target analytes which are not listed as exceptions in the Summary of CAM Reporting Limits may exceed the recommended RL based on sample initial volume or weight provided, % moisture content, or responsiveness of a particular analyte to purge and trap instrumentation.

See below for any non-conformances and issues relating to quality control samples and/or sample analysis/matrix.

MADEP EPH 5/2004 R

Samples:

SB88437-06	*B-205 (OW)*

Elevated Reporting Limits due to limited sample volume.

Sample Acceptance Check Form

Client:	Fay, Spofford & Thorndike - Plymouth, MA
Project:	CBC-Cambridge, MA / 1394.001.01 (GC-014)
Work Order:	SB88437
Sample(s) received on:	4/25/2014
Received by:	Jessica Hoffman

The following outlines the condition of samples for the attached Chain of Custody upon receipt.

	Yes	No	N/A
1. Were custody seals present?	☐	☑	☐
2. Were custody seals intact?	☐	☐	☑
3. Were samples received at a temperature of ≤ 6°C?	☑	☐	☐
4. Were samples cooled on ice upon transfer to laboratory representative?	☑	☐	☐
5. Were samples refrigerated upon transfer to laboratory representative?	☐	☑	☐
6. Were sample containers received intact?	☑	☐	☐
7. Were samples properly labeled (labels affixed to sample containers and include sample ID, site location, and/or project number and the collection date)?	☑	☐	☐
8. Were samples accompanied by a Chain of Custody document?	☑	☐	☐
9. Does Chain of Custody document include proper, full, and complete documentation, which shall include sample ID, site location, and/or project number, date and time of collection, collector's name, preservation type, sample matrix and any special remarks concerning the sample?	☑	☐	☐
10. Did sample container labels agree with Chain of Custody document?	☑	☐	☐
11. Were samples received within method-specific holding times?	☑	☐	☐

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
NRG-1	1394.001.01 (GC-014)	Ground Water	25-Apr-14 09:00	25-Apr-14
SB88437-01				

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
Extractable Petroleum Hydrocarbons													
MADEP EPH (Low)													
Prepared by method SW846 3510C													
	C9-C18 Aliphatic Hydrocarbons	< 100		µg/l	100	40.9	1	MADEP EPH 5/2004 R	03-May-14	06-May-14	MWP	1409820	
	C19-C36 Aliphatic Hydrocarbons	< 100		µg/l	100	73.0	1	"	"	"	"	"	
	C11-C22 Aromatic Hydrocarbons	< 100		µg/l	100	63.1	1	"	"	"	"	"	
	Unadjusted C11-C22 Aromatic Hydrocarbons	< 100		µg/l	100	63.1	1	"	"	"	"	"	
91-20-3	Naphthalene	< 1.00		µg/l	1.00	0.236	1	"	"	"	"	"	
91-57-6	2-Methylnaphthalene	< 1.00		µg/l	1.00	0.256	1	"	"	"	"	"	
208-96-8	Acenaphthylene	< 1.00		µg/l	1.00	0.235	1	"	"	"	"	"	
83-32-9	Acenaphthene	< 1.00		µg/l	1.00	0.310	1	"	"	"	"	"	
86-73-7	Fluorene	< 1.00		µg/l	1.00	0.243	1	"	"	"	"	"	
85-01-8	Phenanthrene	< 1.00		µg/l	1.00	0.271	1	"	"	"	"	"	
120-12-7	Anthracene	< 1.00		µg/l	1.00	0.280	1	"	"	"	"	"	
206-44-0	Fluoranthene	< 1.00		µg/l	1.00	0.390	1	"	"	"	"	"	
129-00-0	Pyrene	< 1.00		µg/l	1.00	0.373	1	"	"	"	"	"	
56-55-3	Benzo (a) anthracene	< 1.00		µg/l	1.00	0.492	1	"	"	"	"	"	
218-01-9	Chrysene	< 1.00		µg/l	1.00	0.633	1	"	"	"	"	"	
205-99-2	Benzo (b) fluoranthene	< 1.00		µg/l	1.00	0.612	1	"	"	"	"	"	
207-08-9	Benzo (k) fluoranthene	< 1.00		µg/l	1.00	0.711	1	"	"	"	"	"	
50-32-8	Benzo (a) pyrene	< 0.200		µg/l	0.200	0.194	1	"	"	"	"	"	
193-39-5	Indeno (1,2,3-cd) pyrene	< 0.500		µg/l	0.500	0.459	1	"	"	"	"	"	
53-70-3	Dibenzo (a,h) anthracene	< 0.500		µg/l	0.500	0.429	1	"	"	"	"	"	
191-24-2	Benzo (g,h,i) perylene	< 1.00		µg/l	1.00	0.506	1	"	"	"	"	"	
Surrogate recoveries:													
3386-33-2	*1-Chlorooctadecane*	*45*			*40-140 %*			"	"	"	"	"	
84-15-1	*Ortho-Terphenyl*	*64*			*40-140 %*			"	"	"	"	"	
321-60-8	*2-Fluorobiphenyl*	*65*			*40-140 %*			"	"	"	"	"	

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
NRG-2	1394.001.01 (GC-014)	Ground Water	25-Apr-14 11:30	25-Apr-14
SB88437-02				

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
Extractable Petroleum Hydrocarbons													
MADEP EPH (Low)													
Prepared by method SW846 3510C													
	C9-C18 Aliphatic Hydrocarbons	< 100		µg/l	100	40.9	1	MADEP EPH 5/2004 R	03-May-14	07-May-14	MWP	1409820	
	C19-C36 Aliphatic Hydrocarbons	< 100		µg/l	100	73.0	1	"	"	"	"	"	
	C11-C22 Aromatic Hydrocarbons	< 100		µg/l	100	63.1	1	"	"	"	"	"	
	Unadjusted C11-C22 Aromatic Hydrocarbons	< 100		µg/l	100	63.1	1	"	"	"	"	"	
91-20-3	Naphthalene	< 1.00		µg/l	1.00	0.236	1	"	"	"	"	"	
91-57-6	2-Methylnaphthalene	< 1.00		µg/l	1.00	0.256	1	"	"	"	"	"	
208-96-8	Acenaphthylene	< 1.00		µg/l	1.00	0.235	1	"	"	"	"	"	
83-32-9	Acenaphthene	< 1.00		µg/l	1.00	0.310	1	"	"	"	"	"	
86-73-7	Fluorene	< 1.00		µg/l	1.00	0.243	1	"	"	"	"	"	
85-01-8	Phenanthrene	< 1.00		µg/l	1.00	0.271	1	"	"	"	"	"	
120-12-7	Anthracene	< 1.00		µg/l	1.00	0.280	1	"	"	"	"	"	
206-44-0	Fluoranthene	< 1.00		µg/l	1.00	0.390	1	"	"	"	"	"	
129-00-0	Pyrene	< 1.00		µg/l	1.00	0.373	1	"	"	"	"	"	
56-55-3	Benzo (a) anthracene	< 1.00		µg/l	1.00	0.492	1	"	"	"	"	"	
218-01-9	Chrysene	< 1.00		µg/l	1.00	0.633	1	"	"	"	"	"	
205-99-2	Benzo (b) fluoranthene	< 1.00		µg/l	1.00	0.612	1	"	"	"	"	"	
207-08-9	Benzo (k) fluoranthene	< 1.00		µg/l	1.00	0.711	1	"	"	"	"	"	
50-32-8	Benzo (a) pyrene	< 0.200		µg/l	0.200	0.194	1	"	"	"	"	"	
193-39-5	Indeno (1,2,3-cd) pyrene	< 0.500		µg/l	0.500	0.459	1	"	"	"	"	"	
53-70-3	Dibenzo (a,h) anthracene	< 0.500		µg/l	0.500	0.429	1	"	"	"	"	"	
191-24-2	Benzo (g,h,i) perylene	< 1.00		µg/l	1.00	0.506	1	"	"	"	"	"	
Surrogate recoveries:													
3386-33-2	*1-Chlorooctadecane*	*48*			*40-140 %*			"	"	"	"	"	
84-15-1	*Ortho-Terphenyl*	*80*			*40-140 %*			"	"	"	"	"	
321-60-8	*2-Fluorobiphenyl*	*60*			*40-140 %*			"	"	"	"	"	

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
RW-1	1394.001.01 (GC-014)	Ground Water	25-Apr-14 09:30	25-Apr-14
SB88437-03				

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
Extractable Petroleum Hydrocarbons													
MADEP EPH (Low)													
Prepared by method SW846 3510C													
	C9-C18 Aliphatic Hydrocarbons	< 100		µg/l	100	40.9	1	MADEP EPH 5/2004 R	03-May-14	07-May-14	MWP	1409820	
	C19-C36 Aliphatic Hydrocarbons	< 100		µg/l	100	73.0	1	"	"	"	"	"	
	C11-C22 Aromatic Hydrocarbons	< 100		µg/l	100	63.1	1	"	"	"	"	"	
	Unadjusted C11-C22 Aromatic Hydrocarbons	< 100		µg/l	100	63.1	1	"	"	"	"	"	
91-20-3	Naphthalene	< 1.00		µg/l	1.00	0.236	1	"	"	"	"	"	
91-57-6	2-Methylnaphthalene	< 1.00		µg/l	1.00	0.256	1	"	"	"	"	"	
208-96-8	Acenaphthylene	< 1.00		µg/l	1.00	0.235	1	"	"	"	"	"	
83-32-9	Acenaphthene	< 1.00		µg/l	1.00	0.310	1	"	"	"	"	"	
86-73-7	Fluorene	< 1.00		µg/l	1.00	0.243	1	"	"	"	"	"	
85-01-8	Phenanthrene	< 1.00		µg/l	1.00	0.271	1	"	"	"	"	"	
120-12-7	Anthracene	< 1.00		µg/l	1.00	0.280	1	"	"	"	"	"	
206-44-0	Fluoranthene	< 1.00		µg/l	1.00	0.390	1	"	"	"	"	"	
129-00-0	Pyrene	< 1.00		µg/l	1.00	0.373	1	"	"	"	"	"	
56-55-3	Benzo (a) anthracene	< 1.00		µg/l	1.00	0.492	1	"	"	"	"	"	
218-01-9	Chrysene	< 1.00		µg/l	1.00	0.633	1	"	"	"	"	"	
205-99-2	Benzo (b) fluoranthene	< 1.00		µg/l	1.00	0.612	1	"	"	"	"	"	
207-08-9	Benzo (k) fluoranthene	< 1.00		µg/l	1.00	0.711	1	"	"	"	"	"	
50-32-8	Benzo (a) pyrene	< 0.200		µg/l	0.200	0.194	1	"	"	"	"	"	
193-39-5	Indeno (1,2,3-cd) pyrene	< 0.500		µg/l	0.500	0.459	1	"	"	"	"	"	
53-70-3	Dibenzo (a,h) anthracene	< 0.500		µg/l	0.500	0.429	1	"	"	"	"	"	
191-24-2	Benzo (g,h,i) perylene	< 1.00		µg/l	1.00	0.506	1	"	"	"	"	"	
Surrogate recoveries:													
3386-33-2	*1-Chlorooctadecane*	*51*			*40-140 %*			"	"	"	"	"	
84-15-1	*Ortho-Terphenyl*	*81*			*40-140 %*			"	"	"	"	"	
321-60-8	*2-Fluorobiphenyl*	*67*			*40-140 %*			"	"	"	"	"	

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
B-202 (OW)	1394.001.01 (GC-014)	Ground Water	25-Apr-14 08:00	25-Apr-14
SB88437-04				

CAS No.	*Analyte(s)*	*Result*	*Flag*	*Units*	**RDL*	*MDL*	*Dilution*	*Method Ref.*	*Prepared*	*Analyzed*	*Analyst*	*Batch*	*Cert.*
Extractable Petroleum Hydrocarbons													
MADEP EPH (Low)													
Prepared by method SW846 3510C													
	C9-C18 Aliphatic Hydrocarbons	< 100		µg/l	100	40.9	1	MADEP EPH 5/2004 R	03-May-14	07-May-14	MWP	1409820	
	C19-C36 Aliphatic Hydrocarbons	< 100		µg/l	100	73.0	1	"	"	"	"	"	
	C11-C22 Aromatic Hydrocarbons	< 100		µg/l	100	63.1	1	"	"	"	"	"	
	Unadjusted C11-C22 Aromatic Hydrocarbons	< 100		µg/l	100	63.1	1	"	"	"	"	"	
91-20-3	Naphthalene	< 1.00		µg/l	1.00	0.236	1	"	"	"	"	"	
91-57-6	2-Methylnaphthalene	< 1.00		µg/l	1.00	0.256	1	"	"	"	"	"	
208-96-8	Acenaphthylene	< 1.00		µg/l	1.00	0.235	1	"	"	"	"	"	
83-32-9	Acenaphthene	< 1.00		µg/l	1.00	0.310	1	"	"	"	"	"	
86-73-7	Fluorene	< 1.00		µg/l	1.00	0.243	1	"	"	"	"	"	
85-01-8	Phenanthrene	< 1.00		µg/l	1.00	0.271	1	"	"	"	"	"	
120-12-7	Anthracene	< 1.00		µg/l	1.00	0.280	1	"	"	"	"	"	
206-44-0	Fluoranthene	< 1.00		µg/l	1.00	0.390	1	"	"	"	"	"	
129-00-0	Pyrene	< 1.00		µg/l	1.00	0.373	1	"	"	"	"	"	
56-55-3	Benzo (a) anthracene	< 1.00		µg/l	1.00	0.492	1	"	"	"	"	"	
218-01-9	Chrysene	< 1.00		µg/l	1.00	0.633	1	"	"	"	"	"	
205-99-2	Benzo (b) fluoranthene	< 1.00		µg/l	1.00	0.612	1	"	"	"	"	"	
207-08-9	Benzo (k) fluoranthene	< 1.00		µg/l	1.00	0.711	1	"	"	"	"	"	
50-32-8	Benzo (a) pyrene	< 0.200		µg/l	0.200	0.194	1	"	"	"	"	"	
193-39-5	Indeno (1,2,3-cd) pyrene	< 0.500		µg/l	0.500	0.459	1	"	"	"	"	"	
53-70-3	Dibenzo (a,h) anthracene	< 0.500		µg/l	0.500	0.429	1	"	"	"	"	"	
191-24-2	Benzo (g,h,i) perylene	< 1.00		µg/l	1.00	0.506	1	"	"	"	"	"	
Surrogate recoveries:													
3386-33-2	*1-Chlorooctadecane*	*59*			*40-140 %*			"	"	"	"	"	
84-15-1	*Ortho-Terphenyl*	*79*			*40-140 %*			"	"	"	"	"	
321-60-8	*2-Fluorobiphenyl*	*58*			*40-140 %*			"	"	"	"	"	

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
B-204 (OW)	1394.001.01 (GC-014)	Ground Water	25-Apr-14 10:30	25-Apr-14
SB88437-05				

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
Extractable Petroleum Hydrocarbons													
MADEP EPH (Low)													
Prepared by method SW846 3510C													
	C9-C18 Aliphatic Hydrocarbons	< 100		µg/l	100	40.9	1	MADEP EPH 5/2004 R	03-May-14	07-May-14	MWP	1409820	
	C19-C36 Aliphatic Hydrocarbons	< 100		µg/l	100	73.0	1	"	"	"	"	"	
	C11-C22 Aromatic Hydrocarbons	< 100		µg/l	100	63.1	1	"	"	"	"	"	
	Unadjusted C11-C22 Aromatic Hydrocarbons	< 100		µg/l	100	63.1	1	"	"	"	"	"	
91-20-3	Naphthalene	< 1.00		µg/l	1.00	0.236	1	"	"	"	"	"	
91-57-6	2-Methylnaphthalene	< 1.00		µg/l	1.00	0.256	1	"	"	"	"	"	
208-96-8	Acenaphthylene	< 1.00		µg/l	1.00	0.235	1	"	"	"	"	"	
83-32-9	Acenaphthene	< 1.00		µg/l	1.00	0.310	1	"	"	"	"	"	
86-73-7	Fluorene	< 1.00		µg/l	1.00	0.243	1	"	"	"	"	"	
85-01-8	Phenanthrene	< 1.00		µg/l	1.00	0.271	1	"	"	"	"	"	
120-12-7	Anthracene	< 1.00		µg/l	1.00	0.280	1	"	"	"	"	"	
206-44-0	Fluoranthene	< 1.00		µg/l	1.00	0.390	1	"	"	"	"	"	
129-00-0	Pyrene	< 1.00		µg/l	1.00	0.373	1	"	"	"	"	"	
56-55-3	Benzo (a) anthracene	< 1.00		µg/l	1.00	0.492	1	"	"	"	"	"	
218-01-9	Chrysene	< 1.00		µg/l	1.00	0.633	1	"	"	"	"	"	
205-99-2	Benzo (b) fluoranthene	< 1.00		µg/l	1.00	0.612	1	"	"	"	"	"	
207-08-9	Benzo (k) fluoranthene	< 1.00		µg/l	1.00	0.711	1	"	"	"	"	"	
50-32-8	Benzo (a) pyrene	< 0.200		µg/l	0.200	0.194	1	"	"	"	"	"	
193-39-5	Indeno (1,2,3-cd) pyrene	< 0.500		µg/l	0.500	0.459	1	"	"	"	"	"	
53-70-3	Dibenzo (a,h) anthracene	< 0.500		µg/l	0.500	0.429	1	"	"	"	"	"	
191-24-2	Benzo (g,h,i) perylene	< 1.00		µg/l	1.00	0.506	1	"	"	"	"	"	
Surrogate recoveries:													
3386-33-2	*1-Chlorooctadecane*	*97*			*40-140 %*			"	"	"	"	"	
84-15-1	*Ortho-Terphenyl*	*78*			*40-140 %*			"	"	"	"	"	
321-60-8	*2-Fluorobiphenyl*	*56*			*40-140 %*			"	"	"	"	"	

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
B-205 (OW)	1394.001.01 (GC-014)	Ground Water	25-Apr-14 13:15	25-Apr-14
SB88437-06				

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
Extractable Petroleum Hydrocarbons													
MADEP EPH (Low)			R02										
Prepared by method SW846 3510C													
	C9-C18 Aliphatic Hydrocarbons	< 100		µg/l	100	40.9	1	MADEP EPH 5/2004 R	03-May-14	07-May-14	MWP	1409820	
	C19-C36 Aliphatic Hydrocarbons	< 100		µg/l	100	73.0	1	"	"	"	"	"	
	C11-C22 Aromatic Hydrocarbons	< 100		µg/l	100	63.1	1	"	"	"	"	"	
	Unadjusted C11-C22 Aromatic Hydrocarbons	< 100		µg/l	100	63.1	1	"	"	"	"	"	
91-20-3	Naphthalene	< 1.00		µg/l	1.00	0.236	1	"	"	"	"	"	
91-57-6	2-Methylnaphthalene	< 1.00		µg/l	1.00	0.256	1	"	"	"	"	"	
208-96-8	Acenaphthylene	< 1.00		µg/l	1.00	0.235	1	"	"	"	"	"	
83-32-9	Acenaphthene	< 1.00		µg/l	1.00	0.310	1	"	"	"	"	"	
86-73-7	Fluorene	< 1.00		µg/l	1.00	0.243	1	"	"	"	"	"	
85-01-8	Phenanthrene	< 1.00		µg/l	1.00	0.271	1	"	"	"	"	"	
120-12-7	Anthracene	< 1.00		µg/l	1.00	0.280	1	"	"	"	"	"	
206-44-0	Fluoranthene	< 1.00		µg/l	1.00	0.390	1	"	"	"	"	"	
129-00-0	Pyrene	< 1.00		µg/l	1.00	0.373	1	"	"	"	"	"	
56-55-3	Benzo (a) anthracene	< 1.00		µg/l	1.00	0.492	1	"	"	"	"	"	
218-01-9	Chrysene	< 1.00		µg/l	1.00	0.633	1	"	"	"	"	"	
205-99-2	Benzo (b) fluoranthene	< 1.00		µg/l	1.00	0.612	1	"	"	"	"	"	
207-08-9	Benzo (k) fluoranthene	< 1.00		µg/l	1.00	0.711	1	"	"	"	"	"	
50-32-8	Benzo (a) pyrene	< 0.200		µg/l	0.200	0.194	1	"	"	"	"	"	
193-39-5	Indeno (1,2,3-cd) pyrene	< 0.500		µg/l	0.500	0.459	1	"	"	"	"	"	
53-70-3	Dibenzo (a,h) anthracene	< 0.500		µg/l	0.500	0.429	1	"	"	"	"	"	
191-24-2	Benzo (g,h,i) perylene	< 1.00		µg/l	1.00	0.506	1	"	"	"	"	"	
Surrogate recoveries:													
3386-33-2	*1-Chlorooctadecane*	*62*			*40-140 %*			"	"	"	"	"	
84-15-1	*Ortho-Terphenyl*	*82*			*40-140 %*			"	"	"	"	"	
321-60-8	*2-Fluorobiphenyl*	*67*			*40-140 %*			"	"	"	"	"	

Extractable Petroleum Hydrocarbons - Quality Control

Analyte(s)	Result	Flag	Units	*RDL	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch 1409820 - SW846 3510C										
Blank (1409820-BLK1)					Prepared: 03-May-14 Analyzed: 05-May-14					
C9-C18 Aliphatic Hydrocarbons	< 100		µg/l	100						
C19-C36 Aliphatic Hydrocarbons	< 100		µg/l	100						
C11-C22 Aromatic Hydrocarbons	< 100		µg/l	100						
Unadjusted C11-C22 Aromatic Hydrocarbons	< 100		µg/l	100						
Total Petroleum Hydrocarbons	< 300		µg/l	300						
Unadjusted Total Petroleum Hydrocarbons	< 300		µg/l	300						
Naphthalene	< 1.00		µg/l	1.00						
2-Methylnaphthalene	< 1.00		µg/l	1.00						
Acenaphthylene	< 1.00		µg/l	1.00						
Acenaphthene	< 1.00		µg/l	1.00						
Fluorene	< 1.00		µg/l	1.00						
Phenanthrene	< 1.00		µg/l	1.00						
Anthracene	< 1.00		µg/l	1.00						
Fluoranthene	< 1.00		µg/l	1.00						
Pyrene	< 1.00		µg/l	1.00						
Benzo (a) anthracene	< 1.00		µg/l	1.00						
Chrysene	< 1.00		µg/l	1.00						
Benzo (b) fluoranthene	< 1.00		µg/l	1.00						
Benzo (k) fluoranthene	< 1.00		µg/l	1.00						
Benzo (a) pyrene	< 0.200		µg/l	0.200						
Indeno (1,2,3-cd) pyrene	< 0.500		µg/l	0.500						
Dibenzo (a,h) anthracene	< 0.500		µg/l	0.500						
Benzo (g,h,i) perylene	< 1.00		µg/l	1.00						
n-Nonane (C9)	< 5.00		µg/l	5.00						
n-Decane	< 5.00		µg/l	5.00						
n-Dodecane	< 5.00		µg/l	5.00						
n-Tetradecane	< 5.00		µg/l	5.00						
n-Hexadecane	< 5.00		µg/l	5.00						
n-Octadecane	< 5.00		µg/l	5.00						
n-Nonadecane	< 5.00		µg/l	5.00						
n-Eicosane	< 5.00		µg/l	5.00						
n-Docosane	< 5.00		µg/l	5.00						
n-Tetracosane	< 5.00		µg/l	5.00						
n-Hexacosane	< 5.00		µg/l	5.00						
n-Octacosane	< 5.00		µg/l	5.00						
n-Triacontane	< 5.00		µg/l	5.00						
n-Hexatriacontane	< 5.00		µg/l	5.00						
Naphthalene (aliphatic fraction)	**0.00**		µg/l							
2-Methylnaphthalene (aliphatic fraction)	**0.00**		µg/l							
Surrogate: 1-Chlorooctadecane	*54.7*		µg/l		*50.0*		*109*	*40-140*		
Surrogate: Ortho-Terphenyl	*41.7*		µg/l		*50.0*		*83*	*40-140*		
Surrogate: 2-Fluorobiphenyl	*23.1*		µg/l		*40.0*		*58*	*40-140*		
LCS (1409820-BS1)					Prepared: 03-May-14 Analyzed: 05-May-14					
C9-C18 Aliphatic Hydrocarbons	**378**		µg/l	100	600		63	40-140		
C19-C36 Aliphatic Hydrocarbons	**748**		µg/l	100	800		93	40-140		
Unadjusted C11-C22 Aromatic Hydrocarbons	**764**		µg/l	100	1700		45	40-140		
n-Nonane (C9)	**37.4**		µg/l	5.00	100		37	30-140		
n-Decane	**47.1**		µg/l	5.00	100		47	40-140		
n-Dodecane	**55.8**		µg/l	5.00	100		56	40-140		
n-Tetradecane	**67.0**		µg/l	5.00	100		67	40-140		

Analyte(s)	Result	Flag	Units	*RDL	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch 1409820 - SW846 3510C										
LCS (1409820-BS1)						Prepared: 03-May-14	Analyzed: 05-May-14			
n-Hexadecane	**77.6**		µg/l	5.00	100		78	40-140		
n-Octadecane	**85.6**		µg/l	5.00	100		86	40-140		
n-Nonadecane	**87.8**		µg/l	5.00	100		88	40-140		
n-Eicosane	**89.6**		µg/l	5.00	100		90	40-140		
n-Docosane	**90.2**		µg/l	5.00	100		90	40-140		
n-Tetracosane	**90.0**		µg/l	5.00	100		90	40-140		
n-Hexacosane	**89.0**		µg/l	5.00	100		89	40-140		
n-Octacosane	**89.9**		µg/l	5.00	100		90	40-140		
n-Triacontane	**84.4**		µg/l	5.00	100		84	40-140		
n-Hexatriacontane	**77.0**		µg/l	5.00	100		77	40-140		
Naphthalene (aliphatic fraction)	**0.00**		µg/l					0-200		
2-Methylnaphthalene (aliphatic fraction)	**0.00**		µg/l					0-200		
Surrogate: 1-Chlorooctadecane	*44.2*		µg/l		*50.0*		*88*	*40-140*		
Surrogate: Ortho-Terphenyl	*29.7*		µg/l		*50.0*		*59*	*40-140*		
Surrogate: 2-Fluorobiphenyl	*21.3*		µg/l		*40.0*		*53*	*40-140*		
LCS (1409820-BS2)						Prepared: 03-May-14	Analyzed: 05-May-14			
Naphthalene	**6.74**		µg/l	1.00	15.0		45	40-140		
2-Methylnaphthalene	**6.76**		µg/l	1.00	15.0		45	40-140		
Acenaphthylene	**7.54**		µg/l	1.00	15.0		50	40-140		
Acenaphthene	**8.18**		µg/l	1.00	15.0		55	40-140		
Fluorene	**9.14**		µg/l	1.00	15.0		61	40-140		
Phenanthrene	**10.6**		µg/l	1.00	15.0		71	40-140		
Anthracene	**8.44**		µg/l	1.00	15.0		56	40-140		
Fluoranthene	**12.1**		µg/l	1.00	15.0		80	40-140		
Pyrene	**11.7**		µg/l	1.00	15.0		78	40-140		
Benzo (a) anthracene	**12.1**		µg/l	1.00	15.0		81	40-140		
Chrysene	**12.3**		µg/l	1.00	15.0		82	40-140		
Benzo (b) fluoranthene	**11.9**		µg/l	1.00	15.0		79	40-140		
Benzo (k) fluoranthene	**12.8**		µg/l	1.00	15.0		85	40-140		
Benzo (a) pyrene	**10.3**		µg/l	0.200	15.0		69	40-140		
Indeno (1,2,3-cd) pyrene	**11.3**		µg/l	0.500	15.0		75	40-140		
Dibenzo (a,h) anthracene	**11.8**		µg/l	0.500	15.0		79	40-140		
Benzo (g,h,i) perylene	**11.1**		µg/l	1.00	15.0		74	40-140		
Surrogate: Ortho-Terphenyl	*5.24*		µg/l		*7.50*		*70*	*40-140*		
Surrogate: 2-Fluorobiphenyl	*19.4*		µg/l		*40.0*		*48*	*40-140*		
LCS (1409820-BS3)						Prepared: 03-May-14	Analyzed: 05-May-14			
C9-C18 Aliphatic Hydrocarbons	**397**		µg/l	100	600		66	40-140		
C19-C36 Aliphatic Hydrocarbons	**697**		µg/l	100	800		87	40-140		
Unadjusted C11-C22 Aromatic Hydrocarbons	**970**		µg/l	100	1700		57	40-140		
n-Nonane (C9)	**49.5**		µg/l	5.00	100		49	30-140		
n-Decane	**56.7**		µg/l	5.00	100		57	40-140		
n-Dodecane	**60.6**		µg/l	5.00	100		61	40-140		
n-Tetradecane	**66.1**		µg/l	5.00	100		66	40-140		
n-Hexadecane	**72.3**		µg/l	5.00	100		72	40-140		
n-Octadecane	**77.2**		µg/l	5.00	100		77	40-140		
n-Nonadecane	**79.1**		µg/l	5.00	100		79	40-140		
n-Eicosane	**80.4**		µg/l	5.00	100		80	40-140		
n-Docosane	**81.0**		µg/l	5.00	100		81	40-140		
n-Tetracosane	**80.8**		µg/l	5.00	100		81	40-140		
n-Hexacosane	**80.4**		µg/l	5.00	100		80	40-140		

Analyte(s)	Result	Flag	Units	*RDL	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch 1409820 - SW846 3510C										
LCS (1409820-BS3)						Prepared: 03-May-14	Analyzed: 05-May-14			
n-Octacosane	**81.8**		µg/l	5.00	100		82	40-140		
n-Triacontane	**78.4**		µg/l	5.00	100		78	40-140		
n-Hexatriacontane	**74.0**		µg/l	5.00	100		74	40-140		
Naphthalene (aliphatic fraction)	**0.00**		µg/l					0-200		
2-Methylnaphthalene (aliphatic fraction)	**0.00**		µg/l					0-200		
Surrogate: 1-Chlorooctadecane	*39.8*		µg/l		*50.0*		*80*	*40-140*		
Surrogate: Ortho-Terphenyl	*34.3*		µg/l		*50.0*		*69*	*40-140*		
Surrogate: 2-Fluorobiphenyl	*23.4*		µg/l		*40.0*		*59*	*40-140*		
LCS (1409820-BS4)						Prepared: 03-May-14	Analyzed: 05-May-14			
Naphthalene	**10.5**		µg/l	1.00	20.0		52	40-140		
2-Methylnaphthalene	**10.6**		µg/l	1.00	20.0		53	40-140		
Acenaphthylene	**11.0**		µg/l	1.00	20.0		55	40-140		
Acenaphthene	**11.3**		µg/l	1.00	20.0		57	40-140		
Fluorene	**12.2**		µg/l	1.00	20.0		61	40-140		
Phenanthrene	**13.0**		µg/l	1.00	20.0		65	40-140		
Anthracene	**10.2**		µg/l	1.00	20.0		51	40-140		
Fluoranthene	**14.0**		µg/l	1.00	20.0		70	40-140		
Pyrene	**13.9**		µg/l	1.00	20.0		70	40-140		
Benzo (a) anthracene	**13.9**		µg/l	1.00	20.0		69	40-140		
Chrysene	**14.7**		µg/l	1.00	20.0		73	40-140		
Benzo (b) fluoranthene	**13.9**		µg/l	1.00	20.0		70	40-140		
Benzo (k) fluoranthene	**14.5**		µg/l	1.00	20.0		72	40-140		
Benzo (a) pyrene	**12.3**		µg/l	0.200	20.0		62	40-140		
Indeno (1,2,3-cd) pyrene	**13.6**		µg/l	0.500	20.0		68	40-140		
Dibenzo (a,h) anthracene	**14.3**		µg/l	0.500	20.0		71	40-140		
Benzo (g,h,i) perylene	**13.5**		µg/l	1.00	20.0		67	40-140		
Naphthalene (aliphatic fraction)	**0.00**		µg/l					0-200		
2-Methylnaphthalene (aliphatic fraction)	**0.00**		µg/l					0-200		
Surrogate: Ortho-Terphenyl	*6.28*		µg/l		*10.0*		*63*	*40-140*		
Surrogate: 2-Fluorobiphenyl	*22.4*		µg/l		*40.0*		*56*	*40-140*		
LCS Dup (1409820-BSD1)						Prepared: 03-May-14	Analyzed: 05-May-14			
C9-C18 Aliphatic Hydrocarbons	**381**		µg/l	100	600		64	40-140	0.8	25
C19-C36 Aliphatic Hydrocarbons	**637**		µg/l	100	800		80	40-140	16	25
Unadjusted C11-C22 Aromatic Hydrocarbons	**901**		µg/l	100	1700		53	40-140	16	25
n-Nonane (C9)	**37.8**		µg/l	5.00	100		38	30-140	1	25
n-Decane	**46.0**		µg/l	5.00	100		46	40-140	2	25
n-Dodecane	**55.4**		µg/l	5.00	100		55	40-140	0.7	25
n-Tetradecane	**66.7**		µg/l	5.00	100		67	40-140	0.4	25
n-Hexadecane	**76.9**		µg/l	5.00	100		77	40-140	0.8	25
n-Octadecane	**84.8**		µg/l	5.00	100		85	40-140	0.9	25
n-Nonadecane	**87.5**		µg/l	5.00	100		88	40-140	0.3	25
n-Eicosane	**89.2**		µg/l	5.00	100		89	40-140	0.4	25
n-Docosane	**87.9**		µg/l	5.00	100		88	40-140	3	25
n-Tetracosane	**84.3**		µg/l	5.00	100		84	40-140	6	25
n-Hexacosane	**80.6**		µg/l	5.00	100		81	40-140	10	25
n-Octacosane	**79.7**		µg/l	5.00	100		80	40-140	12	25
n-Triacontane	**74.5**		µg/l	5.00	100		75	40-140	12	25
n-Hexatriacontane	**65.6**		µg/l	5.00	100		66	40-140	16	25
Naphthalene (aliphatic fraction)	**0.00**		µg/l					0-200		200
2-Methylnaphthalene (aliphatic fraction)	**0.00**		µg/l					0-200		200

Extractable Petroleum Hydrocarbons - Quality Control

Analyte(s)	Result	Flag	Units	*RDL	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch 1409820 - SW846 3510C										
LCS Dup (1409820-BSD1)						Prepared: 03-May-14 Analyzed: 05-May-14				
Surrogate: 1-Chlorooctadecane	*44.0*		µg/l		*50.0*		*88*	*40-140*		
Surrogate: Ortho-Terphenyl	*32.3*		µg/l		*50.0*		*65*	*40-140*		
Surrogate: 2-Fluorobiphenyl	*22.9*		µg/l		*40.0*		*57*	*40-140*		
LCS Dup (1409820-BSD2)						Prepared: 03-May-14 Analyzed: 05-May-14				
Naphthalene	**8.48**		µg/l	1.00	20.0		42	40-140	6	25
2-Methylnaphthalene	**8.96**		µg/l	1.00	20.0		45	40-140	0.6	25
Acenaphthylene	**10.0**		µg/l	1.00	20.0		50	40-140	0.5	25
Acenaphthene	**10.4**		µg/l	1.00	20.0		52	40-140	5	25
Fluorene	**11.8**		µg/l	1.00	20.0		59	40-140	3	25
Phenanthrene	**14.2**		µg/l	1.00	20.0		71	40-140	0.5	25
Anthracene	**11.2**		µg/l	1.00	20.0		56	40-140	0.5	25
Fluoranthene	**15.9**		µg/l	1.00	20.0		79	40-140	1	25
Pyrene	**15.5**		µg/l	1.00	20.0		78	40-140	0.4	25
Benzo (a) anthracene	**15.7**		µg/l	1.00	20.0		78	40-140	3	25
Chrysene	**16.5**		µg/l	1.00	20.0		83	40-140	0.9	25
Benzo (b) fluoranthene	**16.3**		µg/l	1.00	20.0		82	40-140	3	25
Benzo (k) fluoranthene	**16.4**		µg/l	1.00	20.0		82	40-140	4	25
Benzo (a) pyrene	**14.0**		µg/l	0.200	20.0		70	40-140	2	25
Indeno (1,2,3-cd) pyrene	**15.0**		µg/l	0.500	20.0		75	40-140	0.1	25
Dibenzo (a,h) anthracene	**16.1**		µg/l	0.500	20.0		80	40-140	2	25
Benzo (g,h,i) perylene	**15.3**		µg/l	1.00	20.0		76	40-140	3	25
Naphthalene (aliphatic fraction)	**0.00**		µg/l					0-200		200
2-Methylnaphthalene (aliphatic fraction)	**0.00**		µg/l					0-200		200
Surrogate: Ortho-Terphenyl	*6.90*		µg/l		*10.0*		*69*	*40-140*		
Surrogate: 2-Fluorobiphenyl	*24.2*		µg/l		*40.0*		*61*	*40-140*		

Analyte(s)	Average RF	CCRF	% D	Limit
Batch S404811				
Calibration Check (S404811-CCV1)				
Naphthalene	7.654551	7.913317	3.4	25
2-Methylnaphthalene	5.566119	6.035377	8.4	25
Acenaphthylene	7.685898	8.202377	6.7	25
Acenaphthene	4.306471	4.625072	7.4	25
Fluorene	5.580853	6.125909	9.8	25
Phenanthrene	7.20908	8.033266	11.4	25
Anthracene	7.45808	7.825444	4.9	25
Fluoranthene	6.734257	7.563337	12.3	25
Pyrene	7.132997	8.009134	12.3	25
Benzo (a) anthracene	5.970965	6.792136	13.8	25
Chrysene	5.559885	6.209175	11.7	25
Benzo (b) fluoranthene	5.242217	5.303559	1.2	25
Benzo (k) fluoranthene	5.283657	6.23713	18.0	25
Benzo (a) pyrene	5.154832	5.603553	8.7	25
Indeno (1,2,3-cd) pyrene	5.513259	6.363448	15.4	25
Dibenzo (a,h) anthracene	4.664449	5.483676	17.6	25
Benzo (g,h,i) perylene	4.72355	5.393767	14.2	25
Calibration Check (S404811-CCV2)				
C9-C18 Aliphatic Hydrocarbons	302221.9	285135.3	8.5	25
C19-C36 Aliphatic Hydrocarbons	596935.6	318037.5	3.8	25
Unadjusted C11-C22 Aromatic Hydrocarbons	24.68878	17.10447	0.06	25
n-Nonane (C9)	262228.9	266138	1.5	30
n-Decane	262820.7	272595.4	3.7	25
n-Dodecane	262601.7	275147	4.8	25
n-Tetradecane	260454.5	272978.4	4.8	25
n-Hexadecane	257375.7	269957.2	4.9	25
n-Octadecane	252236.4	255868.2	1.4	25
n-Nonadecane	246673.5	243706.8	-1.2	25
n-Eicosane	241555.5	230715.2	-4.5	25
n-Docosane	235619.4	216546.2	-8.1	25
n-Tetracosane	231283.6	214349.4	-7.3	25
n-Hexacosane	230400.3	205940	-10.6	25
n-Octacosane	224214	198107.9	-11.6	25
n-Triacontane	228545.5	206833.2	-9.5	25
n-Hexatriacontane	212745.2	166514.5	-21.7	25
Calibration Check (S404811-CCV3)				
Naphthalene	7.654551	8.097871	5.8	25
2-Methylnaphthalene	5.566119	5.872597	5.5	25
Acenaphthylene	7.685898	8.06491	4.9	25
Acenaphthene	4.306471	4.735079	10.0	25
Fluorene	5.580853	5.962671	6.8	25
Phenanthrene	7.20908	8.096319	12.3	25
Anthracene	7.45808	7.954456	6.7	25
Fluoranthene	6.734257	7.687539	14.2	25
Pyrene	7.132997	8.28344	16.1	25
Benzo (a) anthracene	5.970965	6.825793	14.3	25
Chrysene	5.559885	6.552466	17.9	25
Benzo (b) fluoranthene	5.242217	5.264559	0.4	25
Benzo (k) fluoranthene	5.283657	6.221061	17.7	25
Benzo (a) pyrene	5.154832	6.152044	19.3	25
Indeno (1,2,3-cd) pyrene	5.513259	6.229434	13.0	25

Extractable Petroleum Hydrocarbons - CCV Evaluation Report

Analyte(s)	Average RF	CCRF	% D	Limit
Batch S404811				
Calibration Check (S404811-CCV3)				
Dibenzo (a,h) anthracene	4.664449	5.471048	17.3	25
Benzo (g,h,i) perylene	4.72355	5.551977	17.5	25
Calibration Check (S404811-CCV4)				
C9-C18 Aliphatic Hydrocarbons	302221.9	298191	13.7	25
C19-C36 Aliphatic Hydrocarbons	596935.6	340058.5	13.5	25
Unadjusted C11-C22 Aromatic Hydrocarbons	24.68878	16.53993	-3.7	25
n-Nonane (C9)	262228.9	278560.4	6.2	30
n-Decane	262820.7	285522.6	8.6	25
n-Dodecane	262601.7	287079.2	9.3	25
n-Tetradecane	260454.5	284183.2	9.1	25
n-Hexadecane	257375.7	283404.2	10.1	25
n-Octadecane	252236.4	283170.4	12.3	25
n-Nonadecane	246673.5	279587.4	13.3	25
n-Eicosane	241555.5	275246.8	13.9	25
n-Docosane	235619.4	271809.4	15.4	25
n-Tetracosane	231283.6	267114.6	15.5	25
n-Hexacosane	230400.3	263033.4	14.2	25
n-Octacosane	224214	254400.2	13.5	25
n-Triacontane	228545.5	258283	13.0	25
n-Hexatriacontane	212745.2	215945	1.5	25
Batch S404913				
Calibration Check (S404913-CCV1)				
Naphthalene	7.654551	7.572687	-1.1	25
2-Methylnaphthalene	5.566119	5.650103	1.5	25
Acenaphthylene	7.685898	7.614199	-0.9	25
Acenaphthene	4.306471	4.331649	0.6	25
Fluorene	5.580853	5.648531	1.2	25
Phenanthrene	7.20908	7.757499	7.6	25
Anthracene	7.45808	7.502627	0.6	25
Fluoranthene	6.734257	7.540209	12.0	25
Pyrene	7.132997	8.023778	12.5	25
Benzo (a) anthracene	5.970965	6.737263	12.8	25
Chrysene	5.559885	6.640309	19.4	25
Benzo (b) fluoranthene	5.242217	5.949548	13.5	25
Benzo (k) fluoranthene	5.283657	5.941666	12.5	25
Benzo (a) pyrene	5.154832	6.135827	19.0	25
Indeno (1,2,3-cd) pyrene	5.513259	6.379554	15.7	25
Dibenzo (a,h) anthracene	4.664449	5.479093	17.5	25
Benzo (g,h,i) perylene	4.72355	5.641675	19.4	25
Calibration Check (S404913-CCV2)				
C9-C18 Aliphatic Hydrocarbons	302221.9	271470.8	3.1	25
C19-C36 Aliphatic Hydrocarbons	596935.6	279920.3	-13.1	25
Unadjusted C11-C22 Aromatic Hydrocarbons	24.68878	16.88306	-1.4	25
n-Nonane (C9)	262228.9	254676.2	-2.9	30
n-Decane	262820.7	262695.8	-0.05	25
n-Dodecane	262601.7	265174.6	1.0	25
n-Tetradecane	260454.5	263705.6	1.2	25
n-Hexadecane	257375.7	260856.4	1.4	25
n-Octadecane	252236.4	248580	-1.4	25
n-Nonadecane	246673.5	237074.6	-3.9	25
n-Eicosane	241555.5	224279.8	-7.2	25

Extractable Petroleum Hydrocarbons - CCV Evaluation Report

Analyte(s)	Average RF	CCRF	% D	Limit
Batch S404913				
Calibration Check (S404913-CCV2)				
n-Docosane	235619.4	210102.6	-10.8	25
n-Tetracosane	231283.6	202435.2	-12.5	25
n-Hexacosane	230400.3	200021.4	-13.2	25
n-Octacosane	224214	193225.1	-13.8	25
n-Triacontane	228545.5	197250.9	-13.7	25
n-Hexatriacontane	212745.2	167305.7	-21.4	25
Calibration Check (S404913-CCV3)				
Naphthalene	7.654551	7.90084	3.2	25
2-Methylnaphthalene	5.566119	5.707321	2.5	25
Acenaphthylene	7.685898	8.013371	4.3	25
Acenaphthene	4.306471	4.641424	7.8	25
Fluorene	5.580853	6.077628	8.9	25
Phenanthrene	7.20908	7.756984	7.6	25
Anthracene	7.45808	7.4093	-0.7	25
Fluoranthene	6.734257	7.044291	4.6	25
Pyrene	7.132997	7.424758	4.1	25
Benzo (a) anthracene	5.970965	6.296545	5.5	25
Chrysene	5.559885	6.010955	8.1	25
Benzo (b) fluoranthene	5.242217	5.204513	-0.7	25
Benzo (k) fluoranthene	5.283657	5.568132	5.4	25
Benzo (a) pyrene	5.154832	5.383932	4.4	25
Indeno (1,2,3-cd) pyrene	5.513259	6.040085	9.6	25
Dibenzo (a,h) anthracene	4.664449	5.206729	11.6	25
Benzo (g,h,i) perylene	4.72355	4.994957	5.7	25
Calibration Check (S404913-CCV4)				
C9-C18 Aliphatic Hydrocarbons	302221.9	278819.9	6.0	25
C19-C36 Aliphatic Hydrocarbons	596935.6	304988	-2.0	25
Unadjusted C11-C22 Aromatic Hydrocarbons	24.68878	17.24238	1.0	25
n-Nonane (C9)	262228.9	256117	-2.3	30
n-Decane	262820.7	265925.6	1.2	25
n-Dodecane	262601.7	267991.2	2.1	25
n-Tetradecane	260454.5	266928.4	2.5	25
n-Hexadecane	257375.7	262044.8	1.8	25
n-Octadecane	252236.4	251810.2	-0.2	25
n-Nonadecane	246673.5	245774.2	-0.4	25
n-Eicosane	241555.5	237896.8	-1.5	25
n-Docosane	235619.4	228343.2	-3.1	25
n-Tetracosane	231283.6	222590	-3.8	25
n-Hexacosane	230400.3	220696.8	-4.2	25
n-Octacosane	224214	213071	-5.0	25
n-Triacontane	228545.5	217587.6	-4.8	25
n-Hexatriacontane	212745.2	187975.4	-11.6	25

Notes and Definitions

R02	Elevated Reporting Limits due to limited sample volume.
dry	Sample results reported on a dry weight basis
NR	Not Reported
RPD	Relative Percent Difference

Laboratory Control Sample (LCS): A known matrix spiked with compound(s) representative of the target analytes, which is used to document laboratory performance.

Matrix Duplicate: An intra-laboratory split sample which is used to document the precision of a method in a given sample matrix.

Matrix Spike: An aliquot of a sample spiked with a known concentration of target analyte(s). The spiking occurs prior to sample preparation and analysis. A matrix spike is used to document the bias of a method in a given sample matrix.

Method Blank: An analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank should be carried through the complete sample preparation and analytical procedure. The method blank is used to document contamination resulting from the analytical process.

Method Detection Limit (MDL): The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix type containing the analyte.

Reportable Detection Limit (RDL): The lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. For many analytes the RDL analyte concentration is selected as the lowest non-zero standard in the calibration curve. While the RDL is approximately 5 to 10 times the MDL, the RDL for each sample takes into account the sample volume/weight, extract/digestate volume, cleanup procedures and, if applicable, dry weight correction. Sample RDLs are highly matrix-dependent.

Surrogate: An organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples. These compounds are spiked into all blanks, standards, and samples prior to analysis. Percent recoveries are calculated for each surrogate.

Continuing Calibration Verification: The calibration relationship established during the initial calibration must be verified at periodic intervals. Concentrations, intervals, and criteria are method specific.

Validated by:
Rebecca Merz

SB 88437

SPECTRUM ANALYTICAL, INC.
Featuring
HANIBAL TECHNOLOGY

CHAIN OF CUSTODY RECORD

Page 1 of 1

Special Handling:
- ☑ Standard TAT - 7 to 10 business days
- ☐ Rush TAT - Date Needed: _____
- All TATs subject to laboratory approval.
- Min. 24-hour notification needed for rushes.
- Samples disposed of after 60 days unless otherwise instructed.

Report To: FST
1 ROBERTS ROAD
PLYMOUTH, MA 02360
Telephone #: 508.747.7900
Project Mgr. CHARLES YOUNG

Invoice To: SAME
P.O. No.: _____ RQN: SPECIAL

Project No.: 1394.001.01 (GC-014)
Site Name: CBC
Location: CAMBRIDGE State: MA
Sampler(s): NCG

1=Na_2S2O_3 2=HCl 3=H_2SO_4 4=HNO_3 5=NaOH 6=Ascorbic Acid 7=CH_3OH
8= $NaHSO_4$ 9= Deionized Water 10=H_3PO_4 11= _____ 12= _____

List preservative code below: 2

QA/QC Reporting Notes:
* additional charges may apply

DW=Drinking Water GW=Groundwater WW=Wastewater
O=Oil SW= Surface Water SO=Soil SL=Sludge A=Air
X1= _____ X2= _____ X3= _____

MA DEP MCP CAM Report: Yes☑ No☐
CT DPH RCP Report: Yes☐ No☐

QA/QC Reporting Level
☑ Standard ☐ No QC ☐ DQA*
☐ NY ASP A* ☐ NY ASP B*
☐ NJ Reduced* ☐ NJ Full*
☐ TIER II* ☐ TIER IV*
☐ Other _____

State-specific reporting standards: GW-1

G=Grab C=Composite

Lab Id:	Sample Id:	Date:	Time:	Type	Matrix	Containers: # of VOA Vials	# of Amber Glass	# of Clear Glass	# of Plastic	Analyses: EPH + PAH
88437-01	NRG-1	04.25.14	0900	G	GW		1			X
-02	NRG-2		1130	↓	↓		↓			↓
-03	RW-1		0930							
-04	B-202 (OW)		0800							
-05	B-204 (OW)		1030							
-06	B-205 (OW)		1315							

Relinquished by:	Received by:	Date:	Time:	Temp°C
		4/25/14	1220	2.6
	FST	4/25/14	1650	-1
				1.16
				02

☑ EDD Format PDF
☑ E-mail to CYOUNG@FSTINC.COM

Condition upon receipt: Custody Seals: ☐ Present ☐ Intact ☐ Broken
☐ Ambient ☒ Iced ☐ Refrigerated ☐ DI VOA Frozen ☐ Soil Jar Frozen

SB 88437

SPECTRUM ANALYTICAL, INC.
Featuring
HANIBAL TECHNOLOGY

CHAIN OF CUSTODY RECORD

Page 1 of 1

Special Handling:
- ☑ Standard TAT - 7 to 10 business days
- ☐ Rush TAT - Date Needed: _____
- All TATs subject to laboratory approval.
- Min. 24-hour notification needed for rushes.
- Samples disposed of after 60 days unless otherwise instructed.

Report To: FST
1 ROBERTS ROAD
PLYMOUTH, MA 02360
Telephone #: 508.747.7900
Project Mgr. CHARLES YOUNG

Invoice To: SAME
P.O. No.: _____ RQN: SPECIAL

Project No.: 1394.001.01 (GC-014)
Site Name: CBC
Location: CAMBRIDGE State: MA
Sampler(s): NCG

1=Na_2S2O_3 2=HCl 3=H_2SO_4 4=HNO_3 5=NaOH 6=Ascorbic Acid 7=CH_3OH
8=$NaHSO_4$ 9=Deionized Water 10=H_3PO_4 11=_____ 12=_____

List preservative code below: 2

QA/QC Reporting Notes:
* additional charges may apply

DW=Drinking Water GW=Groundwater WW=Wastewater
O=Oil SW=Surface Water SO=Soil SL=Sludge A=Air
X1=_____ X2=_____ X3=_____

MA DEP MCP CAM Report: Yes☑ No☐
CT DPH RCP Report: Yes☐ No☐

QA/QC Reporting Level
☑ Standard ☐ No QC ☐ DQA*
☐ NY ASP A* ☐ NY ASP B*
☐ NJ Reduced* ☐ NJ Full*
☐ TIER II* ☐ TIER IV*
☐ Other _____

State-specific reporting standards:

G=Grab C=Composite

Lab Id:	Sample Id:	Date:	Time:	Type	Matrix	Containers: # of VOA Vials	# of Amber Glass	# of Clear Glass	# of Plastic	Analyses: EPH + PAH	State-specific reporting standards:
88437-01	NRG-1	04.25.14	0900	G	GW		1			X	GW-1
-02	NRG-2		1130								
-03	RW-1		0930								
-04	B-202 (OW)		0800								
-05	B-204 (OW)	4/30/14	1030								
-06	B-205 (OW)		1315								client notified @ 4/30/14

Relinquished by:	Received by:	Date:	Time:	Temp°C
		4/25/14	1220	2.6
		4/25/14	1650	-1
				1.6
				02

☑ EDD Format PDF
☑ E-mail to CYOUNG@FSTINC.COM

Condition upon receipt: Custody Seals: ☐ Present ☐ Intact ☐ Broken
☐ Ambient ☒ Iced ☐ Refrigerated ☐ DI VOA Frozen ☐ Soil Jar Frozen

APPENDIX C

GAUGING LOGS

Well Gauging Log

RW-1

2 Gerrys Landing, Cambridge, Massachusetts

RTN 3-27733

Date	DTP (feet)	DTW (feet)	NAPL thickness (feet)
4/11/2011	NP	9.68	
4/14/2011	NP	9.65	
4/21/2011	NP	9.62	
4/29/2011	NP	9.60	
5/13/2011	NM	NM	
5/20/2011	NP	9.66	
6/3/2011	NP	9.68	
6/16/2011	NP	9.73	
6/22/2011	NP	9.79	
7/6/2011	NP	9.75	
7/14/2011	NP	9.66	
7/28/2011	NP	9.84	
8/10/2011	NP	9.64	
8/29/2011	NP	9.60	
12/16/2011	NP	9.54	
4/16/2012	NP	9.75	
7/18/2012	NP	9.93	
8/30/2012	NP	9.97	
9/25/2012	NP	9.76	
10/23/2012	NP	9.75	
11/26/2012	NP	9.75	
12/19/2012	NP	9.68	
1/25/2013	NM	NM	
2/26/2013	NM	NM	
3/22/2013	NP	9.29	
4/24/2013	NP	9.49	
5/20/2013	NP	9.70	
6/28/2013	NP	9.58	
7/26/2013	NP	8.15	
8/29/2013	NP	10.03	
9/26/2013	NP	9.93	
10/30/2013	NP	10.06	
11/26/2013	NP	9.93	
12/27/2013	NP	9.64	
4/25/2014	NP	9.59	
5/20/2015	NP	9.61	

DTP - Depth to product (NAPL)* in feet
DTW - Depth to water* in feet
Underline - Vacuum extraction date (*measurements made prior to extraction)
Bold - NAPL thickness exceeds 0.5" (0.042')
NP - No product
NM - Not measured

Well Gauging Log

RW-2

2 Gerrys Landing, Cambridge, Massachusetts

RTN 3-27733

Date	DTP (feet)	DTW (feet)	NAPL thickness (feet)
4/11/2011	10.14	10.95	**0.81**
4/14/2011	10.09	11.03	**0.94**
4/21/2011	10.11	11.04	**0.93**
4/29/2011	10.15	11.02	**0.87**
5/13/2011	10.16	11.01	**0.85**
5/20/2011	10.13	10.97	**0.84**
6/3/2011	10.22	11.00	**0.78**
6/16/2011	10.41	10.81	**0.40**
6/22/2011	10.46	10.81	**0.35**
7/6/2011	10.44	10.73	**0.29**
7/14/2011	10.33	10.75	**0.42**
7/28/2011	10.56	10.78	**0.22**
8/10/2011	10.22	10.76	**0.54**
8/29/2011	10.19	10.21	0.02
12/16/2011	10.08	10.50	**0.42**
4/16/2012	10.64	10.89	**0.25**
7/18/2012	10.65	10.75	**0.10**
8/30/2012	10.65	10.78	**0.13**
9/25/2012	10.52	10.79	**0.27**
10/23/2012	10.43	10.71	**0.28**
11/26/2012	10.44	10.74	**0.30**
12/19/2012	10.32	10.69	**0.37**
1/25/2013	10.37	10.39	0.02
2/26/2013	10.26	10.28	0.02
3/22/2013	10.25	10.71	**0.46**
4/24/2013	Bailer installed		
5/20/2013	Bailer installed		
6/28/2013	Bailer installed		
7/26/2013	10.11	10.36	**0.25**
8/29/2013	trace	10.49	0.00
9/26/2013	10.45	10.53	**0.08**
10/30/2013	10.53	10.59	**0.06**
11/26/2013	10.50	10.51	0.01
12/27/2013	10.19	10.20	0.01
4/25/2014	10.12	10.48	**0.36**
5/20/2015	10.12	10.6	**0.48**

DTP - Depth to product (NAPL)* in feet

DTW - Depth to water* in feet

Underline - Vacuum extraction date (*measurements made prior to extraction)

Bold - NAPL thickness exceeds 0.5" (0.042')

NP - No product

NM - Not measured

Well Gauging Log

RW-3

2 Gerrys Landing, Cambridge, Massachusetts

RTN 3-27733

Date	DTP (feet)	DTW (feet)	NAPL thickness (feet)
4/11/2011	NP	8.31	0.00
4/14/2011	8.11	8.14	0.03
4/21/2011	8.16	8.22	**0.06**
4/29/2011	8.26	8.26	0.00
5/13/2011	8.30	8.31	0.01
5/20/2011	NP	8.33	0.00
6/3/2011	NP	8.45	0.00
6/16/2011	NP	8.47	0.00
6/22/2011	8.53	8.54	0.01
7/6/2011	NP	8.54	0.00
7/14/2011	NP	8.52	0.00
7/28/2011	Trace	8.65	0.00
8/10/2011	NP	8.51	0.00
8/29/2011	NP	8.43	0.00
12/16/2011	NP	8.49	0.00
4/16/2012	NP	9.39	0.00
7/18/2012	Trace	8.75	0.00
8/30/2012	Trace	8.76	0.00
9/25/2012	NP	8.68	0.00
10/23/2012	NP	8.75	0.00
11/26/2012	NP	8.84	0.00
12/19/2012	Odor	8.75	0.00
1/25/2013	NP	8.93	0.00
2/26/2013	NP	8.76	0.00
3/22/2013	NP	8.56	0.00
4/24/2013	NP	8.77	0.00
5/20/2013	NP	8.89	0.00
6/28/2013	NP	8.58	0.00
7/26/2013	NP	8.70	0.00
8/29/2013	NP	8.81	0.00
9/26/2013	NP	8.80	0.00
10/30/2013	NP	9.32	0.00
11/26/2013	NP	9.51	0.00
12/27/2013	NP	8.88	0.00
4/25/2014	NP	8.71	0.00
5/20/2015	Trace	8.79	0.00

DTP - Depth to product (NAPL)* in feet
DTW - Depth to water* in feet
Underline - Vacuum extraction date (*measurements made prior to extraction)
Bold - NAPL thickness exceeds 0.5" (0.042')
NP - No product
NM - Not measured

Well Gauging Log

RW-4

2 Gerrys Landing, Cambridge, Massachusetts

RTN 3-27733

Date	DTP (feet)	DTW (feet)	NAPL thickness (feet)
4/11/2011	NP	8.68	
4/14/2011	NP	7.76	
4/21/2011	NP	7.60	
4/29/2011	NP	7.72	
5/13/2011	NP	7.95	
5/20/2011	NP	7.18	
6/3/2011	NP	7.98	
6/16/2011	NP	7.86	
6/22/2011	NP	7.95	
7/6/2011	NP	7.75	
7/14/2011	NP	7.80	
7/28/2011	NP	7.98	
8/10/2011	NP	6.44	
8/29/2011	NP	6.82	
12/16/2011	NP	7.62	
4/16/2012	NP	8.40	
7/18/2012	NP	8.06	
8/30/2012	NP	7.69	
9/25/2012	NP	7.56	
10/23/2012	NP	7.40	
11/26/2012	NP	8.04	
12/19/2012	NP	7.08	
1/25/2013	NP	7.98	
2/26/2013	NP	7.35	
3/22/2013	NP	7.53	
4/24/2013	NP	8.08	
5/20/2013	NP	8.27	
6/28/2013	NP	7.43	
7/26/2013	NP	7.16	
8/29/2013	NP	7.70	
9/26/2013	NP	7.95	
10/30/2013	NP	8.73	
11/26/2013	NP	8.92	
12/27/2013	NP	7.61	
4/25/2014	NP	7.85	
5/20/2015	NP	8.11	

DTP - Depth to product (NAPL)* in feet
DTW - Depth to water* in feet
Underline - Vacuum extraction date (*measurements made prior to extraction)
Bold - NAPL thickness exceeds 0.5" (0.042')
NP - No product
NM - Not measured

Well Gauging Log

RW-5

2 Gerrys Landing, Cambridge, Massachusetts

RTN 3-27733

Date	DTP (feet)	DTW (feet)	NAPL thickness (feet)
4/11/2011	NP	7.88	0.00
4/14/2011	7.64	8.40	**0.76**
4/21/2011	7.78	7.80	0.02
4/29/2011	7.92	7.95	0.03
5/13/2011	7.99	8.21	**0.22**
5/20/2011	NP	7.60	0.00
6/3/2011	7.91	7.94	0.03
6/16/2011	7.99	8.05	**0.06**
6/22/2011	8.02	8.17	**0.15**
7/6/2011	8.00	8.02	0.02
7/14/2011	8.03	8.05	0.02
7/28/2011	Trace	8.16	0.00
8/10/2011	7.62	7.63	0.01
8/29/2011	Trace	7.69	0.00
12/16/2011	Trace	7.91	0.00
4/16/2012	Trace	8.17	0.00
7/18/2012	Trace	8.33	0.00
8/30/2012	8.34	8.41	0.00
9/25/2012	7.94	7.96	0.02
10/23/2012	7.70	7.72	0.02
11/26/2012	Trace	8.55	0.00
12/19/2012	7.88	7.90	0.02
1/25/2013	Trace	8.33	0.00
2/26/2013	7.78	7.80	0.02
3/22/2013	7.60	7.63	0.03
4/24/2013	8.02	8.12	**0.10**
5/20/2013	8.12	8.14	0.02
6/28/2013	7.70	7.74	0.04
7/26/2013	7.54	7.56	0.02
8/29/2013	Trace	8.50	0.00
9/26/2013	8.28	8.30	0.02
10/30/2013	8.80	8.81	0.01
11/26/2013	Trace	8.56	0.00
12/27/2013	NP	7.99	0.00
4/25/2014	NP	7.74	0.00
5/20/2015	NP	7.94	0.00

DTP - Depth to product (NAPL)* in feet
DTW - Depth to water* in feet
Underline - Vacuum extraction date (*measurements made prior to extraction)
Bold - NAPL thickness exceeds 0.5" (0.042')
NP - No product
NM - Not measured

Well Gauging Log

RW-6

2 Gerrys Landing, Cambridge, Massachusetts

RTN 3-27733

Date	DTP (feet)	DTW (feet)	NAPL thickness (feet)
4/11/2011	NP	7.17	
4/14/2011	NP	7.04	
4/21/2011	NP	7.08	
4/29/2011	NP	7.19	
5/13/2011	NM	NM	
5/20/2011	NP	7.03	
6/3/2011	NP	7.20	
6/16/2011	NP	7.27	
6/22/2011	NP	7.31	
7/6/2011	NP	7.29	
7/14/2011	NP	7.20	
7/28/2011	NP	7.42	
8/10/2011	NP	6.89	
8/29/2011	NP	6.96	
12/16/2011	NP	6.62	
4/16/2012	NP	7.01	
7/18/2012	NP	6.92	
8/30/2012	NP	6.23	
9/25/2012	NP	6.39	
10/23/2012	NP	6.53	
11/26/2012	NP	6.98	
12/19/2012	NP	6.60	
1/25/2013	NP	7.11	
2/26/2013	NP	6.49	
3/22/2013	NP	6.27	
4/24/2013	NP	7.03	
5/20/2013	NP	6.53	
6/28/2013	NP	6.34	
7/26/2013	NP	6.21	
8/29/2013	NP	6.62	
9/26/2013	NP	6.82	
10/30/2013	NP	7.58	
11/26/2013	NP	7.76	
12/27/2013	NP	6.73	
4/25/2014	NP	7.29	
5/20/2015	NP	6.33	

DTP - Depth to product (NAPL)* in feet
DTW - Depth to water* in feet
Underline - Vacuum extraction date (*measurements made prior to extraction)
Bold - NAPL thickness exceeds 0.5" (0.042')
NP - No product
NM - Not measured

Well Gauging Log

RW-7

2 Gerrys Landing, Cambridge, Massachusetts

RTN 3-27733

Date	DTP (feet)	DTW (feet)	NAPL thickness (feet)
4/11/2011	NP	9.28	
4/14/2011	NP	6.38	
4/21/2011	NP	6.42	
4/29/2011	NP	6.44	
5/13/2011	NM	NM	
5/20/2011	NP	6.29	
6/3/2011	NP	6.41	
6/16/2011	NP	6.45	
6/22/2011	NP	6.49	
7/6/2011	NP	6.26	
7/14/2011	NP	7.25	
7/28/2011	NP	6.56	
8/10/2011	NP	6.25	
8/29/2011	NP	6.19	
12/16/2011	NP	6.45	
4/16/2012	NP	7.01	
7/18/2012	NP	7.21	
8/30/2012	NP	6.54	
9/25/2012	NP	6.48	
10/23/2012	NP	6.47	
11/26/2012	NP	7.09	
12/19/2012	NP	6.38	
1/25/2013	NP	6.97	
2/26/2013	NP	6.34	
3/22/2013	NP	6.26	
4/24/2013	NP	6.73	
5/20/2013	NP	7.06	
6/28/2013	NP	6.22	
7/26/2013	NP	6.13	
8/29/2013	NP	7.23	
9/26/2013	NP	6.88	
10/30/2013	NP	7.62	
11/26/2013	NP	7.32	
12/27/2013	NP	6.51	
4/25/2014	NP	6.51	
5/20/2015	NP	6.77	

DTP - Depth to product (NAPL)* in feet
DTW - Depth to water* in feet
Underline - Vacuum extraction date (*measurements made prior to extraction)
Bold - NAPL thickness exceeds 0.5" (0.042')
NP - No product
NM - Not measured

Well Gauging Log

RW-8

2 Gerrys Landing, Cambridge, Massachusetts

RTN 3-27733

Date	DTP (feet)	DTW (feet)	NAPL thickness (feet)
4/11/2011	NP	9.84	
4/14/2011	NP	9.81	
4/21/2011	NP	9.74	
4/29/2011	NP	9.84	
5/13/2011	NP	9.90	
5/20/2011	NP	9.84	
6/3/2011	NP	9.98	
6/16/2011	NP	10.04	
6/22/2011	NP	10.08	
7/6/2011	NP	10.04	
7/14/2011	NP	9.99	
7/28/2011	NP	10.19	
8/10/2011	NP	9.80	
8/29/2011	NP	9.71	
12/16/2011	NP	9.71	
4/16/2012	NP	10.09	
7/18/2012	NP	10.26	
8/30/2012	NP	10.23	
9/25/2012	NP	10.08	
10/23/2012	NP	10.03	
11/26/2012	NP	10.06	
12/19/2012	NP	9.82	
1/25/2013	NP	9.95	
2/26/2013	NP	9.58	
3/22/2013	NP	9.61	
4/24/2013	NP	9.90	
5/20/2013	NP	10.03	
6/28/2013	NP	9.83	
7/26/2013	NP	9.88	
8/29/2013	NP	10.31	
9/26/2013	NP	10.28	
10/30/2013	NP	10.36	
11/26/2013	NP	10.33	
12/27/2013	NP	9.89	
4/25/2014	NP	9.81	
5/20/2015	NP	9.94	

DTP - Depth to product (NAPL)* in feet
DTW - Depth to water* in feet
Underline - Vacuum extraction date (*measurements made prior to extraction)
Bold - NAPL thickness exceeds 0.5" (0.042')
NP - No product
NM - Not measured

Well Gauging Log

RW-9

2 Gerrys Landing, Cambridge, Massachusetts

RTN 3-27733

Date	DTP (feet)	DTW (feet)	NAPL thickness (feet)
4/11/2011	NP	6.96	
4/14/2011	NP	6.95	
4/21/2011	NP	6.77	
4/29/2011	NP	7.05	
5/13/2011	NM	NM	
5/20/2011	NP	6.93	
6/3/2011	NP	7.48	
6/16/2011	NP	7.47	
6/22/2011	NP	7.63	
7/6/2011	NP	7.55	
7/14/2011	NP	7.79	
7/28/2011	NP	7.87	
8/10/2011	NP	6.81	
8/29/2011	NP	6.74	
12/16/2011	NP	7.18	
4/16/2012	NP	7.71	
7/18/2012	NP	7.98	
8/30/2012	NP	7.94	
9/25/2012	NP	7.67	
10/23/2012	NP	7.57	
11/26/2012	NP	8.15	
12/19/2012	NP	7.07	
1/25/2013	NP	7.83	
2/26/2013	NP	6.57	
3/22/2013	NP	6.48	
4/24/2013	NP	7.43	
5/20/2013	NP	7.79	
6/28/2013	NP	7.25	
7/26/2013	NP	6.56	
8/29/2013	NP	8.22	
9/26/2013	NP	8.05	
10/30/2013	NP	8.29	
11/26/2013	NP	7.97	
12/27/2013	NP	7.30	
4/25/2014	NP	7.43	
5/20/2015	NP	7.59	

DTP - Depth to product (NAPL)* in feet
DTW - Depth to water* in feet
Underline - Vacuum extraction date (*measurements made prior to extraction)
Bold - NAPL thickness exceeds 0.5" (0.042')
NP - No product
NM - Not measured

Well Gauging Log

B-201 (OW)

2 Gerrys Landing, Cambridge, Massachusetts

RTN 3-27733

Date	DTP (feet)	DTW (feet)	NAPL thickness (feet)
4/2/2009	*10.30*	*10.90*	***0.60***
4/28/2009	*10.30*	*10.90*	***0.60***
5/15/2009	*10.40*	*11.00*	***0.60***
5/18/2009	*10.40*	*11.10*	***0.70***
4/11/2011	10.05	10.15	**0.10**
4/14/2011	10.04	10.89	**0.85**
4/21/2011	10.03	10.84	**0.81**
4/29/2011	10.07	10.88	**0.81**
5/13/2011	10.08	10.85	**0.77**
5/20/2011	10.05	10.80	**0.75**
6/3/2011	10.14	10.86	**0.72**
6/16/2011	10.19	10.56	**0.37**
6/22/2011	10.44	10.59	**0.15**
7/6/2011	10.22	10.53	**0.31**
7/14/2011	10.11	10.45	**0.34**
7/28/2011	10.34	10.57	**0.23**
8/10/2011	9.99	10.51	**0.52**
8/29/2011	10.07	10.40	**0.33**
12/16/2011	10.31	10.76	**0.45**
4/16/2012	10.45	10.80	**0.35**
7/18/2012	10.19	10.40	**0.21**
8/30/2012		Bailer installed	
9/25/2012		Bailer installed	
10/23/2012		Bailer installed	
11/26/2012		Bailer installed	
12/19/2012		Bailer installed	
1/25/2013		Bailer installed	
2/26/2013		Bailer installed	
3/22/2013		Bailer installed	
4/24/2013	9.88	10.22	**0.34**
5/20/2013	9.93	10.26	**0.33**
6/28/2013	NM	NM	
7/26/2013	9.82	10.31	**0.49**
8/29/2013	10.22	10.36	**0.14**
9/26/2013	10.18	10.28	**0.10**
10/30/2013	10.26	10.32	**0.06**
11/26/2013	10.23	10.28	**0.05**
12/27/2013	9.92	10.01	**0.09**
4/25/2014	9.86	10.17	**0.31**
5/20/2015	9.87	10.25	**0.38**

DTP - Depth to product (NAPL)* in feet

DTW - Depth to water* in feet

Underline - Vacuum extraction date (*measurements made prior to extraction)

Italic - McPhail Associates gauging data

Bold - NAPL thickness exceeds 0.5" (0.042')

NP - No product

NM - Not measured

Well Gauging Log

B-202 (OW)

2 Gerrys Landing, Cambridge, Massachusetts

RTN 3-27733

Date	DTP (feet)	DTW (feet)	NAPL thickness (feet)
4/11/2011	NP	8.09	
4/14/2011	NP	8.07	
4/21/2011	NP	7.81	
4/29/2011	NP	8.09	
5/13/2011	NM	NM	
5/20/2011	NP	8.10	
6/3/2011	NP	8.59	
6/16/2011	NP	8.68	
6/22/2011	NP	8.81	
7/6/2011	NP	8.76	
7/14/2011	NP	8.89	
7/28/2011	NP	9.15	
8/10/2011	NP	8.34	
8/29/2011	NP	7.85	
12/16/2011	NP	8.04	
4/16/2012	NP	9.01	
7/18/2012	NP	9.09	
8/30/2012	NP	9.11	
9/25/2012	NP	8.69	
10/23/2012	NP	8.70	
11/26/2012	NP	8.96	
12/19/2012	NP	8.23	
1/25/2013	NP	8.93	
2/26/2013	NP	7.57	
3/22/2013	NP	7.64	
4/24/2013	NP	8.55	
5/20/2013	NP	8.89	
6/28/2013	NP	5.50	
7/26/2013	NP	8.91	
8/29/2013	NP	9.36	
9/26/2013	NP	9.32	
10/30/2013	NP	9.45	
11/26/2013	NP	9.09	
12/27/2013	NP	8.38	
4/25/2014	NP	8.42	
5/20/2015	NP	8.77	

DTP - Depth to product (NAPL)* in feet
DTW - Depth to water* in feet
Underline - Vacuum extraction date (*measurements made prior to extraction)
Italic - McPhail Associates gauging data
Bold - NAPL thickness exceeds 0.5" (0.042')
NP - No product
NM - Not measured

Well Gauging Log

B-204 (OW)

2 Gerrys Landing, Cambridge, Massachusetts

RTN 3-27733

Date	DTP (feet)	DTW (feet)	NAPL thickness (feet)
4/11/2011	NP	0.58	
4/14/2011	NM	NM	
4/21/2011	NP	0.56	
4/29/2011	NP	0.59	
5/13/2011	NP	0.75	
5/20/2011	NP	0.29	
6/3/2011	NM	NM	
6/16/2011	NP	0.33	
6/22/2011	NP	0.83	
7/6/2011	NP	0.61	
7/14/2011	NP	0.37	
7/28/2011	NM	NM	
8/10/2011	NP	0.25	
8/29/2011	NM	NM	
12/16/2011	NP	0.54	
4/16/2012	NP	0.71	
7/18/2012	NP	0.80	
8/30/2012	NP	0.64	
9/25/2012	NP	0.53	
10/23/2012	NP	0.56	
11/26/2012	NP	0.69	
12/19/2012	NP	0.38	
1/25/2013	NP	0.73	
2/26/2013	NP	0.33	
3/22/2013	NP	0.33	
4/24/2013	NP	0.54	
5/20/2013	NP	0.57	
6/28/2013	NP	0.33	
7/26/2013	NP	0.21	
8/29/2013	NP	0.79	
9/26/2013	NP	0.75	
10/30/2013	NP	1.02	
11/26/2013	NP	0.90	
12/27/2013	NP	0.52	
4/25/2014	NP	0.54	
5/20/2015	NP	0.52	

DTP - Depth to product (NAPL)* in feet
DTW - Depth to water* in feet
Underline - Vacuum extraction date (*measurements made prior to extraction)
Italic - McPhail Associates gauging data
Bold - NAPL thickness exceeds 0.5" (0.042')
NP - No product
NM - Not measured

Well Gauging Log

B-205 (OW)

2 Gerrys Landing, Cambridge, Massachusetts

RTN 3-27733

Date	DTP (feet)	DTW (feet)	NAPL thickness (feet)
4/11/2011	NP	0.44	
4/14/2011	NM	NM	
4/21/2011	NP	0.34	
4/29/2011	NP	0.37	
5/13/2011	NP	0.62	
5/20/2011	NP	0.47	
6/3/2011	NM	NM	
6/16/2011	NP	0.62	
6/22/2011	NP	0.42	
7/6/2011	NP	0.36	
7/14/2011	NP	0.25	
7/28/2011	NM	NM	
8/10/2011	NP	0.20	
8/29/2011	NM	NM	
12/16/2011	NP	0.30	
4/16/2012	NP	0.58	
7/18/2012	NP	0.81	
8/30/2012	NP	1.06	
9/25/2012	NP	0.52	
10/23/2012	NP	0.33	
11/26/2012	NP	0.85	
12/19/2013	NP	0.27	
1/25/2013	NP	Dry	
2/26/2013	NP	0.25	
3/22/2013	NP	0.19	
4/24/2013	NP	0.22	
5/20/2013	NP	0.66	
6/28/2013	NP	0.23	
7/26/2013	NP	0.21	
8/29/2013	NP	1.00	
9/26/2013	NP	1.04	
10/30/2013	NP	>1.25	(dry)
11/26/2013	NP	1.25	
12/27/2013	NP	0.38	
4/25/2014	NP	0.33	
5/20/2015	NP	0.50	

DTP - Depth to product (NAPL)* in feet
DTW - Depth to water* in feet
Underline - Vacuum extraction date (*measurements made prior to extraction)
Italic - McPhail Associates gauging data
Bold - NAPL thickness exceeds 0.5" (0.042')
NP - No product
NM - Not measured

Well Gauging Log

NRG-1

2 Gerrys Landing, Cambridge, Massachusetts

RTN 3-27733

Date	DTP (feet)	DTW (feet)	NAPL thickness (feet)
4/11/2011	NP	6.85	
4/14/2011	NP	6.60	
4/21/2011	NP	6.56	
4/29/2011	NP	6.87	
5/13/2011	NP	7.07	
5/20/2011	NP	6.70	
6/3/2011	NP	7.21	
6/16/2011	NP	7.16	
6/22/2011	NP	7.27	
7/6/2011	NP	7.06	
7/14/2011	NP	7.37	
7/28/2011	NP	7.46	
8/10/2011	NP	6.15	
8/29/2011	NP	6.20	
12/16/2011	NP	6.98	
4/16/2012	NP	7.41	
7/18/2012	NP	7.41	
8/30/2012	NP	7.22	
9/25/2012	NP	6.91	
10/23/2012	NP	6.78	
11/26/2012	NP	7.59	
12/19/2012	NP	6.33	
1/25/2013	NP	7.41	
2/26/2013	NP	5.96	
3/22/2013	NP	6.84	
4/24/2013	NP	7.02	
5/20/2013	NP	7.46	
6/28/2013	NP	6.85	
7/26/2013	NP	5.70	
8/29/2013	NP	7.50	
9/26/2013	NP	7.32	
10/30/2013	NP	7.68	
11/26/2013	NP	7.44	
12/27/2013	NP	6.88	
4/25/2014	NP	6.87	
5/20/2015	NP	6.99	

DTP - Depth to product (NAPL)* in feet
DTW - Depth to water* in feet
Underline - Vacuum extraction date (*measurements made prior to extraction)
Bold - NAPL thickness exceeds 0.5" (0.042')
NP - No product
NM - Not measured

Well Gauging Log

NRG-2

2 Gerrys Landing, Cambridge, Massachusetts

RTN 3-27733

Date	DTP (feet)	DTW (feet)	NAPL thickness (feet)
7/14/2011	NP	0.43	
7/28/2011	NM	NM	
8/10/2011	NP	0.42	
8/29/2011	NM	NM	
12/16/2011	NP	0.43	
4/16/2012	NP	0.79	
7/18/2012	NM	NM	
8/30/2012	NM	NM	
9/25/2012	NM	NM	
10/23/2012	NM	NM	
11/26/2012	NP	0.54	
12/19/2012	NP	0.44	
1/25/2013	NP	0.54	
2/26/2013	NP	0.44	
3/22/2013	NP	0.33	
4/24/2013	NP	0.50	
5/20/2013	NP	0.60	
6/28/2013	NP	0.46	
7/26/2013	NP	0.50	
8/29/2013	NP	0.83	
9/26/2013	NP	0.81	
10/30/2013	NP	0.83	
11/26/2013	NP	0.83	
12/27/2013	NP	0.50	
4/25/2014	NP	0.49	
5/20/2015	NP	0.58	

DTP - Depth to product (NAPL)* in feet

DTW - Depth to water* in feet

Underline - Vacuum extraction date (*measurements made prior to extraction)

Bold - NAPL thickness exceeds 0.5" (0.042')

NP - No product

NM - Not measured

APPENDIX D

SHORTFORMS

Method 3 Risk Assessment for Resident Exposed to Chemicals in Soil - Shortform 2012 (sf12rs)

Index

Tab	
EPCs	Table RS-1: Select chemicals and enter Exposure Point Concentrations (EPCs). Estimated risks are shown to the right.
	Table RS-2: Produce risk. Select chemical and enter EPCs.
C Eq	Table RS-3: Equations to calculate cancer risks
cNC Eq	Table RS-4: Equations to calculate chronic noncancer risks
scNC Eq	Table RS-5: Equations to calculate subchronic noncancer risks
Exp	Table RS-6: Definitions and exposure factors
Produce	Table RS-7: Equations to calculate produce ingestion rate
Chem	Table RS-8: Chemical-specific data
Cyanide	Table RS-9: Cyanide Calculations

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Resident - Soil: Table RS-1
Exposure Point Concentration (EPC)
Based on Resident Ages 1-31 (Cancer), 1-8 (Chronic Noncancer), and 1-2 (Subchronic Noncancer)

ShortForm Version 10-12

Vlookup Versionv0315

ELCR (all chemicals) =

Chronic HI (all chemicals) = 4.1E-01

Subchronic HI (all chemicals) = 1.6E-01

Do not insert or delete any rows

Click on empty cell below and select OHM using arrow.

Oil or Hazardous Material	EPC (mg/kg)	$ELCR_{ingestion}$	$ELCR_{dermal}$	Derm & Ing $ELCR_{total}$	Chronic HQ_{ing}	Chronic HQ_{derm}	Derm & Ing HQ_{total}	Subchronic HQ_{ing}	Subchronic HQ_{derm}	Derm & Ing HQ_{total}
AROMATICS C9 to C10	2.4E+02				1.9E-02	3.3E-02	5.2E-02	5.3E-03	6.2E-03	1.2E-02
ALIPHATICS C9 to C12	2.2E+02				5.3E-03	9.0E-03	1.4E-02	1.5E-03	1.7E-03	3.2E-03
ALIPHATICS C9 to C18	1.6E+03				3.8E-02	6.5E-02	1.0E-01	1.0E-02	1.2E-02	2.3E-02
ALIPHATICS C19 to C36	5.0E+02				6.1E-04	1.0E-03	1.7E-03	5.6E-04	6.6E-04	1.2E-03
AROMATICS C11 to C22	2.2E+03				5.2E-02	1.5E-01	2.0E-01	1.4E-02	2.8E-02	4.2E-02
METHYLNAPHTHALENE, 2-	5.2E+01				9.4E-03	2.7E-02	3.6E-02	2.6E-02	5.0E-02	7.6E-02
NAPHTHALENE	1.0E+00				3.7E-05	1.1E-04	1.4E-04	1.0E-05	2.0E-05	3.0E-05
ACENAPHTHENE	5.1E+00				6.2E-05	1.8E-04	2.4E-04	5.1E-05	1.0E-04	1.5E-04

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Resident - Soil: Table RS-2
Exposure Point Concentration (EPC)
Based on Resident Ages 1-31 (Cancer), 1-8 (Chronic Noncancer), and 1-2 (Subchronic Noncancer)

ELCR (all chemicals) =
Chronic HI (all chemicals) =
Subchronic HI (all chemicals) =

*Vegetable uptake is informational only and NOT included in totals on EPC tab.

Do not insert or delete any rows

Click on empty cell below and select OHM using arrow.

Oil or Hazardous Material	EPC (mg/kg)	Chronic		Subchronic
		$ELCR_{vegetable*}$	$HQ_{vegetable*}$	$HQ_{vegetable*}$

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Resident - Soil: Table RS-3

Equations to Calculate Cancer Risk for Resident (Age 1-31 years)

Cancer Risk from Ingestion

$$ELCR_{ing} = LADD_{ing(1\text{-}31)} * CSF$$

$$LADD_{ing\ (1\text{-}31)} = LADD_{ing\ (1\text{-}8)} + LADD_{ing\ (8\text{-}15)} + LADD_{ing\ (15\text{-}31)}$$

$$LADD_{ing\ (age\ group\ x)} = \frac{[OHM]_{soil} * IR_x * RAF_{c\text{-}ing} * EF_{ing} * ED * EP_x * C}{BW_x * AP_{lifetime}}$$

Cancer Risk from Dermal Absorption

$$ELCR_{derm} = LADD_{derm} * CSF$$

$$LADD_{derm\ (1\text{-}31)} = LADD_{derm\ (1\text{-}8)} + LADD_{derm\ (8\text{-}15)} + LADD_{derm\ (15\text{-}31)}$$

$$LADD_{derm(age\ group\ x)} = \frac{[OHM]_{soil} * SA_x * RAF_{c\text{-}derm} * SAF_x * EF_{derm} * ED * EP_x * C}{BW_x * AP_{lifetime}}$$

Cancer Risk from Homegrown Produce

$$ELCR_{produce} = LADD_{produce(1\text{-}31)} * CSF$$

$$LADD_{produce(1\text{-}31)} = LADD_{produce(1\text{-}8)} + LADD_{produce(8\text{-}15)} + LADD_{produce(15\text{-}31)}$$

$$LADD_{produce(age\ x)} = \frac{[OHM_{soil}] * PUF * PIR_x * RAF_{produce} * EF_{produce} * ED * EP_x * C}{BW_x * AP_{lifetime}}$$

Vlookup Versionv0315

Parameter	Value	Units
CSF	OHM specific	$(mg/kg\text{-}day)^{-1}$
LADD	age/OHM specific	mg/kg-day
$[OHM]_{soil}$	OHM specific	mg/kg
$IR_{(1\text{-}8)}$	100	mg/day
$IR_{(8\text{-}15)}$	50	mg/day
$IR_{(15\text{-}31)}$	50	mg/day
$PIR_{(1\text{-}8)}$	12,099	mg/day
$PIR_{(8\text{-}15)}$	17,809	mg/day
$PIR_{(15\text{-}31)}$	24,420	mg/day
$RAF_{c\text{-}ing}$	OHM specific	dimensionless
$RAF_{c\text{-}derm}$	OHM specific	dimensionless
$RAF_{c\text{-}produce}$	OHM specific	dimensionless
$EF_{ing,derm}$	0.412	event/day
$EF_{produce}$	1.00	event/day
ED	1	day/event
$EP_{(1\text{-}8)}$	7	years
$EP_{(8\text{-}15)}$	7	years
$EP_{(15\text{-}31)}$	16	years
C	0.000001	kg/mg
$BW_{(1\text{-}8)}$	17.0	kg
$BW_{(8\text{-}15)}$	39.9	kg
$BW_{(15\text{-}31)}$	58.7	kg
$AP_{(lifetime)}$	70	years
$SA_{(1\text{-}8)}$	2431	cm^2 / day
$SA_{(8\text{-}15)}$	4427	cm^2 / day
$SA_{(15\text{-}31)}$	5653	cm^2 / day
$SAF_{(1\text{-}8)}$	0.35	mg/cm^2
$SAF_{(8\text{-}15)}$	0.14	mg/cm^2
$SAF_{(15\text{-}31)}$	0.13	mg/cm^2
PUF	OHM specific	$(mg/mg)(mg/mg)^{-1}$

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Resident - Soil: Table RS-4
Equations to Calculate Chronic Noncancer Risk for Resident Child (Age 1-8 years)

Vlookup Versionv0315

Chronic Noncancer Risk from Ingestion

$$HQ_{ing} = \frac{ADD_{ing}}{RfD}$$

$$ADD_{ing} = \frac{[OHM]_{soil} * IR * RAF_{nc\text{-}ing} * EF_{ing} * ED * EP * C}{BW * AP}$$

Chronic Noncancer Risk from Dermal Absorption

$$HQ_{derm} = \frac{ADD_{ing,derm}}{RfD}$$

$$ADD_{derm} = \frac{[OHM]_{soil} * SA * RAF_{nc\text{-}derm} * SAF * EF_{derm} * ED * EP * C}{BW * AP}$$

Chronic Noncancer Risk from Homegrown Produce

$$HQ_{produce} = \frac{ADD_{produce}}{RfD}$$

$$ADD_{produce} = \frac{[OHM_{soil}] * PUF * PIR * RAF_{produce} * EF_{produce} * ED * EP * C}{BW * AP}$$

Parameter	Value	Units
RfD	OHM specific	mg/kg-day
ADD	OHM specific	mg/kg-day
$[OHM]_{soil}$	OHM specific	mg/kg
IR	100	mg/day
PIR	12,099	mg/day
$RAF_{nc\text{-}ing}$	OHM specific	dimensionless
$RAF_{nc\text{-}derm}$	OHM specific	dimensionless
$RAF_{nc\text{-}produce}$	OHM specific	dimensionless
$EF_{ing,derm}$	0.412	event/day
$EF_{produce}$	1.00	event/day
ED	1	day/event
EP	7	years
C	0.000001	kg/mg
BW	17.0	kg
AP	7	year
SA	2431	cm^2 / day
SAF	0.35	mg/cm^2
PUF	OHM specific	$(mg/mg)(mg/mg)^{-1}$

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Resident - Soil: Table RS-5

Equations to Calculate Subchronic Noncancer Risk for Resident Child (Age 1-2 years)

Vlookup Versionv0315

Subchronic Noncancer Risk from Ingestion

$$HQ_{ing} = \frac{ADD_{ing}}{RfD_{subchronic}}$$

$$ADD_{ing} = \frac{[OHM]_{soil} * IR * RAF_{nc\text{-}ing} * EF_{ing} * ED * EP * C}{BW * AP}$$

Subchronic Noncancer Risk from Dermal Absorption

$$HQ_{derm} = \frac{ADD_{derm}}{RfD_{subchronic}}$$

$$ADD_{derm} = \frac{[OHM]_{soil} * SA * RAF_{nc\text{-}derm} * SAF * EF_{derm} * ED * EP * C}{BW * AP}$$

Subchronic Noncancer Risk from Homegrown Produce

$$HQ_{produce} = \frac{ADD_{produce}}{RfD_{subchronic}}$$

$$ADD_{produce} = \frac{[OHM_{soil}] * PUF * PIR * RAF_{produce} * EF_{produce} * ED * EP * C}{BW * AP}$$

Parameter	Value	Units
RfD	OHM specific	mg/kg-day
ADD	OHM specific	mg/kg-day
$[OHM]_{soil}$	OHM specific	mg/kg
IR	100	mg/day
PIR	10,900	mg/day
$RAF_{nc\text{-}ing}$	OHM specific	dimensionless
$RAF_{nc\text{-}derm}$	OHM specific	dimensionless
$RAF_{nc\text{-}produce}$	OHM specific	dimensionless
$EF_{ing,derm}$	0.714	event/day
$EF_{produce}$	1.00	event/day
ED	1	day/event
EP	0.577	years
C	0.000001	kg/mg
BW	10.7	kg
AP	0.577	year
SA	1670	cm^2 / day
SAF	0.35	mg/cm^2
PUF	OHM specific	$(mg/mg)(mg/mg)^{-1}$

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Resident - Soil: Table RS-6
Definitions and Exposure Factors

Vlookup Versionv0315

Parameter	Value	Units	Notes
ELCR - Excess Lifetime Cancer Risk	chemical specific	dimensionless	Pathway specific (ing =ingestion, derm=dermal, inh=inhalation)
CSF - Cancer Slope Factor	chemical specific	$(mg/kg\text{-}day)^{-1}$	see Table RS-7
LADD - Lifetime Average Daily Dose	chemical specific	mg/kg-day	Pathway specific
LADE - Lifetime Average Daily Exposure	chemical specific	$\mu g/m^3$	
HQ - Hazard Quotient	chemical specific	dimensionless	Pathway specific (ing =ingestion, derm=dermal, inh=inhalation)
RfD - Reference Dose	chemical specific	mg/kg-day	see Table RS-7
ADD - Average Daily Dose	chemical specific	mg/kg-day	Pathway specific
ADE - Average Daily Exposure	chemical specific	mg/m^3	
EPC - Exposure Point Concentration	chemical specific	mg/kg	
PUF - Plant Uptake Factor	chemical specific	$(mg/mg)(mg/mg)^{-1}$	See Table RS-7; $(mg_{OHM}/mg_{plant})/(mg_{OHM}/mg_{soil})^{-1}$
$IR_{(1-2)}$ - Soil Ingestion Rate for age group 1-2	100	mg/day	MADEP. 2002. Technical Update: Calculation of an Enhanced Soil Ingestion Rate. (http://www.mass.gov/dep/ors/orspubs.htm)
$IR_{(1-8)}$ - Soil Ingestion Rate for age group 1-8	100	mg/day	Ibid
$IR_{(8-15)}$ - Soil Ingestion Rate for age group 8-15	50	mg/day	Ibid
$IR_{(15-31)}$ - Soil Ingestion Rate for age group 15-31	50	mg/day	Ibid
$PIR_{(1-2)}$ = Produce Ingestion Rate for age group 1-2	10,900	mg/day	see Table RS-6
$PIR_{(1-8)}$ = Produce Ingestion Rate for age group 1-8	12,099	mg/day	see Table RS-6
$PIR_{(8-15)}$ = Produce Ingestion Rate for age group 8-15	17,809	mg/day	Ibid
$PIR_{(15-31)}$ = Produce Ingestion Rate for age group 15-31	24,420	mg/day	Ibid
RAF_c - Relative Absorption Factor for Cancer Effects	chemical specific	dimensionless	
$EF_{subchronic}$ - Exposure Frequency for subchronic ingestion or dermal exposure	0.714	event/day	5 days/week
$EF_{chronic}$ - Exposure Frequency for chronic ingestion or dermal exposure	0.412	event/day	5 days/week, 30 weeks/year
EF_{cancer} - Exposure Frequency for cancer, ingestion or dermal exposure	0.412	event/day	5 days/week, 30 weeks/year
$EF_{produce}$ - Exposure Frequency for produce ingestion, cancer and noncancer	1.00	event/day	
ED - Exposure Duration	1	day/event	
$EP_{(1-2)}$ - Exposure Period for age group 1-2	0.577	years	30 weeks
$EP_{(1-8)}$ - Exposure Period for age group 1-8	7	years	
$EP_{(8-15)}$ - Exposure Period for age group 8-15	7	years	
$EP_{(15-31)}$ - Exposure Period for age group 15-31	16	years	
$BW_{(1-2)}$ - Body Weight for age group 1-2	10.7	kg	U.S. EPA. 1997. Exposure Factors Handbook. Table 7-7, females.
$BW_{(1-8)}$ - Body Weight for age group 1-8	17.0	kg	Ibid
$BW_{(8-15)}$ - Body Weight for age group 8-15	39.9	kg	Ibid
$BW_{(15-31)}$ - Body Weight for age group 15-31	58.7	kg	Ibid
$AP_{subchronic}$ - Averaging Period for subchronic noncancer	0.577	years	30 weeks
$AP_{chronic}$ - Averaging Period for chronic noncancer	7	years	
AP_{cancer} - Averaging Period for lifetime	70	years	
$SA_{(1-2)}$ - Surface Area for age group 1-2	1670	cm^2 / day	50th percentile of face (1/3 head), forearms, hands, lower legs, and feet for females MADEP. 1995. Guidance for Disposal Site Risk Characterization. Appendix Table B-2.
$SA_{(1-8)}$ - Surface Area for age group 1-8	2431	cm^2 / day	Ibid
$SA_{(8-15)}$ - Surface Area for age group 8-15	4427	cm^2 / day	Ibid
$SA_{(15-31)}$ - Surface Area for age group 15-31	5653	cm^2 / day	Ibid
$SAF_{(1-2)}$ - Surface Adherence Factor for age group 1-2	0.35	mg/cm^2	All SAFs developed for ShortForm according to procedure outlined in MA DEP Technical
$SAF_{(1-8)}$ - Surface Adherence Factor for age group 1-8	0.35	mg/cm^2	Update:Weighted Skin-Soil Adherence Factors, April 2002
$SAF_{(8-15)}$ - Surface Adherence Factor for age group 8-15	0.14	mg/cm^2	
$SAF_{(15-31)}$ - Surface Adherence Factor for age group 15-31	0.13	mg/cm^2	

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Resident - Soil: Table RS-7
Homegrown Produce Ingestion Rate

Vlookup Versionv0315

Data on mean produce ingestion rates (wet weight, ww) in the Northeast was obtained from the 1994-1996 Continuing Survey of Food Intakes by Individuals (USDA). Data for both genders were used for children under 6, while data for males was used for individuals 6 and older. The mean ingestion rates presented in the survey represent the arithmetic average of all individuals surveyed, regardless of whether or not they had consumed the produce item (e.g., an individual that did not consume the produce item was assigned a rate of 0 g/day). To determine the mean ingestion rate for individuals who ate each produce item, the ingestion rate for all individuals (consumers and nonconsumers) was divided by the percentage of individuals who ate the item (Table RS-7A). These mean ingestion rates for the produce consumers were summed to determine the total produce ingestion rate for each age-group and converted to dry weight assuming the produce items were all 90% water.

To convert mean ingestion rates for the age-groups studied in the survey to age-groups used in risk calculations, each age-group ingestion rate from the survey (i.e., 1 - 2 year olds, 3 - 5 year olds, 6 - 11 year olds, 12 - 19 year olds, and 20 - 39 year olds) was weighted according to the number of years spent in the risk calculation age group (i.e., 1 - 8 year olds, 8 - 15 year olds, and 15 - 31 year olds) (Table RS-7B). It was assumed that 25% of produce ingested was home-grown (Table RS-7C).

Table RS-7

	White Potatoes			Dark-green vegetables			Deep-yellow vegetables		
Age-groups studied in survey	Ingestion Rate for All g/d (ww)	% of individuals that consumed item.	Ingestion Rate for Consumers g/d (ww)	Ingestion Rate for All g/d (ww)	% of individuals that consumed item.	Ingestion Rate for Consumers g/d (ww)	Ingestion Rate for All g/d (ww)	% of individuals that consumed item.	Ingestion Rate for Consumers g/d (ww)
1-2	28	40.3	69.5	6	10.1	59.4	5	12.7	39.4
3-5	30	37.1	80.9	5	6.5	76.9	7	12.7	55.1
6-11	47	44.2	106.3	6	9.1	65.9	2	8.5	23.5
12-19	59	40.3	146.4	2	2.3	87.0	11	15.8	69.6
20-39	76	45.1	168.5	25	14.7	170.1	4	5.7	70.2

	Tomatoes			Lettuce			Green Beans		
Age-groups studied in survey	Ingestion Rate for All g/d (ww)	% of individuals that consumed item.	Ingestion Rate for Consumers g/d (ww)	Ingestion Rate for All g/d (ww)	% of individuals that consumed item.	Ingestion Rate for Consumers g/d (ww)	Ingestion Rate for All g/d (ww)	% of individuals that consumed item.	Ingestion Rate for Consumers g/d (ww)
1-2	10	27.9	35.8	1	6	16.7	7	12.1	57.9
3-5	10	37.1	27.0	4	14	28.6	3	5.7	52.6
6-11	20	42	47.6	8	14.9	53.7	1	2	50.0
12-19	29	45.2	64.2	19	28.7	66.2	2	2.4	83.3
20-39	48	50.9	94.3	18	29.6	60.8	4	3.7	108.1

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Table RS-7a (continued)

Age-groups studied in survey	Corn, Green peas, Lima beans: Ingestion Rate for All g/d (ww)	Corn, Green peas, Lima beans: % of individuals that consumed item.	Corn, Green peas, Lima beans: Ingestion Rate for Consumers g/d (ww)	Melons, berries: Ingestion Rate for All g/d (ww)	Melons, berries: % of individuals that consumed item.	Melons, berries: Ingestion Rate for Consumers g/d (ww)	Totals Wet Weight WWI g/day	Totals Dry Weight DWI g/day
1-2	12	15	80.0	7	9	77.8	436.4	43.6
3-5	14	21.7	64.5	14	11.6	120.7	506.3	50.6
6-11	9	13.6	66.2	5	5.9	84.7	498.0	49.8
12-19	14	9.9	141.4	17	5	340.0	998.1	99.8
20-39	12	7.3	164.4	6	4.5	133.3	969.7	97.0

Table RS-7B

Age-groups studied in survey	Years spent in age-group 1-8 year old	Years spent in age-group 8-15 year old	Years spent in age-group 15-31 year old
1-2	2		
3-5	3		
6-11	2	4	
12-19		3	4
20-39			12
	7	7	16

Table RS-7C

	Produce Intake, dry weight: Child 1-2 years g/day	Child 1-8 years g/day	Child 8-15 years g/day	Adult 15-31 g/day
All Produce:	43.6	48.4	71.2	97.7
Homegrown:	10.9	12.1	17.8	24.4

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Resident - Soil: Table RS-8
Chemical-Specific Data

Vlookup Versionv0315

Oil or Hazardous Material	CSF $(mg/kg\text{-}day)^{-1}$	$RAF_{c\text{-}ing}$	$RAF_{c\text{-}derm}$	$RAF_{c\text{-}prod}$	Chronic RfD mg/kg-day	Subchronic RfD mg/kg-day	Chronic $RAF_{nc\text{-}ing}$	Chronic $RAF_{nc\text{-}derm}$	Subchronic $RAF_{nc\text{-}ing}$	Subchronic $RAF_{nc\text{-}derm}$	$RAF_{nc\text{-}prod}$	PUF
AROMATICS C9 to					3.0E-02	3.0E-01	1	0.2	1	0.2		
ALIPHATICS C9 to (					1.0E-01	1.0E+00	1	0.2	1	0.2		
ALIPHATICS C9 to (					1.0E-01	1.0E+00	1	0.2	1	0.2		
ALIPHATICS C19 to					2.0E+00	6.0E+00	1	0.2	1	0.2		
AROMATICS C11 to					3.0E-02	3.0E-01	0.3	0.1	0.3	0.1		
METHYLNAPHTHALENI					4.0E-03	4.0E-03	0.3	0.1	0.3	0.1		
NAPHTHALENE					2.0E-02	2.0E-01	0.3	0.1	0.3	0.1		
ACENAPHTHENE					6.0E-02	2.0E-01	0.3	0.1	0.3	0.1		

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Resident - Soil: Table RS-9
Cyanide Calculations

The soil cyanide concentration limit set to protect a child resident against an acute, potentially lethal one-time dose of cyanide from incidental ingestion of contaminated soil is 100 mg/kg soil. This is the concentration of available cyanide in soil below which acute human health effects would not be expected following a one-time exposure. This soil concentration is calculated using the equation below with a pica-type soil ingestion of 1000 mg_{soil} and an available cyanide dose limit of 0.01 $mg/kg_{body\ weight}$.

MassDEP's guidance on evaluating the risk from a one-time cyanide dose considers cyanide's potentially lethal effects as well as information on cyanide metabolism:

> Cyanides are detoxified rapidly by the body, and a large acute dose which overwhelms the detoxification mechanism is potentially more toxic than the same dose distributed over a period of hours. (MassDEP *Background Documentation for the Development of an Available Cyanide Benchmark Concentration*, originally dated October 1992, Modified August 1998)

Assessment of a potential one-time dose requires an estimate of the maximum soil concentration the receptor could contact at any one time. The average soil concentration within a typical exposure area will underestimate the potential one-time dose. Therefore, to assess the acute risk of a one-time potentially lethal dose, the EPC for cyanide should be a conservative estimate of the maximum soil concentration.

The residential soil concentration limit to protect against adverse effects from an acute (one-time) exposure to cyanide is 100 mg/kg.

Concentration Calculation for Cyanide

$$\text{Concentration} = \frac{\text{HQ x Acute Dose Limit x BW}}{\text{IR x RAF x Conversion Factor}}$$

Parameter	Value	Units
HQ (Hazard Quotient)	1	(unitless)
Acute Dose Limit	0.01	mg avail. CN/ kg BW
BW (Body Weight) 1-2	10.7	kg
IR (1-time reasonable max)	1000	mg
Conversion Factor	1.0E-06	kg soil / mg soil
RAF	1	(unitless)

The toxicological basis for estimating an allowable one-time dose is documented in MassDEP's 1992 *Background Documentation for the Development of an "Available Cyanide" Benchmark Concentration,* which is published at: http://www.mass.gov/eea/docs/dep/toxics/stypes/dscyanide.pdf

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Method 3 Risk Assessment for a Trespasser Exposed to Chemicals in Soil - Shortform 2012 (sf12ts)

Index

Tab	
EPCs	Table TS-1: Select chemicals and enter Exposure Point Concentrations (EPCs). Estimated risks are shown to the right.
C Eq	Table TS-2: Equations to calculate cancer risks
cNC Eq	Table TS-3: Equations to calculate chronic noncancer risks
scNC Eq	Table TS-4: Equations to calculate subchronic noncancer risks
Exp	Table TS-5: Definitions and exposure factors
Chem	Table TS-6: Chemical-specific data
Cyanide	Table TS-7: Cyanide calculations

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Trespasser - Soil: Table TS-1
Exposure Point Concentration (EPC)
Based on Trespasser Ages 11-18 (Cancer and Non-Cancer)

ShortForm Version 10-12

Vlookup Version v0315

ELCR (all chemicals) =

Chronic HI (all chemicals) = 2.7E-02

Subchronic HI (all chemicals) = 9.5E-03

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Click on empty cell below and select OHM using arrow.

Oil or Hazardous Material	EPC (mg/kg)	$ELCR_{ingestion}$	$ELCR_{dermal}$	$ELCR_{total}$	Chronic HQ_{ing}	Chronic HQ_{derm}	Chronic HQ_{total}	Subchronic HQ_{ing}	Subchronic HQ_{derm}	Subchronic HQ_{total}
AROMATICS C9 to C10	2.4E+02				1.3E-03	2.1E-03	3.4E-03	2.8E-04	3.9E-04	6.8E-04
ALIPHATICS C9 to C12	2.2E+02				3.6E-04	5.9E-04	9.4E-04	7.8E-05	1.1E-04	1.9E-04
ALIPHATICS C9 to C18	1.6E+03				2.6E-03	4.3E-03	6.9E-03	5.7E-04	7.9E-04	1.4E-03
ALIPHATICS C19 to C36	5.0E+02				4.1E-05	6.7E-05	1.1E-04	3.0E-05	4.1E-05	7.1E-05
AROMATICS C11 to C22	2.2E+03				3.6E-03	9.8E-03	1.3E-02	7.8E-04	1.8E-03	2.6E-03
METHYLNAPHTHALENE, 2-	5.2E+01				6.3E-04	1.7E-03	2.4E-03	1.4E-03	3.2E-03	4.6E-03
NAPHTHALENE	1.0E+00				2.4E-06	6.7E-06	9.1E-06	5.3E-07	1.2E-06	1.8E-06
ACENAPHTHENE	5.1E+00				4.1E-06	1.1E-05	1.5E-05	2.7E-06	6.3E-06	9.0E-06

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Trespasser - Soil: Table TS-2
Equations to Calculate Cancer Risk for a Trespasser (Age 11-18 years)

Cancer Risk from Ingestion

$$ELCR_{ing} = LADD_{ing} * CSF$$

$$LADD_{ing} = \frac{[OHM]_{soil} * IR * RAF_{c\text{-}ing} * EF_{ing} * ED * EP * C}{BW * AP_{lifetime}}$$

Cancer Risk from Dermal Absorption

$$ELCR_{derm} = LADD_{derm} * CSF$$

$$LADD_{derm} = \frac{[OHM]_{soil} * SA * RAF_{c\text{-}derm} * SAF * EF_{derm} * ED * EP * C}{BW * AP_{lifetime}}$$

Vlookup Version v0315

Parameter	Value	Units
CSF	OHM specific	$(mg/kg\text{-}day)^{-1}$
LADD	age/OHM specific	mg/kg-day
$[OHM]_{soil}$	OHM specific	mg/kg
IR	50	mg/day
$RAF_{c\text{-}ing}$	OHM specific	dimensionless
$RAF_{c\text{-}derm}$	OHM specific	dimensionless
$EF_{ing,derm}$	0.164	event/day
ED	1	day/event
EP	7	years
C	0.000001	kg/mg
BW	50.7	kg
$AP_{(lifetime)}$	70	years
SA	2940	cm^2 / day
SAF	0.14	mg/cm^2

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Trespasser - Soil: Table TS-3

Equations to Calculate Chronic Noncancer Risk for a Trespasser (Age 11-18 years)

Vlookup Version v0315

Chronic Noncancer Risk from Ingestion

$$HQ_{ing} = \frac{ADD_{ing}}{RfD}$$

$$ADD_{ing} = \frac{[OHM]_{soil} * IR * RAF_{nc\text{-}ing} * EF_{ing} * ED * EP * C}{BW * AP}$$

Chronic Noncancer Risk from Dermal Absorption

$$HQ_{derm} = \frac{ADD_{ing,derm}}{RfD}$$

$$ADD_{derm} = \frac{[OHM]_{soil} * SA * RAF_{nc\text{-}derm} * SAF * EF_{derm} * ED * EP * C}{BW * AP}$$

Parameter	Value	Units
RfD	OHM specific	mg/kg-day
ADD	OHM specific	mg/kg-day
$[OHM]_{soil}$	OHM specific	mg/kg
IR	50	mg/day
$RAF_{nc\text{-}ing}$	OHM specific	dimensionless
$RAF_{nc\text{-}derm}$	OHM specific	dimensionless
$EF_{ing,derm}$	0.164	event/day
ED	1	day/event
EP	7	years
C	0.000001	kg/mg
BW	50.7	kg
AP	7	year
SA	2940	cm^2 / day
SAF	0.14	mg/cm^2

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Trespasser - Soil: Table TS-4

Equations to Calculate Subchronic Noncancer Risk for a Trespasser (Age 11-12 years)

Vlookup Version v0315

Subchronic Noncancer Risk from Ingestion

$$HQ_{ing} = \frac{ADD_{ing}}{RfD_{subchronic}}$$

$$ADD_{ing} = \frac{[OHM]_{soil} * IR * RAF_{nc\text{-}ing} * EF_{ing} * ED * EP * C}{BW * AP}$$

Subchronic Noncancer Risk from Dermal Absorption

$$HQ_{derm} = \frac{ADD_{derm}}{RfD_{subchronic}}$$

$$ADD_{derm} = \frac{[OHM]_{soil} * SA * RAF_{nc\text{-}derm} * SAF * EF_{derm} * ED * EP * C}{BW * AP}$$

Parameter	Value	Units
RfD	OHM specific	mg/kg-day
ADD	OHM specific	mg/kg-day
$[OHM]_{soil}$	OHM specific	mg/kg
IR	50	mg/day
$RAF_{nc\text{-}ing}$	OHM specific	dimensionless
$RAF_{nc\text{-}derm}$	OHM specific	dimensionless
$EF_{ing,derm}$	0.286	event/day
ED	1	day/event
EP	0.577	years
C	0.000001	kg/mg
BW	40.3	kg
AP	0.577	year
SA	2477	cm^2 / day
SAF	0.14	mg/cm^2

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Trespasser - Soil: Table TS-5
Definitions and Exposure Factors

Vlookup Version v0315

Parameter	Value	Units	Notes
ELCR - Excess Lifetime Cancer Risk	chemical specific	dimensionless	Pathway specific (ing =ingestion, derm=dermal, inh=inhalation)
CSF - Cancer Slope Factor	chemical specific	$(mg/kg\text{-}day)^{-1}$	see Table RS-7
LADD - Lifetime Average Daily Dose	chemical specific	mg/kg-day	Pathway specific
HQ - Hazard Quotient	chemical specific	dimensionless	Pathway specific (ing =ingestion, derm=dermal, inh=inhalation)
RfD - Reference Dose	chemical specific	mg/kg-day	see Table RS-7
ADD - Average Daily Dose	chemical specific	mg/kg-day	Pathway specific
EPC - Exposure Point Concentration	chemical specific	mg/kg	
IR - Soil Ingestion Rate	50	mg/day	MADEP. 2002. Technical Update: Calculation of an Enhanced Soil Ingestion Rate. (http://www.mass.gov/dep/ors/orspubs.htm)
RAF_c - Relative Absorption Factor for Cancer Effects	chemical specific	dimensionless	
$EF_{subchronic}$ - Exposure Frequency for subchronic ingestion or dermal exposure	0.286	event/day	2 days/week
$EF_{chronic}$ - Exposure Frequency for chronic ingestion or dermal exposure	0.164	event/day	2 days/week, 30 weeks/year
EF_{cancer} - Exposure Frequency for cancer, ingestion or dermal exposure	0.164	event/day	2 days/week, 30 weeks/year
ED - Exposure Duration	1	day/event	
$EP_{(11\text{-}12)}$ - Exposure Period for age group 11-12	0.577	years	30 weeks
$EP_{(11\text{-}18)}$ - Exposure Period for age group 11-18	7	years	
$BW_{(11\text{-}12)}$ - Body Weight for age group 11-12	40.3	kg	U.S. EPA. 1997. Exposure Factors Handbook. Table 7-7
$BW_{(11\text{-}18)}$ - Body Weight for age group 11-18	50.7	kg	Ibid
$AP_{subchronic}$ - Averaging Period for subchronic noncancer	0.577	years	30 weeks
$AP_{chronic}$ - Averaging Period for chronic noncancer	7	years	
AP_{cancer} - Averaging Period for lifetime	70	years	
$SA_{(11\text{-}12)}$ - Surface Area for age group 11-12	2477	cm^2 / day	50th percentile of forearms, hands, and feet for females. MADEP 1995 Guidance for Disposal Site Risk Characterization, Table B-2.
$SA_{(11\text{-}18)}$ - Surface Area for age group 11-18	2940	cm^2 / day	Ibid
SAF - Surface Adherence Factor, Trespasser	0.14	mg/cm^2	SAF developed for ShortForm according to procedure outlined in MA DEP Technical Update: Weighted Skin-Soil Adherence Factors, April 2002.

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Trespasser - Soil: Table TS-6
Chemical-Specific Data

Vlookup Version v0315

Oil or Hazardous Material	CSF $(mg/kg\text{-}day)^{-1}$	$RAF_{c\text{-}ing}$	$RAF_{c\text{-}derm}$	Chronic RfD mg/kg-day	Subchronic RfD mg/kg-day	Chronic $RAF_{nc\text{-}ing}$	Chronic $RAF_{nc\text{-}derm}$	Subchronic $RAF_{nc\text{-}ing}$	Subchronic $RAF_{nc\text{-}derm}$
AROMATICS C9 to				3.0E-02	3.0E-01	1	0.2	1	0.2
ALIPHATICS C9 to C				1.0E-01	1.0E+00	1	0.2	1	0.2
ALIPHATICS C9 to C				1.0E-01	1.0E+00	1	0.2	1	0.2
ALIPHATICS C19 to				2.0E+00	6.0E+00	1	0.2	1	0.2
AROMATICS C11 to				3.0E-02	3.0E-01	0.3	0.1	0.3	0.1
METHYLNAPHTHALENI				4.0E-03	4.0E-03	0.3	0.1	0.3	0.1
NAPHTHALENE				2.0E-02	2.0E-01	0.3	0.1	0.3	0.1
ACENAPHTHENE				6.0E-02	2.0E-01	0.3	0.1	0.3	0.1

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Trespasser - Soil: Table TS-7
Cyanide Calculations

The soil cyanide concentration limit set to protect a trespasser against an acute, potentially lethal one-time dose of cyanide from incidental ingestion of contaminated soil is 8,000 mg/kg_{soil}. This is the concentration of available cyanide in soil below which acute human health effects would not be expected following a one-time exposure. This soil concentration is calculated using the equation below with a one-time soil ingestion estimate of 50 mg_{soil} and an available cyanide dose limit of 0.01 $mg/kg_{body\ weight}$.

MassDEP's guidance on evaluating the risk from a one-time cyanide dose considers cyanide's potentially lethal effects as well as information on cyanide metabolism:

> Cyanides are detoxified rapidly by the body, and a large acute dose which overwhelms the detoxification mechanism is potentially more toxic than the same dose distributed over a period of hours. (MassDEP *Background Documentation for the Development of an Available Cyanide Benchmark Concentration,* originally dated October 1992, Modified August 1998)

Assessment of a potential one-time dose requires an estimate of the maximum soil concentration the trespasser could contact at any one time. The average soil concentration within a typical exposure area will underestimate the potential one-time dose. Therefore, to assess the acute risk of a one-time potentially lethal dose, the EPC for cyanide should be a conservative estimate of the maximum soil concentration.

The trespasser soil concentration limit to protect against adverse effects from an acute (one-time) exposure to cyanide is 8000 mg/kg.

Concentration Calculation for Cyanide

$$\text{Concentration} = \frac{\text{HQ x Acute Dose Limit x BW}}{\text{IR x RAF x Conversion Factor}}$$

Parameter	Value	Units
HQ (Hazard Quotient)	1	(unitless)
Acute Dose Limit	0.01	mg avail. CN/ kg BW
BW (Body Weight) $_{11\text{-}12}$	40.3	kg
IR $_{(1\text{-time reasonable max})}$	50	mg
Conversion Factor	1.0E-06	kg soil / mg soil
RAF	1	(unitless)

The toxicological basis for estimating an allowable one-time dose is documented in MassDEP's 1992 *Background Documentation for the Development of an "Available Cyanide" Benchmark Concentration,* which is published at: http://www.mass.gov/eea/docs/dep/toxics/stypes/dscyanide.pdf

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Trespasser - Soil: Table TS-7
Cyanide Calculations

The soil cyanide concentration limit set to protect a trespasser against an acute, potentially lethal one-time dose of cyanide from incidental ingestion of contaminated soil is 8,000 mg/kg_{soil}. This is the concentration of available cyanide in soil below which acute human health effects would not be expected following a one-time exposure. This soil concentration is calculated using the equation below with a one-time soil ingestion estimate of 50 mg_{soil} and an available cyanide dose limit of 0.01 $mg/kg_{body\ weight}$.

MassDEP's guidance on evaluating the risk from a one-time cyanide dose considers cyanide's potentially lethal effects as well as information on cyanide metabolism:

> Cyanides are detoxified rapidly by the body, and a large acute dose which overwhelms the detoxification mechanism is potentially more toxic than the same dose distributed over a period of hours. (MassDEP *Background Documentation for the Development of an Available Cyanide Benchmark Concentration,* originally dated October 1992, Modified August 1998)

Assessment of a potential one-time dose requires an estimate of the maximum soil concentration the trespasser could contact at any one time. The average soil concentration within a typical exposure area will underestimate the potential one-time dose. Therefore, to assess the acute risk of a one-time potentially lethal dose, the EPC for cyanide should be a conservative estimate of the maximum soil concentration.

The trespasser soil concentration limit to protect against adverse effects from an acute (one-time) exposure to cyanide is 8000 mg/kg.

Method 3 Risk Assessment for Chemicals in Soil - Construction Worker Shortform 2012 (sf12cw)

Index

Tab	
EPCs	Table CW-1: Select chemicals and enter Exposure Point Concentrations (EPCs). Estimated risks are shown to the right.
C Eq	Table CW-2: Equations to calculate cancer risks
NC Eq	Table CW-3: Equations to calculate noncancer risks
Exp	Table CW-4: Definitions and exposure factors
Chem	Table CW-5: Chemical-specific data
Cyanide	Table CW-6: Cyanide Calculations

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Construction Worker - Soil: Table CW-1
Exposure Point Concentration (EPC) and Risk
Based on Construction Worker 18-25 years of age

ShortForm Version 10-12
Vlookup Version v0315

ELCR (all chemicals) =
HI (all chemicals) = 4.3E-02

****Do not insert or delete any rows****
Click on empty cell below and select OHM using arrow.

Oil or Hazardous Material (OHM)	EPC (mg/kg)	ELCR ingestion	ELCR dermal	ELCR inhalation GI	ELCR inhalation pulmonary	$ELCR_{total}$	Subchronic HQ_{ing}	Subchronic HQ_{derm}	Subchronic HQ_{inh-GI}	Subchronic HQ_{inh}	HQ_{total}
AROMATICS C9 to C10	2.4E+02						9.9E-04	2.0E-03	2.6E-05	1.8E-05	3.0E-03
ALIPHATICS C9 to C12	2.2E+02						2.7E-04	5.5E-04	7.0E-06	1.4E-05	8.4E-04
ALIPHATICS C9 to C18	1.6E+03						2.0E-03	4.0E-03	5.1E-05	9.9E-05	6.1E-03
ALIPHATICS C19 to C36	5.0E+02						1.0E-04	2.1E-04	2.7E-06		3.1E-04
AROMATICS C11 to C22	2.2E+03						2.7E-03	9.1E-03	7.0E-05	1.6E-04	1.2E-02
METHYLNAPHTHALENE, 2-	5.2E+01						4.8E-03	1.6E-02	1.2E-04	3.9E-06	2.1E-02
NAPHTHALENE	1.0E+00						1.8E-06	6.2E-06	4.8E-08	1.2E-05	2.1E-05
ACENAPHTHENE	5.1E+00						9.4E-06	3.2E-05	2.4E-07	3.8E-07	4.2E-05

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Construction Worker - Soil: Table CW-2

Equations to Calculate Cancer Risk for Construction Worker

Vlookup Version v0315

Cancer Risk from Ingestion

$$ELCR_{ing} = LADD_{ing} * CSF_{oral}$$

$$LADD_{ing} = \frac{EPC * IR * RAF_{c\text{-}ing} * EF * ED_{ing} * EP * C1}{BW * AP_{lifetime}}$$

Cancer Risk from Dermal Absorption

$$ELCR_{derm} = LADD_{derm} * CSF_{oral}$$

$$LADD_{derm} = \frac{EPC * SA * AF * RAF_{c\text{-}derm} * EF * ED_{derm} * EP * C1}{BW * AP_{lifetime}}$$

Cancer Risk from Particulate Inhalation - Gastrointestinal Absorption

$$ELCR_{inh\text{-}GI} = LADD_{inh\text{-}GI} * CSF_{oral}$$

$$LADD_{inh\text{-}GI} = \frac{EPC * RCAF_{inh\text{-}gi} * PM_{10} * VR_{work} * RAF_{c\text{-}ing} * EF * ED_{inh} * EP * C2 * C3 * C4}{BW * AP_{lifetime}}$$

Cancer Risk from Particulate Inhalation - Pulmonary Absorption

$$ELCR_{inh} = LADD_{inh} * CSF_{inhalation}$$

$$LADD = \frac{EPC * RCAF_{inh} * PM_{10} * VR_{work} * RAF_{c\text{-}inh} * EF * ED_{inh} * EP * C2 * C3 * C4}{BW * AP_{lifetime}}$$

Parameter	Value	Units
CSF	OHM-specific	$(mg/kg\text{-}day)^{-1}$
LADD	age/OHM-specific	mg/kg-day
EPC	OHM-specific	mg/kg
IR	100	mg/day
$RAF_{c\text{-}ing}$	OHM-specific	dimensionless
$RAF_{c\text{-}derm}$	OHM-specific	dimensionless
$RAF_{c\text{-}inh}$	OHM-specific	dimensionless
EF	0.714	event/day
$ED_{ing\ \&\ derm}$	1	day/event
ED_{inh}	0.333	day/event
EP	182	days
C1	1.0E-06	kg/mg
C2	1.0E-09	kg/µg
C3	1440	min/days
C4	1.0E-03	m^3/L
BW	58.0	kg
$AP_{(lifetime)}$	25,550	days
VR_{work}	60	L/min
AF	0.29	mg/cm^2
SA	3473	cm^2/day
$RCAF_{inh\text{-}gi}$	1.5	dimensionless
$RCAF_{inh}$	0.5	dimensionless
PM_{10}	60	$\mu g/m^3$

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Construction Worker - Soil: Table CW-3

Equations to Calculate Noncancer Risk for Construction Worker

Vlookup Version v0315

Noncancer Risk from Ingestion

$$HQ_{ing} = \frac{ADD_{ing}}{RfD_{oral\text{-}subchronic}}$$

$$ADD_{ing} = \frac{EPC * IR * RAF_{nc\text{-}ing} * EF * ED_{ing} * EP * C1}{BW * AP_{noncancer}}$$

Noncancer Risk from Dermal Absorption

$$HQ_{derm} = \frac{ADD_{derm}}{RfD_{oral\text{-}subchronic}}$$

$$ADD_{dermal} = \frac{EPC * SA * AF * RAF_{nc\text{-}derm} * EF * ED_{dermal} * EP * C1}{BW * AP_{noncancer}}$$

Noncancer Risk from Particulate Inhalation - Gastrointestinal Absorption

$$HQ_{inh\text{-}GI} = \frac{ADD_{inh\text{-}GI}}{RfD_{oral\text{-}subchronic}}$$

$$ADD_{inh\text{-}GI} = \frac{EPC * RCAF_{inh\text{-}gi} * PM_{10} * VR_{work} * RAF_{nc\text{-}ing} * EF * ED_{inh} * EP * C2 * C3 * C4}{BW * AP_{noncancer}}$$

Noncancer Risk from Particulate Inhalation - Pulmonary Absorption

$$HQ_{inh} = \frac{ADD}{RfD_{inhalation\text{-}subchronic}}$$

$$ADD_{inh} = \frac{EPC_{soil} * RCAF_{inh} * PM_{10} * VR_{work} * RAF_{nc\text{-}inh} * EF * ED_{inh} * EP * C2 * C3 * C4}{BW * AP_{noncancer}}$$

Parameter	Value	Units
RfD	OHM-specific	mg/kg-day
ADD	OHM-specific	mg/kg-day
EPC	OHM-specific	mg/kg
IR	100	mg/day
$RAF_{nc\text{-}ing}$	OHM-specific	dimensionless
$RAF_{nc\text{-}derm}$	OHM-specific	dimensionless
$RAF_{nc\text{-}inh}$	OHM-specific	dimensionless
EF	0.714	event/day
$ED_{ing\ \&\ derm}$	1	day/event
ED_{inh}	0.333	day/event
EP	182	days
C1	1.0E-06	kg/mg
C2	1.0E-09	kg/µg
C3	1440	min/days
C4	1.0E-03	m^3/L
BW	58.0	kg
$AP_{noncancer}$	182	days
VR_{work}	60	L/min
AF	0.29	mg/cm^2
SA	3473	cm^2/day
$RCAF_{inh\text{-}gi}$	1.5	dimensionless
$RCAF_{inh}$	0.5	dimensionless
PM10	60	$µg/m^3$

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Construction Worker - Soil: Table CW-4
Definitions and Exposure Factors

Vlookup Version v0315

Parameter	Value	Units	Notes
ELCR - Excess Lifetime Cancer Risk	chemical specific	dimensionless	Pathway specific (ing =ingestion, derm=dermal, inh=inhalation)
HI - Hazard Index	chemical specific	dimensionless	Pathway specific (ing =ingestion, derm=dermal, inh=inhalation)
CSF - Cancer Slope Factor	chemical specific	$(mg/kg\text{-}day)^{-1}$	see Table CW-5.
RfD - Reference Dose	chemical specific	mg/kg-day	see Table CW-5.
LADD - Lifetime Average Daily Dose	chemical specific	mg/kg-day	Pathway specific. See Table CW-2.
ADD - Average Daily Dose	chemical specific	mg/kg-day	Pathway specific. See Table CW-3.
EPC - Exposure Point Concentration	chemical specific	mg/kg	see Table CW-1.
IR - Soil Ingestion Rate	100	mg/day	MADEP. 2002. Technical Update: Calculation of an Enhanced Soil Ingestion Rate. (http://www.mass.gov/dep/ors/orspubs.htm).
RAF_c - Relative Absorption Factor for Cancer Effects	chemical specific	dimensionless	Pathway specific - see Table CW-5.
RAF_{nc} - Relative Absorption Factor for Noncancer Effects	chemical specific	dimensionless	Pathway specific - see Table CW-5.
EF - Exposure Frequency	0.714	event/day	5 events (days) / 7 events (days) in a week; MADEP 1995 Guidance for Disposal Site Risk Characterization pg B-38.
$ED_{ing,derm}$ - Exposure Duration for ingestion or dermal exposure	1	day/event	
ED_{inh} - Exposure Duration for inhalation exposure	0.333	day/event	Represents 8 hours / event.
EP - Exposure Period	182	days	6 months; MADEP 1995 Guidance for Disposal Site Risk Characterization.
BW - Body Weight	58.0	kg	U.S. EPA. 1997. Exposure Factors Handbook. Table 7-7, Females, ages 18 - 25.
$AP_{(lifetime)}$ - Averaging Period for lifetime	25,550	days	Represents 70 years
$AP_{(noncancer)}$ - Averaging Period for noncancer	182	days	6 months; MADEP 1995 Guidance for Disposal Site Risk Characterization.
AF - Adherence Factor	0.29	mg/cm^2	MA DEP. 2002 Technical Update: Weighted Skin-Soil Adherence Factors. (http://www.mass.gov/dep/ors/orspubs.htm)
VR_{work} - Ventilation Rate during work (heavy exertion)	60	L/min	Table B-4 MADEP 1995 Guidance for Disposal Site Risk Characterization.
SA - Surface Area	3473	cm^2/day	MADEP. 1995. Guidance for Disposal Site Risk Characterization. 50th percentile for females. Appendix Table B-2.
$IFAF_{inh\text{-}gi}$ - Ingestion Fraction Adjustment Factor, gastrointestinal	1.5	dimensionless	MADEP 2007. Characterization of Risks Due to Inhalation of Particulates by Construction Workers
$IFAF_{inh}$ - Inhalation Fraction Adjustment Factor, inhalation	0.5	dimensionless	MADEP 2002. Characterization of Risks Due to Inhalation of Particulates by Construction Workers
PM10 - Concentration of PM_{10}	60	$\mu g/m^3$	MADEP 1995 Guidance for Disposal Site Risk Characterization pg B-11

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Construction Worker - Soil: Table CW-5
Chemical-Specific Data

Vlookup Version v0315

Oil or Hazardous Material	Oral CSF $(mg/kg\text{-}day)^{-1}$	$RAF_{c\text{-}ing}$	$RAF_{c\text{-}derm}$	$RAF_{c\text{-}inh}$	Inhalation CSF $(mg/kg\text{-}day)^{-1}$	Subchronic Oral RfD mg/kg-day	Subchronic $RAF_{nc\text{-}ing}$	Subchronic $RAF_{nc\text{-}derm}$	Subchronic $RAF_{nc\text{-}inh}$	Subchronic Inhalation RfD
AROMATICS C9 to C10						3.0E-01	1	0.2	1	1.4E-01
ALIPHATICS C9 to C12						1.0E+00	1	0.2	1	1.7E-01
ALIPHATICS C9 to C18						1.0E+00	1	0.2	1	1.7E-01
ALIPHATICS C19 to C36						6.0E+00	1	0.2		
AROMATICS C11 to C22						3.0E-01	0.3	0.1	1	1.4E-01
METHYLNAPHTHALENE, 2-						4.0E-03	0.3	0.1	1	1.4E-01
NAPHTHALENE						2.0E-01	0.3	0.1	1	8.6E-04
ACENAPHTHENE						2.0E-01	0.3	0.1	1	1.4E-01

MassDEP ORS
Contact: Lydia Thompson
Lydia.Thompson@state.ma.us
617-556-1165

Construction Worker - Soil: Table CW-6
Cyanide Calculations

The soil cyanide concentration limit set to protect a construction worker against an acute, potentially lethal one-time dose of cyanide from incidental ingestion of contaminated soil is 12,000 mg/kg_{soil}. This is the concentration of available cyanide in soil below which acute human health effects would not be expected following a one-time exposure. This soil concentration is calculated using the equation below with a one-time soil ingestion estimate of 50 mg_{soil} and an available cyanide dose limit of 0.01 $mg/kg_{body\ weight}$.

MassDEP's guidance on evaluating the risk from a one-time cyanide dose considers cyanide's potentially lethal effects as well as information on cyanide metabolism:

> Cyanides are detoxified rapidly by the body, and a large acute dose which overwhelms the detoxification mechanism is potentially more toxic than the same dose distributed over a period of hours. (MassDEP *Background Documentation for the Development of an Available Cyanide Benchmark Concentration,* originally dated October 1992, Modified August 1998)

Assessment of a potential one-time dose requires an estimate of the maximum soil concentration the trespasser could contact at any one time. The average soil concentration within a typical exposure area will underestimate the potential one-time dose. Therefore, to assess the acute risk of a one-time potentially lethal dose, the EPC for cyanide should be a conservative estimate of the maximum concentration.

The construction worker soil concentration limit to protect against adverse effects from an acute (one-time) exposure to cyanide is 12,000 mg/kg.

Acute Concentration Calculation for Cyanide

$$\text{Concentration} = \frac{\text{HQ x Acute Dose Limit x BW}}{\text{IR x RAF x Conversion Factor}}$$

Parameter	Value	Units
HQ (Hazard Quotient)	1	(unitless)
Acute Dose Limit	0.01	mg avail. CN/ kg BW
BW (Body Weight) $_{11\text{-}12}$	58	kg
IR $_{(1\text{-time reasonable max})}$	50	mg
Conversion Factor	1.0E-06	kg soil / mg soil
RAF	1	(unitless)

The toxicological basis for estimating an allowable one-time dose is documented in MassDEP's 1992 *Background Documentation for the Development of an "Available Cyanide" Benchmark Concentration,* which is published at: http://www.mass.gov/eea/docs/dep/toxics/stypes/dscyanide.pdf

MassDEP ORS
Contact: Lydia Thompson
Lydia.Thompson@state.ma.us
617-556-1165

APPENDIX E

WASTE MANIFEST

Please print or type. (Form designed for use on elite (12-pitch) typewriter.) WO 1401072535-0 SC PPW 5/22/2014 Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Manifest Tracking Number
MV5082293545	1	(800) 483-3718	007845913 FLE

GENERATOR

5. Generator's Name and Mailing Address
Trident Env Group LLC
58 LaCombe Street Unit 10
Marlborough, MA 01752
Generator's Phone: (508) 229-3545

Generator's Site Address (if different than mailing address)
SAME

6. Transporter 1 Company Name
Clean Harbors Environmental Services Inc
U.S. EPA ID Number
MAD039322250

7. Transporter 2 Company Name
Robbie D Wood INC
U.S. EPA ID Number
ALD067137891

8. Designated Facility Name and Site Address
Spring Grove Resource Recovery Inc
4879 Spring Grove Avenue
Cincinnati, OH 45232
Facility's Phone: (513) 681-5738
U.S. EPA ID Number
OHD000816629

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes
	1. NON DOT REGULATED MATERIAL. (OILY SLUDGE)	1	DM	55	G	MA01
	2. NON DOT REGULATED MATERIAL, (IRON SALT SOLUTION)	4	DM	220	G	MA99
	3.					
	4.					

14. Special Handling Instructions and Additional Information
1. CH587809 (1X55)
2. CH830472 (4X55)

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name: Diane Woodman
Signature: D M Woodman
Month 07 Day 02 Year 14

INT'L

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

TRANSPORTER

17. Transporter Acknowledgment of Receipt of Materials
Transporter 1 Printed/Typed Name: PAUL RICHARD
Signature: Paul Richard
Month 07 Day 02 Year 14
Transporter 2 Printed/Typed Name: Jay Snyderman
Signature: Jay Snyderman
Month 7 Day 7 Year 14

DESIGNATED FACILITY

18. Discrepancy
18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection
Manifest Reference Number:
18b. Alternate Facility (or Generator) U.S. EPA ID Number
Facility's Phone:
18c. Signature of Alternate Facility (or Generator) Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

1.	2.	3.	4.
H141	H141		

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a
Printed/Typed Name: LeAnna Edwards
Signature: L. Edwards
Month 7 Day 11 Year 14

EPA Form 8700-22 (Rev. 3-05) Previous editions are obsolete.

DESIGNATED FACILITY TO DESTINATION STATE (IF REQUIRED)

APPENDIX F

PUBLIC INVOLVEMENT LETTER

Stantec Consulting Services Inc.
400 Crown Colony Drive Suite 200, Quincy MA 02169-0982

October 4, 2016
File: 191750018

Attention: E. Denise Simmons, Mayor
Cambridge City Hall
795 Massachusetts Avenue
Cambridge, Massachusetts, 02139

Dear Mayor Simmons,

Reference: Document Availability: Permanent Solution with Conditions
2 Gerry's Landing Road, Cambridge, MA
MassDEP RTN# 3-27723

In accordance with the public notification requirements of the Massachusetts Contingency Plan 310 CMR 40.1400, Stantec wishes to notify the City of Cambridge of the completion and availability of a Permanent Solution with Conditions for the Cambridge Boat Club at the above-referenced property. The Permanent Solution documents our finding that a condition of No Significant Risk (NSR) to human health, public welfare, safety, and the environment exists for all current and foreseeable uses of the property with the implementation of an Activity and Use Limitation (AUL). The oil and/or hazardous materials (OHM) at the Site is fuel oil, and exists in soil and groundwater only in a small area against the upslope side of the foundation of the on-site building.

This report may be reviewed at our office in Quincy, Massachusetts or, after submittal, at the MassDEP's Northeast Regional Office located at 205B Lowell Street, Wilmington, Massachusetts (or through MassDEP's online database: http://public.dep.state.ma.us/SearchableSites2/Search.aspx).

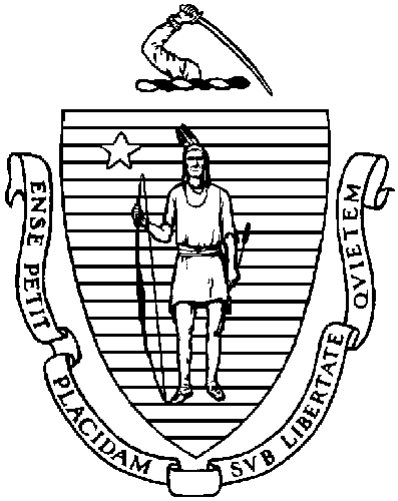
Should you have any questions regarding this matter, please do not hesitate to contact the undersigned.

Regards,

STANTEC CONSULTING SERVICES INC.

Charles Young, LSP
Senior Environmental Project Manager
Phone: (508) 591-4326
Fax: (617) 786-7962
Charles.Young@stantec.com

c. Cambridge Public Health Department, 119 Windsor Street, Ground Level, Cambridge, MA 02139



BID PACKAGE

PART V

TECHNICAL SPECIFICATIONS

SPECIAL PROVISIONS

CITY OF CAMBRIDGE
MEMORIAL DRIVE PARKWAY IMPOROVEMENTS

GENERAL

The General Contractor is responsible for coordinating all aspects of the Memorial Drive Parkway Improvements project, located along Memorial Drive, Cambridge, MA between the Eliot Bridge and the Anderson Memorial Bridge.

- **Respect for Greenway Users**: The Contractor and subcontractors must be respectful of all Greenway users within the Charles River Reservation.
- **Working Hours:** Monday through Friday, from 7:00 AM to 3:30 PM, unless otherwise approved by DCR.
- **Requests for Information (RFIs):** Any RFIs should be submitted electronically to the Department via email, with the project manager and engineer copied.

SCOPE OF WORK

All work under this Contract shall be done in conformance with the *Massachusetts Department of Transportation Standard Specifications for Highways and Bridges dated 2024 with all amendments and supplements, the 2017 Construction Standard Details, the Traffic Management Plans and Detail Drawings, MassDOT Work Zone Safety Temporary Traffic Control, the 1990 Standard Drawings for Signs and Supports; the 2015 Overhead Signal Structure and Foundation Standard Drawings, the 2009 Manual on Uniform Traffic Control Devices (MUTCD)* with Massachusetts Amendments; *the 1968 Standard Drawings for Traffic Signals and Highway Lighting; The American Standard for Nursery Stock;* the Plans and these Special Provisions.

MEMORIAL DRIVE PARKWAY

The work to be performed consists of, but is not limited to the following: installation of erosion and sediment control measures, establishment of temporary traffic controls, clearing and grubbing, excavation (including temporary earth support system, if selected by the Contractor), installation of a proposed shared use path and stabilized aggregate walking path (including amenities), mill & overlay and limited full depth reconstruction of the parkway, installation of three (3) traffic signal locations and two (2) pedestrian signal locations, installation of a new street lighting system, modifications to the existing drainage system, new trees and plantings, and other incidental work necessary to complete the proposed project.

If the Contractor elects to propose modifications to the project the net result shall be a cost savings to the Commonwealth of Massachusetts Department of Conservation and Recreation (DCR) or at the Contractor's expense. All acceptance of proposed project modifications shall be at the discretion of DCR and the Engineer.

For the work specified under this Contract, the Contractor shall be prequalified by the Massachusetts Department of Transportation Highway Division (MassDOT) in Highway Construction.

SEQUENCE OF CONSTRUCTION, SCHEDULE, AND RESTRICTIONS

Work Sequence: The Contractor must follow a clear and structured work sequence and schedule during the entire project. The Contractor shall begin with establishment and verification of horizontal and vertical control, locating the project limits, and mobilizing all necessary equipment to the site. The Contractor's schedule for progress and completion will be reviewed by the Department of Conservation and Recreation (DCR).

The Contractor must ensure that all work methods are planned and executed to avoid any damage to existing structures, vegetation (to remain), trees (to remain), hardscapes (such as parking lots and nearby walkways to remain), utility infrastructure and drainage facilities to remain, or wildlife habitat areas. These elements must be protected from any damage. Any damage to these areas or adjacent property caused by the Contractor's activities, whether directly or indirectly and determined by DCR, will be the Contractor's responsibility and repaired at no additional cost to the Department.

Construction Schedule of Operations: Before starting any work under this Contract, the Contractor shall submit a *Schedule of Operations*. The *Schedule of Operations* shall be prepared in accordance with the contract requirements. The Contractor shall submit, to and for comment of the Engineer, a schedule of operations within 15 days after the date of the executed Contract to the Contractor. The schedule shall show the proposed methods of construction and sequence of work and the time the Contractor proposes to complete the various items of work within the time specified in the Contract.

If the Contractor's operations are materially affected by changes in the plans or in the quantity of the work, or if he has failed to comply with the submitted and reviewed schedule, the Contractor shall submit a revised schedule if requested by the Engineer within seven days after the date of the Engineer's request. This revised schedule shall show how the Contractor proposes to prosecute the balance of the work, so as to complete the work within the time specified in the Contract. The cost to produce the schedule of operations shall be as specified in Section 722 Construction Scheduling Description located herein.. The schedule should outline the entire work sequence and phasing to include timeframes and preparation tasks including, but not limited to, the following:

- Material and equipment delivery
- Erosion and sediment control installation
- Tree protection
- Major earthwork activities
- Utility pipe and utility structure work
- Traffic and pedestrian signal installations, including mast arm foundations
- Parkway lighting installations
- Roadway rehabilitation and sidewalk reconstruction
- Helical pile and overlook viewing platform installations
- Shared-use and stabilized aggregate path work
- Hardscape and site furnishings installations

- Invasive plant removal, planting and plant maintenance
- Turf and coir log establishment
- Final sitework

The schedule must account for the following **site-specific restrictions:**

Permit Availability on Site at All Times: Keep all required permits, including OOC, Chapter 91 Licenses, MWRA permit, general permits, any extensions, any approved plans, on-site at all times.

Charles River Regatta: No work is allowed during the **Charles River Regatta**. Secure the entire site for this event. If plant warranty/replacement work is needed, no work is allowed during this event.

Weekend Closures of Memorial Drive: The Department of Conservation and Recreation (DCR) closes this portion of Memorial Drive to motor vehicle traffic each weekend from the end of April to mid-November to allow pedestrians, cyclists, and others to enjoy the riverfront. No work will be allowed during these closures. The Contractor must coordinate with DCR to determine the specific timing of these closures and what actions may be needed to safely protect the public during these closures.

Utility Coordination: Begin coordinating with utility companies as soon after the NTP is issued to avoid delays.

Certificate of Compliance: Per the Order of Conditions issued by the City of Cambridge Conservation Commission, as-built plans prepared by a Professional Engineer or Land Surveyor registered in the Commonwealth of Massachusetts showing final park development shall be submitted to DCR for submission to the Conservation Commission with a request for a Certificate of Compliance. In addition, an affidavit from a Professional Engineer or Land Surveyor registered in the Commonwealth of Massachusetts shall be submitted, which states that the project was completed in accordance with the requirements of the Order of Conditions. The Contractor shall include this work in their bid.

Plant Maintenance: Contractor shall perform all required plant maintenance between 7am -11am Monday – Friday only. From 11am onward the public will have access to paths, viewing platforms and other amenities, as applicable, along the Charles River. Contractor should submit a plan for public access for this period of time.

The Contractor is advised to review the project permits attached and above restrictions to determine what work is impacted by these restrictions and shall plan the work accordingly. Schedule constraints will be discussed at the pre-bid meeting.

SUBMITTALS

Submittal Schedule: Unless otherwise specified, within seven **(7)** calendar days from the date of the notice to proceed or at the pre-construction meeting, whichever occurs first, the Contractor shall submit to DCR a list of all submittals needing approval and a timeline of their submission.

Schedule Updates: The construction schedule must be maintained on-site for review during meetings. Any significant changes to the schedule must be emailed to the resident engineer with the project manager copied immediately for review.

INSPECTIONS

Inspection Team: The Department will assign inspectors and/or resident engineers to this project on either a full time or part-time basis, as required to cover the work under this Contract, as justified by the Department.

Material Shipments: The contractor must notify the Department at least **48 hours** in advance of material shipments to arrange for inspection.

PERMITS

Permits: All permits required to be obtained by DCR prior to construction are included in the attached documentation.

Compliance: The contractor shall comply with all permit requirements.

ADDITIONAL SITE-SPECIFIC NOTES

Minimize Interference: Perform site work and debris removal in a way that minimizes disruption to streets, walkways, parking areas, buildings, and other adjacent facilities.

Permission for Closures: Obtain written permission from the relevant authorities and police details, if determined by DCR, to close or obstruct streets, walkways, or adjacent facilities. If necessary, provide alternate routes for traffic and pedestrians as required by those authorities.

Protect Utilities and Fixtures: Where applicable, protect and maintain light poles, utility poles and services, traffic signal control boxes, curb boxes, valves, and other utilities, unless specified for removal or modification.

Coordination with Adjacent Contractor/Construction Activities: The Contractor is hereby notified of the following construction activities that will be on-going within or adjacent to the project site during the construction period of this contract.

- MassDOT Project No. 608762 Eliot Bridge Preservation Project
- City of Cambridge CAM005 Drainage Outfall Improvements Project and CAM007 Relocation and Replacement of CSO Monitoring Cabinet Project
- Harvard University Eliot House Renovation Project
- On-going exterior repair work to all residential buildings abutting Memorial Drive

The Contractor must coordinate his sequence of operations and coordinate all construction activities with the work of these other contractors to ensure no scheduling conflicts arise that could adversely impact the approved project schedule.

PERSONAL PROTECTIVE SAFETY EQUIPMENT FOR CONTRACTOR PERSONNEL

The Contractor is responsible to ensure that all personnel, including all subcontractors, working on the project are issued and are wearing all necessary personal protective safety equipment while working within the project limits. This equipment shall include, as a minimum, a hardhat and a safety vest, regardless of the type of work being performed. Other safety equipment shall be added as required to perform the work in which they are engaged and in accordance with all local, state and federal requirements in effect. Safety equipment

shall be provided at no additional cost to DCR.

APPROVAL OF MATERIALS

The Contractor shall submit a list of all materials for approval within 15 days of the Notice to Proceed. This list shall include kind and type, manufacturer's name, trade name, size, catalog number, and it shall be complete in full text.

The list shall be delivered to DCR's representative. DCR or their representative shall have the right to reject any material or equipment that, in their judgment does not meet these Specifications.

The Contractor shall further provide DCR written evidence within 30 days of receipt of the contract that orders have been confirmed in writing by the manufacturer with delivery dates appropriate for timely completion of the project.

STRUCTURAL INTEGRITY

It is the Contractor's responsibility to maintain the integrity of any adjacent structures and ancillary facilities/related elements including, but not necessarily limited to, the following: the existing condominium and apartment buildings and walkways located along the northerly side of Memorial Drive, the Cambridge Boat Club, the BBN Boat House and the Eliot Bridge underpass, as shown on the Plans.

The Contractor shall perform whatever activities he/she deems necessary, at no additional cost to the owner, to ensure the pre-construction integrity of any adjacent structures and ancillary facilities are maintained throughout the construction period of this contract.

DISPOSAL OF EXCESS MATERIAL

Surplus materials obtained from any type of excavation, and all existing and other materials not required to be removed and stacked or needed for use on the project, as determined by the Engineer, shall become the property of the Contractor and disposed of subject to the regulations and requirements of local authorities governing the disposal of such materials, at no additional compensation.

ENVIRONMENTAL

All applicable portions of MassDOT Specification Sections 961.65 "Worker Protection" and 961.66 "Environmental Protection and Monitoring" shall be followed when performing this work. Any questionable, hazardous material shall be collected and tested during construction operations and disposed of in accordance with state and local regulations and as outlined in these specifications.

The applicable submittals shall be according to MassDOT Specification Section 961.69 "Submittals".

PROTECTION OF UNDERGROUND FACILITIES

The Contractor's attention is directed to the necessity of making his own subsurface investigation in order to assure that no damage to existing structures, drainage lines, water lines, traffic signal conduits, lighting conduits, communication lines, etc., will occur. The Contractor shall notify Massachusetts DIG SAFE and procure a Dig Safe Number for each location prior to disturbing existing ground in any way. The telephone number of the Dig Safe Call Center is 811 or 1-888-344-7233.

NOTICE TO OWNERS OF UTILITIES

Written notice shall be given by the Contractor to all public service corporations or officials owning or having charge of public or private utilities, of his/her intention to commence operations affecting such utilities at least one week in advance of the start of such operations. The Contractor shall at the same time file a copy of said notice with the Engineer. A list of public and private utilities can be found on the MassDOT website at: http://www.massdot.state.ma.us/

Following are the names and addresses of the companies or agencies that may be affected, but the completeness of the list is not guaranteed:

CAMBRIDGE FIRE DEPT
Thomas Cahill
Fire Chief
491 Broadway
Cambridge, MA 02138
Phone: (617) 349-4900

CAMBRIDGE POLICE DEPT.
Christine Elow
Police Commissioner
125 Sixth Street
Cambridge, MA 02142
Phone: (617) 349--3300

CAMBRIDGE DPW - ENGINEERING
Kathy Watkins, Commissioner
147 Hampshire Street
Cambridge, MA 02139
Phone: (617) 349-4800

MWRA WASTEWATER OPERATIONS
Kevin McKenna
2 Griffin Way
Chelsea, MA 02150
(617) 305-5956

COMCAST CABLE CORP.
Wendy Brown
Project Coordinator
PO Box 6505, 5 Omni Way
Chelmsford, MA 01824
Phone: (978) 848-5163

EVERSOURCE ELECTRIC
Ned Sadowski
Account Executive
1165 Massachusetts Ave
Dorchester, MA 02125
(617) 427-4176

AT&T/TC SYSTEMS
c/o Siena Engineering Group
Erica Hudson
50 Mall Road – Suite 203
Burlington, MA 01803
Phone: (781) 221-8400 X7041

CROWN CASTLE
Mark Bonanno
80 Central Street
Boxborough, MA 01719
Phone: (508) 616-7818

DESIGNER – STANTEC
Rick Azzalina, PE
45 Blue Sky Drive, 3rd Floor
Burlington, MA 01803
(781) 221-1221

DCR PROJECT MANAGER
Dan Driscoll
Director, Green Infrastructure
Project Planning and Design
(617) 447-3834

SUBSECTION 5.02 – SHOP DRAWING SUBMITTALS.

(Replace Subsection 5.02, 8th paragraph)

The Contractor shall submit two sets of full-scale shop drawing prints to the Engineer for approval. If

corrections are required, one set of the marked-up drawings will be returned to the Contractor for revision and subsequent re-submittal. No changes shall be made to the approved drawings without the written consent of the Engineer.

PREVENTION OF WATER POLLUTION - SANITARY PROVISIONS

(Supplementing subsection 7.02)

During the performance of all Work done under this contract, the Contractor shall adopt such precautions in the conduct of his operations as may be necessary to avoid contaminating water in and around the adjacent Charles River area. All moving of equipment and other operations likely to create silting, shall be so planned and conducted as to minimize pollution in and around the adjacent Charles River area. Water used for any purpose by the Contractor, which has been contaminated with soil, bitumen, salt or other pollutants shall be so discharged as to avoid affecting nearby waters. Under no circumstances shall the Contractor discharge pollutants directly into any river/stream or pond area.

Erosion/Sedimentation Controls

All sedimentation barriers shall be maintained in good repair until all disturbed areas have been fully stabilized with vegetation or other means. At no time shall sediments be deposited in a wetland or water body. During construction, the Contractor or his/her designee shall inspect erosion controls on a daily basis and shall remove accumulated sediments as needed. An adequate stockpile of erosion control materials shall be kept on site for emergency or routine repairs. The Contractor shall immediately control any erosion problems that occur at the site and shall also immediately notify the Resident Engineer who reserves the right to require additional erosion and/or damage prevention controls he/she may deem necessary.

Hazardous Spills

Supplies for cleanup of oil, gasoline and other hazardous materials to be used during the project shall be kept onsite at all times. Spills of reportable quantities of hazardous materials shall be reported, as required, to the Department of Environmental Protection (DEP) and cleaned up in compliance with all DEP guidelines.

EROSION AND SEDIMENTATION CONTROL

(Supplementing Sub-sections 5.01, 7.01, 7.02 & 8.06)

The Engineer has the authority to limit the surface areas of erodible earth material exposed by excavation, borrow and fill, or any such operations, and to direct the Contractor to provide immediate, permanent or temporary control measures. Such measures will involve the construction of sediment barriers, sedimentation basins, silt fences or other control devices or methods as necessary to control erosion and sedimentation.

The erosion and sediment control features installed by the Contractor shall conform to the requirements of issued environmental permits and shall be satisfactorily maintained by the Contractor until acceptance of the work under this Contract.

In case of conflict between these specifications and laws, rules, or regulations of local agencies, the more restrictive requirements, as determined by the Resident Engineer, shall apply.

If temporary erosion and sediment control measures are required due to the Contractor's negligence or carelessness, the Contractor at his/her own expense shall install and maintain the control measures. Construction of temporary erosion and sediment control measures, which are not attributed to the Contractor's negligence, carelessness, or failure to install permanent controls, will be performed as shown on the Plans and/or as required by the Resident Engineer. Repeated failures by the Contractor to control erosion, pollution, and/or siltation, shall be cause for the Resident Engineer to employ outside assistance or to use his own forces to provide the necessary corrective measures. The cost of such assistance plus project engineering costs will be charged to the Contractor and appropriate deductions made from the Contractor's monthly progress estimate.

SUBSECTION 7.09 – PUBLIC SAFETY AND CONVENIENCE

(Supplementing Subsection 7.09)

The Contractor shall provide, in accordance with the Contract Plans, all traffic barriers, signs and other specified traffic control devices needed to provide the necessary traffic management in the vicinity of the construction site as indicated on the Plans. No construction activities shall begin within any phase of the work until all traffic control devices, signs, and barriers have been provided and approved by the Engineer.

The Contractor shall pay particular attention to maintaining safe and convenient access along the northerly Memorial Drive sidewalk and to the front of all adjacent residential buildings at **ALL** times for the benefit of pedestrians and emergency responders (i.e., police, fire, ambulance, etc.). Additionally, the Contractor shall provide 72 hour advance notice to adjacent residential abutters to accommodate potential moving activities and/or deliveries.

Construction work on the project shall not commence until the construction signing and traffic barriers as described in the Contract Plans have been installed and approved by the Engineer.

Particular care shall be taken to establish and maintain such methods and procedures so that hazards of an unusual nature will not be created.

CONSTRUCTION STAKING

The selected Contractor will be furnished information and ties for the project survey and construction baselines and benchmarks including AutoCAD drawings and field notes if needed. All survey control provided to the contractor shall be field verified for accuracy with any discrepancies reported to the Engineer. The Contractor shall perform all survey and construction staking required for the work. All costs associated with Construction Staking shall be considered incidental to this Contract.

EXISTING BOUNDS AND MONUMENTS

The Contractor shall exercise due care when working around all existing property bounds and markers discovered during the course of his/her construction activities. Should any damage to a property bound or marker result from the actions of the Contractor, it shall be replaced and/or realigned by the Contractor at no cost to the project.

CITY OF CAMBRIDGE PERMIT(S)

The Contractor shall obtain the necessary permit(s) from the City of Cambridge required to perform work within their City street layout on Ash Street, Hawthorn Street and other adjacent City streets. All costs shall be incidental to the project.

SECTION 722
CONSTRUCTION SCHEDULING
DESCRIPTION

722.20 General

The Contractor's approach to prosecution of the Work shall be disclosed to the Department by submission of a Critical Path Method (CPM) schedule and a cost/resource loaded Construction Schedule as defined by the schedule type set forth below. These requirements are in addition to any requirements imposed in other sections.

This section establishes the requirement for scheduling submissions. There are four schedule types identified as types A, B, C and D. The schedule type applicable to this project is established in the project special provisions.

All schedules shall be prepared and submitted in accordance with this specification and the instructions contained in the Construction Schedule Toolkit located on the MassDOT-Highway Division website at https://www.mass.gov/info-details/massdot-highway-contractors-schedule-toolkit.

Type A –

- Schedule Planning Session
- Baseline CPM Schedule
- Monthly Update CPM Schedule
- Short-term Construction Schedule
- Contract Schedule Update Meeting
- Cost-loaded & Resource Loaded CPM
- Resources Graphic Reporting
- Cash Flow Projections from the CPM
- Cash Flow Charts
- Monthly Projected Spending Report (PSR)
- Contractor-furnished CPM software and computer

Type B –

- Schedule Planning Session
- Baseline CPM Schedule
- Monthly Update CPM Schedule
- Short-term Construction Schedule
- Contract Schedule Update Meeting
- Cost-loaded & Resource Loaded CPM
- Monthly Projected Spending Report (PSR)
- Contractor-furnished CPM software and computer

Type C –

- Schedule Planning Session
- Baseline CPM Schedule
- Monthly Update CPM Schedule
- Short-term Construction Schedule
- Contract Schedule Update Meeting
- Monthly Projected Spending Report (PSR)
- Contractor-furnished CPM software and computer

Type D -

- Bar chart schedule updated monthly or at the request of the Engineer
- Short-term Construction Schedule
- Monthly Projected Spending Report (PSR)
-

EQUIPMENT, PERSONNEL

722.40 General

A. Software Requirements

The Contractor shall use Primavera P6 computer scheduling software.
In addition to the requirements of Section 740 – Engineer's Field Office and Equipment, the Contractor shall provide to the Department one (1) copy of the scheduling software, one (1) software license and one (1) computer capable of running the scheduling software for the duration of the Contract. This computer and software shall be installed in the Engineer's Field Office. The computer and software shall be maintained and serviced at no additional cost to the Department.

B. Scheduler Requirements

The Scheduler shall be approved by the Engineer.
For Type A, B and C Schedules the name of the Contractor's Project Scheduler together with his/her qualifications shall be submitted to the Department for approval by the Engineer within seven (7) Calendar Days after NTP. The Project Scheduler shall have a minimum of five (5) years of project CPM scheduling experience, three (3) years of which shall be on projects of similar scope and value as the project for which the Project Scheduler is being proposed. References shall be provided from past projects that can attest to the capabilities of the Project Scheduler.

SCHEDULING METHODS

722.60 General

A. **Schedule Planning Session**

The Contractor shall conduct a schedule planning session prior to submission of the Baseline Schedule. This session will be attended by the Department and its consultants. During this session, the Contractor shall present its planned approach to the project including, but not limited to:

1. the Work to be performed by the Contractor and its subcontractors;
2. the planned construction sequence and phasing; planned crew sizes;
3. summary of equipment types, sizes, and numbers to be used for each work activity;
4. all early work related to third party utilities;
5. identification of the most critical submittals and projected submission timelines;
6. estimated durations of major work activities;
7. the anticipated Critical Path of the project and a summary of the activities on that Critical Path;
8. a summary of the most difficult schedule challenges the Contractor is anticipating and how it plans to manage and control those challenges;

9. a summary of the anticipated quarterly cash flow over the life of the project.

This will be an interactive session and the Contractor shall answer all questions that the Department and its consultants may have. The Contractor shall provide a written summary of the information presented and discussed during the session to the Engineer. The Contractor's Baseline Schedule and accompanying Schedule Narrative shall incorporate the information discussed at this Schedule Planning Session.

B. **Schedule Reviews by the Department**

1. Baseline Schedule Reviews
   The Engineer will respond to the Baseline Schedule Submission within thirty (30) Calendar Days of receipt providing comments, questions and/or disposition that either accepts the schedule or requires revision and resubmittal. Rejected Baseline Schedules shall be resubmitted within fifteen (15) Calendar Days after receipt of the Engineer's comments.

2. Contract Progress Schedule / Monthly Update Reviews / Recovery Schedules
   The Engineer will respond to each submittal within twenty-one (21) Calendar Days. Rejected schedules shall be resubmitted by the Contractor within five (5) Calendar Days after receipt of the Engineer's comments.

The Engineer's review comments shall not be construed as direction to change the Contractor's means and methods. The review and acceptance of the CPM schedule does not relieve the Contractor of the responsibility for accomplishing the work within the contract required completion dates. Omissions and errors in the accepted CPM schedule shall not excuse performance less than that required by the Contract.

722.61 Schedule Content and Preparation Requirements

All schedules shall be prepared and submitted in accordance with the instructions contained in the Construction Schedule Toolkit located on the MassDOT-Highway Division website at:

https://www.mass.gov/info-details/massdot-highway-contractors-schedule-toolkit
and the following:

A. **LOGIC**

The schedules shall divide the Work into activities with appropriate logic ties to show:

1. conformance with the requirements of this Section and Division I, Subsection 8.02 - Schedule of Operations
2. the Contractor's overall approach to the planning, scheduling, and execution of the Work
3. conformance with any additional sequences of Work required by the Contract Documents, including, but not limited to, Subsection 8.03 - Prosecution of Work and Subsection 8.06 – Limitations of Operations.

SECTION 722 (Continued)

B. **ACTIVITIES**

The schedule shall clearly define the progression of the Work from the Notice to Proceed (NTP) to Contractor Field Completion (CFC) by using separate activities, or including attributes within appropriate activities, to address each of the following:

1. Notice to Proceed
2. Work Breakdown Structure
3. The Critical Path is clearly defined and organized.
4. Float shall be clearly identified.
5. Detailed activities to satisfy permit requirements.
6. Subcontractor approvals at fifteen (15) Calendar Days from submittal to response
7. The preparation and submission of shop drawings, procedures, and other required submittals, with a planned duration that is to be demonstrated to the Engineer as reasonable.
8. The review and return of shop drawings, procedures, and other required submittals, approved or with comments, the duration of which shall be thirty (30) Calendar Days, unless otherwise specified or as approved by the Engineer.
9. Procurement of fabricated materials and equipment with long lead times, including time for review and approval of submittals required before procuring and fabricating.
10. Each component of the Work defined by specific activities.
11. Right-of-Way (ROW) takings that have been identified in the Contract.
12. Early Utility Relocation (by others) that has been identified in the Contract.
13. Interfaces with adjacent work, utility companies, other public agencies, sensitive abutters, and/or any other third-party work affecting the Contract.
14. Utility work to be performed in accordance with the Project Utility Coordination (PUC) Form as provided in Section 8.14 - Utilities Coordination, Documentation and Monitoring Responsibilities
15. Access Restraints – restrictions on access to areas of the Work that are defined by the Department in the bid package, in Subsection 8.06 – Limitations of Operations or elsewhere in the Contract
16. Limitations of Work – time of year restrictions and any other limitations identified in the contract
17. Traffic work zone set-up and removal, night work and phasing
18. Material Certifications
19. Milestones listed in Subsection 8.03 - Prosecution of Work or elsewhere in the Contract Documents
20. For Type A and B Contracts only: All items to be paid for, including all Unit Price and Lump Sum pay items, shall be identified by activity. This shall include all non-construction activities such as engineering work; purchase of permanent materials and equipment, purchase of structural steel stock, equipment procurement, equipment delivery to the site or storage location and the representative amount of overhead/indirect costs that was included in the Contractor's Bid Prices.

21. Contractor's request for validation of FBU (ready to open to traffic)
22. Full Beneficial Use (FBU) Contract Milestone per the following requirements: The majority of contract Work has been completed and the asset(s) has been opened for full multi-modal transportation use, except for limited contract work items that do not materially impair or hinder the intended public use of the transportation facility. All anticipated lane takings have been completed, except for minor, short term work items and as defined in Subsection 8.03 - Prosecution of Work
23. The Department's confirmation of completed work to allow for FBU.
24. Contractor's request for validation of Substantial Completion
25. Department generated punch list of twenty-one (21) Calendar Days
26. Substantial Completion Contract Milestone as defined in the standard specifications.
27. Punch list Completion Period of at least thirty (30) Calendar Days per the requirements of Subsections 5.11 - Final Acceptance, 7.15 - Claims Against Contractors for Payment of Labor, Materials and Other Purposes
28. Contractor confirmation that all punchlist work and documentation has been completed.
29. Physical Completion of the Work Contract Milestone per the requirements of Subsections 5.11 - Final Acceptance and 8.03 - Prosecution of Work
30. Documentation Completion per the requirements of Subsections 5.11 - Final Acceptance and 8.03 - Prosecution of Work
31. Contractor Field Completion Contract Milestone (which can also be considered the completion date) per the following requirements: All physical contract Work is complete including punchlist. The Contractor has fully de-mobilized from field operations and as defined in Subsection 5.11

C. **EARLY AND LATE DATES**

Early Dates shall be based on proceeding with the Work or a designated part of the Work exactly on the date when the corresponding Contract Time commences. Late Dates shall be based on completing the Work or a designated part of the Work exactly on the corresponding Contract Time, even if the Contractor anticipates early completion.

D. **DURATIONS**

Activity durations shall be in Work Days. Planned Original Durations shall be established with consideration of resources and production rates that correspond to the Contractor's Bid Price. Within all of the Department-required schedules, the Contractor shall plan the Work using durations for all physical construction activities of no less than one (1) Work Day and no greater than fourteen (14) Work Days, unless approved by the Engineer as part of the Baseline Schedule Review.

Should there be an activity with a duration that is determined by the Engineer to be unreasonable, the Contractor will be asked to provide a basis of the duration using bid documents, historic production rates for similar work, or other form of validation that is acceptable to the Engineer. Should the Contractor and the Engineer be unable to agree on reasonable activity durations, the Engineer will, at a minimum, note the disagreement in the Baseline Schedule Review along with a duration the Engineer considers reasonable and the basis for that duration. A schedule that contains a substantial number of activities with durations that are deemed unreasonable by the Engineer will not be accepted.

E. **MATERIALS ON HAND**

The Contractor shall identify in the Baseline Schedule all items of permanent materials (Materials On Hand) for which the Contractor intends to request payment prior to the incorporation of such items into the Work.

F. **ACTIVITY DESCRIPTIONS**

The Contractor shall use activity descriptions in all schedules that clearly describe the work to be performed using a combination of words, structure numbers, station numbers, bid item numbers, work breakdown structure (WBS) and/or elevations in a concise and compact label.

G. **ACTIVITY IDENTIFICATION NUMBERS**

The Contractor shall use the activity identification numbering system specified in the MassDOT Highway Division Contractor Construction Schedule Toolkit.

H. **ACTIVITY CODES**

The Contractor shall use the activity codes specified in the MassDOT Highway Division Contractor Construction Schedule Toolkit.

I. **CALENDARS**

Different calendars may be created and assigned to all activities or to individual activities. Calendars define the available hours of work in each Calendar Day, holidays and general or project-specific non-Work Days such as Fish Migration Periods, time-of-year (TOY) restrictions and/or area roadway restrictions. All calendars shall extend two years beyond the current project completion date.

Project Special Provisions identify specific calendar restrictions some examples of special calendars include, but are not limited to:

- Winter Shutdown Period, specific work is required by separate special provision to be performed during the winter. See Special Provision 8.03 (if applicable)
- Peak traffic hours on heavily traveled roadways. This shall be from 6:30 am to 9:30 am and from 3:30 pm to 7:00 pm, unless specified differently elsewhere in the Contract.
- Special requirements by sensitive abutters, railroads, utilities and/or other state agencies as defined in the Contract.
- Planting seasons for trees, shrubs and grasses and wetlands mitigation work.

- Cape Cod and the Islands Summer Roadway Work Restrictions: A general restriction against highway and bridge construction is enforced between Memorial Day and Labor Day, unless otherwise directed by the Engineer. Cape Ann Summer Roadway Work Restrictions: While there are no general restrictions for Cape Ann as there are for Cape Cod and the Islands, project-specific restrictions may be enforced.
- Turtle and/or Fish Migration Periods and/or other in-water work restrictions: Refer to the Project Special Provisions for specific restrictions.
- Working over Waterways Restricted Periods.
- Night-time paving and striping operations, traffic, and temperature restrictions.
- Utility Restrictions shall be as specified within the Contract.

J. **FLOAT**

For the calculation of float in the CPM schedule, the setting for *Retained Logic* is required for all schedule submissions, starting with the Baseline Schedule Submission. Should the Contractor have a reason to propose that an alternative calculation setting such as *Progress Override* be used, the Contractor shall obtain the Engineer's approval prior to modifying to this setting.

K. **COST AND RESOURCE LOADING (Types A and B only)**

For all Type A and B Schedules, the Contractor shall provide a cost and resource-loaded schedule with an accurate allocation of the costs and resources necessary to complete the Work. The costs and resources shall be assigned to all schedule activities in order to enable the Contractor to efficiently execute the Contract requirements and the Engineer to validate the original plan, monitor progress, provide cash flow projections, and analyze delays.

1. Each schedule activity shall have an assigned cost that accurately represents the value of the Work. Each schedule activity shall have its resources assigned to it by craft and the anticipated hours to accomplish the work. Each schedule activity's equipment resources shall be assigned to it by equipment type and hours operated. Front-loading or other unbalancing of the cost distribution will not be permitted.
2. The sum of the cost of all schedule activities shall be equal to the Contractor's Bid Price.
3. Indicating the labor hours per individual, per day, by craft and equipment hours/day will be acceptable.
4. The Engineer reserves the right to use the cost-loading as a means to resolve changes, disputes, time entitlement evaluations, increases or decreases in the scope of Work, unit price renegotiations and/or claims.
5. For all Type A and B Schedules, all subnets, fragnets, Proposal Schedules, and Recovery Schedules shall be cost and resource- loaded to help to quickly validate and monitor the duration of the Work to be performed.
6. For Type A Schedules, cost-loading of the schedule will also be used for cash flow projection purposes.

The cost-loading of each activity shall indicate the portion of the cost for that activity that is applicable to a specific bid item (cost account.) The total cost for each cost account must equal the bid item price.

L. **NOT TO BE USED IN THE CONTRACTOR'S CPM SCHEDULE**

1. Milestones or constraint dates not specified in the Contract.
2. Scheduled work not required for the accomplishment of a Contract Milestone
3. Use of activity durations, logic ties and/or sequences deemed unreasonable by the Engineer.
4. Delayed starts of follow-on trades.
5. Float suppression techniques.
6. Leads such as leads, lags, SS, SF, & FF relationships without the expressed permission of the Department.

722.62 Submittal Requirements

All schedules shall be prepared and submitted in accordance with the requirements listed below.
Each monthly Contract Progress Schedule submittal shall be uniquely identified.
Each Submission shall, at a minimum, include the following:

a. Narrative
b. Schedule submittals shall be signed by the Scheduler
c. Schedule Printout - All Activities
d. Schedule Printout - Critical Path Layout
e. Schedule Printout - Remaining Work
f. Schedule Printout - Top 3 Float Path
g. Work Breakdown Structure (WBS) Summary
h. Project Spending Report (PSR) in Portable Document Format (.PDF)
i. Project Spending Report (PSR) in Microsoft Excel spreadsheet (.XLS)
j. Oracle Primavera P6 Schedule File (.XER)

All digital file submittals will be labeled with the following information.

- Contract Number
- Project Number
- Project locations (i.e., town(s))
- Brief description
- Submittal description (i.e., UP07)
- Data Date (MM-DD-YY)
- File Description (i.e., Critical Path)

Example: C110464 (P606309) - Orange Route 2 over 202 – UP23 (07-15-22) - Critical Path

A. Narratives

A written narrative shall be submitted with every schedule submittal. The narrative shall:

1. itemize and describe the flow of work for all activities on the Critical Path in a format that includes any changes made to the schedule since the previous Contract Progress Schedule / Monthly Update or the Baseline Schedule, whichever is most recent.
2. provide a description of any specification requirements that are not being followed. Identify those that are improvements and those that are not considered to be meeting the requirements.

3. provide all references to any Notice of Delay that has been issued, within the time period of the Contract Progress Schedule Update, by letter to the Engineer. Note that any Notice of Delay that is not issued by letter will not be recognized by the Engineer. See Subsection 722.64.A – Notice of Delay.
4. provide a description of each third-party utility's planned vs. actual progress and note any that are trending late or are late per the durations and commitments as provided in the PUC Form; provide a description of the five (5) most important responses needed from the Department and the need date for the responses in order to maintain the current Schedule of Record.
5. provide a description of all critical issues that are not within the control of the Contractor or the Department (third party) and any impact they had or may have on the Critical Path.
6. provide a description of any possible considerations to improve the probability of completing the project early or on time.
7. compare Early and Late Dates for activities on the Critical Path and describe reasons for changes in the top three (3) most critical paths.
8. describe the Contractor's plan, approach, methodologies, and resources to be employed for completing the various operations and elements of the Work for the top three (3) most critical paths. For update schedules, describe and propose changes to those plans and verify that a Proposal Schedule is not required.
9. describe, in general, the need for shifts that are not 5 days/week, 8 hours/day, the holidays that are inserted into each calendar and a tabulation of each calendar that has been used in the schedule.
10. describe any out-of-sequence logic and provide an explanation of why each out-of-sequence activity does not require a correction, if one has not been provided, and an adequate demonstration that these changes represent the basis of how these activities will be built, including considerations for resources, dependencies, and previously approved production rates.
11. identify any possible duration increases resulting from actual or anticipated unit price item quantity overruns as compared to the baseline duration, with a corresponding suggestion to mitigate any possible delays to the Critical Path. If the delay is anticipated to impact the Critical Path, refer to Subsections 4.06 – Increased or Decreased Contract Quantities and 8.10 – Determination and Extension of Contract Time for Completion and submit a letter to the Engineer notifying of a potential delay.
12. include a schedule log consisting of the name of the schedule, the data date and the date submitted.
13. include and describe any notifications, communications and coordination meetings with third-parties such as utility companies that occurred from the last update including personnel names, job titles and contact information, date of meeting(s)/correspondence(s), topics discussed, and reasons the third party provided for deviations from the PUC form.

B. CPM Bar Charts

One (1) timescaled bar chart containing all activities shall be prepared and submitted using a scale that yields readable plots and that meets the requirements of Subsection 722.61 – Schedule Content and Preparation Requirements Activities shall be linked by logic ties and shown on their Early Dates. Critical Paths shall be highlighted, and Total Float shall be shown for all activities.

A second timescaled bar chart shall also be prepared containing only the Critical Path or, if the Critical Path is not the longest path, the Longest Path using a scale that yields readable plots and that meets the requirements of Subsection 722.61 – Schedule Content and Preparation Requirements. Activities shall be linked by logic ties and shown on their Early Dates. Total Float shall be shown for all activities.

C. Detailed Activity Schedule Comparisons

A Detailed Activity Schedule Comparison (DASC) is a simple reporting tool in the format of a graphical report that will provide Resident Engineers with immediate, timely and up-to-date information. The DASC consists of an updated bar chart that overlays the current time period's bar chart onto the previous time period's bar chart for an easily read comparison of progress during the present and previous reporting periods.

D. Activity Cost Report and Monthly Cash Flow Projections (Type A only)

With each Contractor Quantity Estimate (CQE), the Contractor shall submit an Activity Cost Report and Cash Flow Projection that includes all activities grouped by Contract Bid Item.

The Activity Cost Report shall be generated from the Schedule of Record and shall be the basis of the Monthly Cash Flow Projection. Within each contract Bid Item, activities shall be sequenced by ascending activity identification number and shall show:

1. activity ID and description,
2. forecast start and finish dates for each activity and,
3. when submitted as a revised schedule, actual start, and finish dates for each completed activity.
4. any variance to the estimated contract quantity shall be shown.

E. Resource Graphs (Type A only)

Monthly and cumulative resource graphs for the remaining Contract period using the Early Dates and Late Dates in the Contract Progress Schedule shall be included as part of each schedule submittal.

F. Projected Spending Reports

A Projected Spending Report (PSR) shall be prepared and submitted monthly. The PSR shall indicate the monthly spending (cash flow) projection for each month from NTP to Contractor Field Completion (CFC). Each month's actual spending shall be calculated using all CQEs paid during that month. The Projected Spending Report (PSR) shall be depicted in a tabular format and provided in both an .XLS and .PDF.

722.63. Progress Schedule Requirements

A. Baseline Schedule

The Baseline Schedule shall be due thirty (30) Calendar Days after Notice to Proceed (NTP). The Baseline Schedule shall only reflect the Work awarded to the Contractor and shall not include any additional work involving Extra Work Orders or any other type of alleged delay. The Baseline Schedule shall be prepared and submitted in accordance with Subsections 722.61 - Schedule Content and Preparation Requirements and 722.62 - Submittal Requirements. Once the Baseline Schedule has been accepted by the Engineer, with or without comments, it shall represent the as-planned schedule for the Work and become the Contract Progress Schedule of Record until such time as the schedule is updated or revised under Subsections 722.63.C - Contract Progress Schedules / Monthly Updates, 722.64.C - Recovery Schedules and 722.64.D - Proposal Schedules.

The Cost and Resource-Loading information (Types A and B only) shall be provided by the Contractor within forty-five (45) Calendar Days after NTP.

The Engineer's review comments on the Baseline Schedule and the Contractor's responses to them will be maintained for the duration of the Contract and will be used by the Engineer to monitor the Contractor's work progress by comparing it to the Contract Progress Schedule / Monthly Update.

B. Interim Progress-Only Schedule Submissions

The first monthly update of the Contract Progress Schedule/Monthly Update is due within seventy (70) Calendar Days after Notice to Proceed (NTP.) The Baseline Schedule review period ends at sixty (60) Calendar Days after NTP, see Subsection 722.60.B - Schedule Reviews by the Department. If the Baseline Schedule has not been accepted within sixty (60) Calendar Days after NTP, an Interim Progress-Only Schedule shall be due within seventy (70) Calendar Days after NTP. The purpose of the Interim Progress-Only Schedule is to document the actual progress of all activities, including non-construction activities, from NTP until the Baseline Schedule is accepted.

C. Contract Progress Schedules / Monthly Updates

The first Contract Progress Schedule shall be submitted by the Contractor no later than seventy (70) Calendar Days after NTP. The data date for this first Progress Schedule shall be two months (approximately sixty (60) Calendar Days) after NTP. Subsequent Progress Schedules shall be submitted monthly.

Each Contract Progress Schedule shall reflect progress up to the data date. Updated progress shall be limited to asbuilt sequencing and asbuilt dates for completed and inprogress activities. Asbuilt data shall include actual start dates, remaining Work Days and actual finish dates for each activity, but shall not change any activity descriptions, the Original Durations, or the Original Resources (as planned at the time of bid), without the acceptance of the Engineer. If any activities have been completed out-of-sequence, the Contractor shall propose new logic ties for affected in-progress and future activities that accurately reflect the previously approved sequencing. Alternatively, the Contractor may submit to the Engineer for approval an explanation of why an out-of-sequence activity does not require a correction and an adequate demonstration that the changes accurately represent how the activities will be built, including considerations for resources, dependencies, and previously approved production rates. Once approved by the Engineer, the Contractor may incorporate the changes in the next Contract Progress

Schedule/Monthly Update with the affected activities clearly identified and explained in the Schedule Narrative.

No revisions to logic ties, sequence, description, or duration of future activities; or planned resource costs shall be made without prior approval by the Engineer.

Any proposed logic changes for in-progress or future activities shall be submitted to the Engineer for approval before being incorporated into a Contract Progress Schedule. The logic changes must be submitted using a Proposal Schedule or a schedule fragnet submission. Once approved by the Engineer, the Contractor may incorporate the logic in the next Contract Progress Schedule/Monthly Update with the affected activities clearly identified and explained in the Schedule Narrative.

For any proposed changes to the original sequence, description or duration of future activities, the Contractor shall submit to the Engineer for approval an explanation of how the proposed description or duration change reflects how the activity will be progressed, including considerations for resources and previously approved production rates. Any description or duration change that does not accurately reflect how the activity will be progressed will not be approved by the Engineer. Once approved by the Engineer, the Contractor may incorporate the changes in the next Contract Progress Schedule/Monthly Update with the affected activities clearly identified and explained in the Schedule Narrative.

Contract Progress Schedules that extend performance beyond the Contract Time or beyond any Contract Milestone shall not be approved by the Engineer. The Contractor shall submit a Recovery Schedule, or a Time Entitlement Analysis, if any Contract Progress Schedule/Monthly Update indicates a failure to meet the Contract Dates.

D. Short-Term Construction Schedule

The Contractor shall provide a Short-Term Construction Schedule that details daily work activities, including any multiple shift work that the Contractor intends to conduct, in a spreadsheet format. The daily activities shall directly correspond to the Contract Progress Schedule activities, with a matching reference to the activity identification number in the Contract Progress Schedule and may be at a greater level of detail. The Short-Term Construction Schedule shall be submitted every two weeks. It shall display all work for a thirty-five (35) Calendar Day period consisting of completed work for the two (2) week period prior and all planned work for the following three (3) week period. The initial submission shall be provided no later than thirty (30) Calendar Days after NTP or as required by the Engineer.

The Contractor shall be prepared to discuss the Short-Term Construction Schedule, in detail, with the Engineer in order to coordinate field inspection staff requirements, the schedule of work affecting abutters and any corresponding work with affected utilities. Short-Term Construction Schedules shall be prepared and submitted in accordance with Subsections 722.61 - Schedule Content and Preparation Requirements and 722.62 - Submittal Requirements.

722.64 Impacted Schedule Requirements

A. Notice of Delay

The Contractor shall notify the Engineer in writing, with copies to the District and State Construction Engineers, within fifteen (15) of the start of any delays to the Critical Path that are caused by actions or inactions that were not within the control of the Contractor. Delay notifications that are not provided in a letter to the Engineer, such as a delay notification in the schedule narrative, will not be recognized as contractual notice in the determination of any Time Extension related to the impacts to the work associated with this specific alleged delay. Should such a delay continue for more than one (1) week, the Contractor shall note it in the Schedule Narrative until the delay is no longer impacting the Critical Path for the completion of the Contract Milestones. The Engineer will evaluate the alleged delay and its impact and will respond to the Contractor within ten (10) Calendar Days after receipt of a notice of delay.

B. Time Entitlement Analysis

A Time Entitlement Analysis (TEA) shall consist of a descriptive narrative, prepared in accordance with Subsection 722.62.A - Narratives, and an as-built CPM schedule, which may be in the form of a schedule fragnet that has been developed from the project's Contract Progress Schedule of Record, and illustrates the impact of a delay to the Critical Path, Contract Milestones and/or Contract Completion Date as required in Subsection 8.10 - Determination and Extension of Contract Time for Completion. TEAs shall also be used to determine the schedule impact of proposed Extra Work Orders (EWO) as also required in Subsection 8.10.

TEAs shall be prepared and submitted in accordance with the requirements of Subsections 722.61 - Schedule Content and Preparation Requirements and 722.62 - Submittal Requirements and shall be based on the Contract Progress Schedule of Record applicable at the start of the delay or impact from an EWO. A TEA fragnet must start with a specific new activity describing the work contained in either a Notice of Delay previously submitted to the Department per Subsection 722.64.A - Notice of Delay or an EWO.

TEAs shall be submitted:

1. as part of any Extra Work Order that may impact Contract Time,
2. with a request for a Time Extension,
3. within fifteen (15) Calendar Days after a request for a TEA by the Engineer for any other reason.

A TEA shall be submitted to the Engineer before any Time Extension is granted to the Contractor. Time Extensions will not be granted unless the TEA accurately reflects an evaluation of all past delays and the actual events that occurred that impacted the Critical Path. The TEA must also demonstrate a plan for the efficient completion of all of the remaining work through an optimized CPM Schedule. The analysis shall include all delays, including Contractor-caused delays, and shall be subdivided into timeframes and causes of delays.

TEAs shall incorporate any proposed activities, logic ties, resource considerations, and activity costs required to demonstrate the schedule impacts most efficiently in addition to detailing all impacts to existing activities, logic ties, the Critical Path, Contract Milestones, and the Contract Completion Date. In addition, TEAs shall accurately reflect any changes made to activities, logic ties, restraints, and activity costs, necessitated by an Extra Work Order or other schedule impact, for the completion of

the remaining work. The Contractor shall provide TEAs that demonstrate that all delays have been mitigated to the fullest extent possible without requiring an Equitable Adjustment to the original bid basis.

All TEAs shall clearly indicate any overtime hours, additional shifts and the resources that are proposed to be incorporated in the schedule. The Engineer shall have final discretion over the use of overtime hours and additional shifts. The Engineer shall have the right to require that overtime hours and/or additional shifts be used to minimize the duration of Time Extensions if it is determined to be in the best interest of the Department to do so.
When accepted, the changes included in a TEA shall be incorporated into the next Contract Progress Schedule per the requirements of Subsection 722.63.C - Contract Progress Schedules / Monthly Updates. During the review of any TEA, all Contract Progress Schedules shall continue to be submitted as required.
The Engineer may request that the Contractor prepare a Proposal Schedule or a Recovery Schedule to further mitigate any delays that are shown in the accepted TEA or Contract Progress Schedule.

C. Recovery Schedules
The Contractor shall promptly report to the Engineer all schedule delays during the prosecution of the Work. Contract Progress Schedules that predict performance extended beyond the Contract Time or beyond any Contract Milestone shall not be approved as the schedule of record. This requirement is critical to the Department's ability to make informed decisions regarding Contract Time and costs.

The Contractor shall submit a Recovery Schedule within fifteen (15) Calendar Days of a Contract Progress Schedule submission that shows failure to meet the Contract Dates unless a recovery schedule is waived by the Department. Waiving the recovery schedule does not relieve the contractor of the responsibility for the delay. The Department may revoke the waiver of a Recovery Schedule, at which time a Recovery Schedule shall be submitted within fifteen (15) Calendar Days of the Contractor being notified.

Changes represented in accepted Recovery Schedules shall be incorporated into the next Contract Progress Schedule.

D. Proposal Schedules
A Proposal Schedule is an alternative schedule used to evaluate proposed changes to the Contract scope or significant alternatives to previously approved approaches to complete the Work, which may include changes to activity durations, logic, and sequence. For Types A and B Schedules, the Proposal Schedule shall be cost and resource loaded.

A Proposal Schedule may be requested by the Department at any time or may be offered by the Contractor. The Engineer may request that the Contractor prepare a Proposal Schedule to further mitigate any delays that are shown in an accepted TEA or Contract Progress Schedule.

The Contractor shall submit the Proposal Schedule within thirty (30) Calendar Days of a request from the Department.

The Proposal Schedule shall not be considered a Schedule of Record until the logic, durations, narrative, and basis of the Proposal Schedule have been accepted by the Engineer. If the Proposal Schedule took the form of a fragnet, it must be incorporated into the Contract Progress Schedule of Record showing the current progress of all other activities and the impacts/results of the changes made by the Proposal Schedule before the Proposal Schedule is accepted by the Department.

Proposal Schedules shall clearly indicate any proposed acceleration including overtime hours, additional shifts, and the resources that are proposed to be incorporated in the schedule. The Engineer shall have final discretion over the use of overtime hours and additional shifts. Proposal Schedules that contain a cost element shall be submitted with a separate Cost Proposal.

Changes represented in the accepted Proposal Schedules shall be incorporated into the next Contract Progress Schedule. During the review of any Proposal Schedule, all Contract Progress Schedules shall continue to be required every month.

E. Disputes

All schedules shall be submitted, reviewed, dispositioned, and accepted in the timely manner specified herein so as to provide the greatest possible benefit to the execution of this Contract.

The Contractor may dispute a decision by the Engineer by filing a claim notice within seven (7) days after the Contractor's request for additional time has been denied or if the Contractor does not accept the number of days granted in a time extension. The Contractor's claim notice shall include a revised time entitlement analysis that sufficiently explains the basis of the time-related claim. Failure to submit the required time entitlement analysis with the claim notice shall result in denial of the Contractor's claim. A determination on the Contractor's claim shall be in accordance with Subsection 7.16 Claims of Contractor for Compensation. Pending resolution of any dispute, the last schedule accepted by the Engineer will remain the Contract Schedule of Record.

722.65 Schedule Type D Requirements

This section is to detail the requirements for Type D Schedules and is separate from the requirements listed above. These schedules are intended for a project in which a more formal schedule would not be practical. Schedules for Type D projects shall be submitted for each work assignment. The Schedule Type D shall be submitted electronically in .XLS and .PDF format and meet the following requirements.

The schedule requirements for work assignments that are anticipated to last three weeks or less shall conform to the requirements for Short-term Construction Schedules below.

Work assignments that are anticipated to last longer than three weeks shall submit a bar chart baseline and provided update schedules upon request of the engineer as required under Bar Chart Schedule below in addition to meeting the Short-term Construction schedule requirements

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A. Bar Chart Schedule

A Bar Chart that shall include the following:

- Work Assignment start date.
- Activities to identify.
  - Major work operations broken down to be no longer than 14 days.
  - Procurement of fabricated materials and equipment with long lead times, including time for review and approval of submittals required before procuring and fabricating.
  - The preparation and submission of shop drawings, procedures, and other required submittals, with a planned duration that is to be demonstrated to the Engineer as reasonable.
  - The review and return of shop drawings, procedures, and other required submittals, approved or with comments, the duration of which shall be shown as thirty (30) Calendar Days,
  - Detailed activities to satisfy permit requirements.
  - Subcontractor approvals at fifteen (15) Calendar Days from submittal to response
  - Project Close out activities including a 21-calendar day creation of a punchlist activity and 30 calendar day minimum completion of punchlist activity.
- Interfaces with adjacent work, utility companies, other public agencies, sensitive abutters, and/or any other third-party work affecting the Contract.
- Access Restraints – restrictions on access to areas of the Work
- Traffic work zone set-up and removal, night work and phasing
- Contract Milestones including Full beneficial Use, Substantial Completion and Contractor Field Completion

The Bar Char Schedule shall be provided at the beginning of the project and updated with each work order created for the project.

B. Short-Term Construction Schedule

The Contractor shall provide a Short-Term Construction Schedule that details daily work activities, including any multiple shift work that the Contractor intends to conduct, in a spreadsheet format. The daily activities shall directly correspond to the Contract Progress Schedule activities, with a matching reference to the activity identification number in the Contract Progress Schedule and may be at a greater level of detail. See schedule toolkit for suggested format.

The Short-Term Construction Schedule shall be submitted every two weeks. It shall display all work for a thirty-five (35) Calendar Day period consisting of completed work on the assignment for the two week period prior and all planned work for the following three week period. The initial submission shall be provided no later than thirty (30) Calendar Days after NTP or as required by the Engineer.

The Contractor shall be prepared to discuss the Short-Term Construction Schedule, in detail, with the Engineer in order to coordinate field inspection staff requirements, the schedule of work affecting abutters and any corresponding work with affected utilities.

C. Project Spending Report (PSR)

A Projected Spending Report (PSR) shall be prepared and submitted monthly. The PSR shall be for all active work assignments, broken down by work assignment. The PSR shall indicate the monthly spending (cash flow) projection for each month from NTP to Contractor Field Completion (CFC). Each month's actual spending shall be calculated using all CQEs paid during that month. The Projected Spending Report (PSR) shall be depicted in a tabular format and provided in both an .XLS and .PDF

COMPENSATION

722.80 Method of Measurement

Schedule of Operations (Type A, B and C)

The project bid documents specify the fixed-price amounts to be paid to the Contractor for the Project Schedule requirements contained herein. Each bidder shall include this fixed price bid item amounts in their bid. Failure to do so may be grounds for the rejection of the bid.

This fixed price amount is for payment purposes only and is separate from what the Department considers to be the Contractor's General Condition costs. If the Contractor deems it necessary to include additional costs to provide all of the requirements of this section, these additional costs shall be included in the Contractor's overall bid price.

All required schedule-related work, including, but not limited to computers, computer software, the planning and coordination with utilities, training, schedule preparation and schedule submittals will be paid for under the fixed price amount.

Twenty percent (20%) of this pay item will be paid upon the Engineer's acceptance of the Contractor's Baseline Schedule, prepared and submitted in accordance with Subsection 722.63.A.

The remaining eighty percent (80%) of this pay item will be paid in equal monthly installments distributed across the Contract Duration from Notice to Proceed (NTP) to Contractor Field Completion (CFC), less the 2 months required for the submittal and review of the Baseline Schedule in accordance with the following formula:

$$\text{Monthly Payment} = \frac{\text{Remaining Fixed Price amount (80\% of the Item Cost.)}}{\text{Contract Duration in whole months} - 2 \text{ months}}$$

The Schedule of Operations pay item will be adjusted to pay for only the actual quantity of schedules that have been submitted in accordance with this section

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Should there be a Time Extension granted to the Contractor, the Engineer may provide an Equitable Adjustment for additional Contract Progress Schedule Updates at intervals directed by the Engineer. The monthly payment will be the basis for this Equitable Adjustment.

Schedule of Operations (Type D)

For projects assigned with Type D schedule requirements, all scheduling work shall be considered incidental to the project with no separate payment under this section.

722.81 Basis of Payment

The timely and accurate submission of the Baseline Schedule is critical to the Contract and the Department's ability to make informed decisions. Only payments under Item 740 - Engineer's Field Office and Item 748 – Mobilization will be made until the Baseline Schedule is accepted by the Engineer.

All required schedule-related work, including, but not limited to computers, computer software, the planning and coordination with utilities, training, schedule preparation and schedule submittals (including monthly progress schedules, short-term schedules, project spending reports, TEAs, recovery schedules or impacted schedules) shall be included in this work.

No payment for any other pay item will be processed beyond seventy-five (75) Calendar Days from Notice to Proceed (NTP) until the Baseline Schedule is accepted by the Engineer. Until the Engineer's acceptance of the Baseline Schedule, the combined total of all payments made to the Contractor will be limited to an amount no greater than the total price for Item 748 - Mobilization or 3% of the contract price, whichever is less.

All Contract Progress Schedule Updates submitted later than ten (10) Calendar Days after the CQE (Contract Quantity Estimate) completion date, or greater than forty (40) Calendar Days from the Data Date of the previous submission, will be deemed to be no longer useful and will not qualify for payment. The late submission of Impacted schedules, including TEAs, recovery schedules and proposal schedules will result in the forfeiture of the monthly payment for the month in which they were due and subsequent months until the submission is made. Late submission of missed submittals will not result in recovery of the previously forfeited portion of the Schedule of Operations Fixed Price Payment Item.
Failure to submit schedules as and when required may result in the forfeiture of that portion of the Schedule of Operations Fixed Price Payment and/or the withholding of the full or partial CQE payments by the Engineer.

Failure to submit schedules that are acceptable to the Engineer may result in the forfeiture of that portion of the Schedule of Operations Fixed Price Payment and/or the withholding of the full or partial CQE payments by the Engineer.

The Schedule of Operations pay item will be adjusted to pay for only the actual quantity of schedules that have been submitted in accordance with this section.

The Contractor's failure or refusal to comply with the requirements of this Section shall be reasonable evidence that the Contractor is not prosecuting the Work with due diligence and may result in the Engineer withholding of full or partial payments of all work performed.

722.82 Payment Items

722.2 SCHEDULE OF OPERATIONS (TYPE B) - FIXED PRICE $85,000 LUMP SUM

102.	SELECTIVE CLEARING AND THINNING
102.3	CONTROL OF INVASIVE PLANTS EXISTING ON SITE
102.33	INVASIVE PLANT MANAGEMENT STRATEGY
102.51	INDIVIDUAL TREE MAINTENANCE
102.513	AIR EXCAVATION AND ROOT PRUNING
102.52	TEMPORARY TREE PROTECTION FENCE
102.531	TREE CARE PRUNING
102.55	ARBORIST
103.	TREE REMOVED – DIAMETER UNDER 24 INCHES
104.	TREE REMOVED – DIAMETER 24 INCHES AND OVER
127.	CONCRETE EXCAVATION
153.	CONTROLLED DENSITY FILL - EXCAVATABLE
156.13	CHOKER COURSE
180.01	ENVIRONMENTAL HEALTH AND SAFETY PROGRAM
180.02	PERSONAL PROTECTION LEVEL C UPGRADE
180.03	LICENSED SITE PROFESSIONAL SERVICES
181.11	DISPOSAL OF UNREGULATED SOIL
181.12	DISPOSAL OF REGULATED SOIL - IN-STATE FACILITY
181.13	DISPOSAL OF REGULATED SOIL - OUT-OF-STATE FACILITY
181.14	DISPOSAL OF HAZARDOUS WASTE
183.1	TREATMENT OF CONTAMINATED GROUNDWATER
183.2	DISPOSAL OF GRANULAR ACTIVATED CARBON
188.3	DISPOSAL OF MERCURY CONTAINING LAMPS
203.6	SPECIAL MANHOLE – 6 FT DIAMETER
203.12	WATER QUALITY SWALE OUTLET CONTROL STRUCTURE
220.	DRAINAGE STRUCTURE ADJUSTED
222.3	FRAME AND GRATE (OR COVER) MUNICIPAL STANDARD
223.4	FRAME AND GRATE REMOVED AND RESET
225.10	10 INCH HOOD - HIGH DENSITY POLYETHYLENE
252.08	8” HIGH DENSITY POLYETHYLENE PIPE
252.10	10" HIGH DENSITY POLYETHYLENE PIPE
261.14	SUBDRAIN CLEANOUT
272.12	12 INCH AND UNDER PIPE REMOVED AND DISCARDED
390.	DRINKING FOUNTAIN REMOVED AND DISCARDED
506.2	CURB CUT WITH ROCK ENERGY DISSIPATER
507.	MOUNTABLE GRANITE CURB – STRAIGHT
507.1	MOUNTABLE GRANITE CURB – CURVED
513.2	GRANITE EDGING AT BENCH PAD
655.	CEDAR RAIL FENCE
655.3	BICYCLE SAFETY RAIL
655.4	ORNAMENTAL FENCE
686.	RESET MEMORIAL PLAQUE
686.2	MISCELLANEOUS SIGN REMOVED AND RESET
697.1	SILT SACK
698.3	GEOTEXTILE FABRIC FOR SEPARATION
698.5	NON-WOVEN GEOTEXTILE FABRIC (GI)

701.3	CONCRETE LANDSCAPE PAVING
702.1	FLEXIBLE POROUS PAVEMENT SIDEWALK
704.02	DRAINAGE AGGREGATE
704.2	STABILIZED STONE DUST PAVING
707.101	DRINKING FOUNTAIN
707.17	PARK BENCH REMOVED AND STACKED
707.18	SHURCLIFF PARK BENCH
707.19	SHURCLIFF PARK BENCH REFURBISHED AND RESET
707.9	BICYCLE RACK
710.401	GRANITE BENCH
740.	ENGINEERS FIELD OFFICE AND EQUIPMENT (TYPE A)
751.1	LOAM FOR LAWNS
751.2	PLANTING SOIL
751.3	DRY SWALE PLANTING SOIL (GI)
751.5	REINFORCED FIBER SOIL
751.7	COMPOST TOPSOIL
756.	NPDES STORMWATER POLLUTION PREVENTION PLAN
765.1	SEEDED LAWN
765.71	SEEDED MEADOW
765.76	DRY SWALE SEEDING MIX (GI)
767.121	SEDIMENT CONTROL BARRIER
767.5	COMPOST BLANKET
767.7	AGED PINE BARK MULCH
767.95	COIR FIBER LOG BANK STABILIZATION
767.96	COIR EROSION CONTROL MAT
771.01	ALLEGHANY SERVICEBERRY - 8'-10' HT. MULTISTEM
771.02	AMERICAN ELM VALLEY FORGE - 3"-3.5" CAL.
771.03	LONDON PLANE TREE BLOODGOOD - 3"-3.5" CAL.
771.04	FREEMAN MAPLE AUTUMN BLAZE - 3"-3.5" CAL.
771.05	HERITAGE RIVER BIRCH - 8'-10' HT. MULTISTEM
771.06	SWAMP WHITE OAK - 3"-3.5" CAL.
771.07	GRANDMASTER SWEETGUM - 3"-3.5" CAL.
771.08	TULIP TREE - 3"-3.5" CAL.
771.09	WITCH HAZEL - 8'-10' HT MULTISTEM
771.10	APPALACHIAN SNOW DOGWOOD - 8'-10' HT. MULTISTEM
771.11	DECIDUOUS SHRUB - 3 GAL.
771.12	EVERGREEN SHRUB - 24"-30" HT.
771.13	PERENNIAL - 1 GAL.
810.1	ELECTRIC CONDUIT DUCTBANK AND HANDHOLES
812.09	LIGHT STANDARD FOUNDATION PRECAST
813.521	WIRE TYPE 10 NO. 10 GROUNDING AND BONDING
813.522	WIRE TYPE 10 NO. 6 GROUNDING AND BONDING
813.523	WIRE TYPE 10 NO. 4 GROUNDING AND BONDING
815.2	TRAFFIC CONTROL SIGNAL LOCATION NO. 2
815.4	TRAFFIC CONTROL SIGNAL LOCATION NO. 4
815.98	MAST ARM FOOTING COST ADJUSTMENT
816.01	TRAFFIC SIGNAL RECONSTRUCTION LOCATION NO. 1
816.03	TRAFFIC SIGNAL RECONSTRUCTION LOCATION NO. 3

821.101	ORNAMENTAL SINGLE LIGHTING POLE
821.102	ORNAMENTAL SINGLE LIGHTING POLE - REFINISH ONLY
821.103	ORNAMENTAL POST-TOP LIGHTING POLE
823.101	ORNAMENTAL PENDANT LUMINAIRE
823.102	ORNAMENTAL POST-TOP LUMINAIRE
823.72	HIGHWAY LIGHTING POLE, LUMINAIRE AND BASE REMOVED AND DISCARDED
823.73	UTILITY POLE AND LUMINAIRE REMOVED AND DISCARDED
829.05	ROADSIDE GUIDE SIGN (G) - REMOVED AND RESET
829.062	ROADSIDE GUIDE SIGN (G) SUPPORT REMOVED AND DISCARDED
829.2	ROADSIDE GUIDE SIGN (MR) - ALUMINUM PANEL (TYPE B) - DCR
844.201	SUPPORTS FOR GUIDE SIGN (G1) - STEEL - DCR
844.202	SUPPORTS FOR GUIDE SIGN (G2) - STEEL - DCR
847.2	SIGN SUPPORT – ROUND POST - STEEL
852.11	TEMPORARY PEDESTRIAN BARRICADE
852.12	TEMPORARY PEDESTRIAN CURB RAMP
864.05	PAVEMENT ARROWS AND LEGENDS REFL. BLUE (THERMOPLASTIC)
866.104	4 INCH REFLECTORIZED WHITE LINE (THERMOPLASTIC)
867.104	4 INCH REFLECTORIZED YELLOW LINE (THERMOPLASTIC)
874.2	TRAFFIC SIGN REMOVED AND RESET
874.41	TRAFFIC SIGN REMOVED AND DISCARDED
945.021	HELICAL PILE AND BRACKET ASSEMBLY, INSTALLED - TYPE A
945.022	HELICAL PILE AND BRACKET ASSEMBLY, INSTALLED - TYPE B
945.03	STATIC LOAD TEST
995.1	VIEWING PLATFORM STRUCTURE NO.1
995.2	VIEWING PLATFORM STRUCTURE NO.2

ITEM 102. SELECTIVE CLEARING AND THINNING ACRE

DESCRIPTION

General

Examine all other Items of the MassDOT Standard Specifications, Standard Special Provisions and Special Provisions for requirements that may affect the Work of this Item whether or not such work is specifically mentioned.

Work under these Items shall include either a Certified Arborist as specified in section 102.55 Arborist or a representative from DCR to be determined by Owner. Contractor to coordinate with Owner to determine parties required to be involved in overseeing the activities of this Section.

The Landscape Architect will be present for a walk through with the Contractor, and DCR to select and tag specific trees and vegetation to remain and be protected within areas of selective clearing and thinning within the limit of work. Contractor is to notify the Landscape Architect of schedule for clearing at least 1 week prior to performing any work on vegetative removal.

The work under this item shall consist of the removal of hazardous growth and dead, dying or diseased plant material; the removal of groups and individual plants which interfere with the growth of more desirable types of trees and the clearing away of lesser growth that may obscure outstanding trees, tree groups, or scenic views. Any part of tree trunks or base of plant material located on the Location Lines shall be considered within the State Highway Limits.

Densely wooded areas shall be thinned to provide space for healthy growth by eliminating thinner, weaker trees and the reduction of number of varieties.

The desired appearance to be attained in certain areas of heavy growth may require three or more operations. First, the obvious dead, dying and diseased trees and undergrowth shall be cut and cleared out of the area. This work includes removal of any previously fallen trees, branches, uprooted stumps and other debris as directed. Next, the area is to be thinned out, as directed, by removing the less desirable trees and brush which interfere with the growth of the better plant material. Finally, clear out lesser growth which may obscure outstanding trees, tree groups or scenic views.

Tree up-branching and shaping under this item will be restricted to trees which have limbs and branches restricting sight distance, extending over roadways, shoulders, turn outs, etc. Upbranching or trimming will be required to produce the minimum vertical clearance directed by the Engineer.

References

Where references are made in these Specifications to standard specifications, codes, etc., of the U.S. Government, State or local authorities, or professional and industrial societies and associations, the applicable portions thereof shall govern as fully as if they were printed in their entirety, herein, and shall include all revisions thereto issued as of the date of the Notice to Contractors pertaining hereto. Comply with the requirements of the following codes and industry standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. The following references are used herein and shall mean:

MassDOT Standard Specifications: Commonwealth of Massachusetts, Massachusetts Department of Transportation/Highway (formerly Massachusetts Highway Department and Department of Public Works), "Standard Specifications for Highways and Bridges," latest edition and including all applicable Supplemental Specifications, Standard Special Provisions and Special Provisions.

Referenced Standards also include, but are not limited to the following:

TCIA: Tree Care Industry Association (formerly National Arborist Association) ANSI A300 (latest editions), "American National Standard Tree Care Operations," as published by American National Standards Institute, 11 West 42nd Street, New York, NY, 10036.

Standard Specifications: “Standard Specifications for Highways and Bridges,” MassDOT, latest edition and all supplements.

Quality Assurance

The cutting shall be performed by arborists with the ISA Tree Worker Climber Specialist certification.

All trimming and pruning shall conform to ANSI A300 For Tree Care Operations - Tree, Shrub, and Other Woody Plant Management - Standard Practices.

CONSTRUCTION METHODS

Prior to any construction, Contractor shall arrange a conference on the site with the Engineer, Landscape Architect, DCR, and Arborist to review extents of Selective Clearing and Thinning operations. Any trees to be removed as a result of selective clearing and thinning operations shall be tagged by the Contractor and reviewed prior to any removals with the Engineer, Landscape Architect, Arborist, DCR, and City Conservation Committee Agent.

Holes and depressions resulting from the selective clearing and thinning operations shall be suitably backfilled by the Contractor with material to be reviewed by Engineer and/or Landscape Architect. All branches, roots and trunks on trees that are scheduled to remain that are damaged shall be treated as required by the Arborist at no extra cost to DCR.

Shrubs and trees to be protected shall be flagged by the Arborist and reviewed by the Engineer, Landscape Architect, DCR, and City Conservation Committee Agent.

Recognized tree surgery practices include among many others, the fact that all limbs and branches which require removal and all stubs regardless of age must be cut flush either to a union with the next larger sound limb or branch or flush to the trunk of the tree.

Care shall be exercised by the Contractor to prevent injury to trees and shrubs designed to be preserved. Any injury to limbs, bark or roots of such plants shall be repaired by the Contractor, as directed, or the plants replaced without additional compensation for such repair or replacement. Injury to limbs, bark or roots of such plants shall be repaired or the plants replaced by the Contractor, at the discretion of the Engineer, without additional compensation for such repair or replacement.

Cutting and Treatment of Stumps and Stubble

Standing trees and existing stumps to be removed shall be cut flush with the ground and a 2-in. tolerance permitted and the resulting stumps or stubble. Undesirable brush shall be cut to a height of 24-in above finished grade, as directed by DCR, the Engineer or Landscape Archtiect

The Contractor shall use all necessary precautions to prevent injury to crops or damage to other desirable growth on private abutting property, as well as to those within the Right-of-Way, and shall assume full responsibility for any damage.

Disposal of Cuttings

The Contractor may dispose of cut material by processing into a wood chip mulch as described in M6.04.3: Wood Chip Mulch and spreading uniformly throughout the cleared and thinned areas as directed by the Engineer.

Disposition of Trees, Stumps and Brush

All trees, tree stumps, including trunk base, root flare and attached root mass and brush to be cleared shall be subject to the regulations and requirements of state and local authorities governing the disposal of such materials. Trees, stumps and brush shall be chipped to 1-in. maximum chip dimension and spread to a depth not to exceed 4 in., in a location approved by the Engineer, at no additional compensation.

The trees, stumps and brush including cuttings, shall not be stored on site for more than 24 hours unless chipped.
If the existing ground in the area is disturbed by any of the work or equipment, the Contractor shall rough-grade and loam and seed if necessary the disturbed areas without additional compensation.

The Contractor shall be responsible for ensuring that any and all plant pests on site shall not be carried off site and shall be either destroyed or otherwise contained on site. Plant pests shall include invasive plants, noxious weeds, insect pests, and plant diseases (including infected plant tissue). Method of destruction or containment shall be approved by the Engineer. If invasive or contaminated material cannot be either destroyed or contained on site, contractor shall submit plans for disposal for approval by the Engineer. For current list of plant pests and applicable management procedures see the following on-line references:

Invasive Plants: http://www.massnrc.org/mipag/docs/MIPAG_FINDINGS_FINAL_042005.pdf Plant Pests: http://www.massnrc.org/pests/factsheets.htm#commodity

COMPENSATION

METHOD OF MEASUREMENT

Item 102. Selective Clearing and Thinning shall be measured by the horizontal plane area and will be the number of acres within the limiting stations of the project and/or as designated by the Engineer and the outside limits of measurement shall extend to a point 5 ft beyond the top or bottom of slopes, excluding existing roadway and shoulder surfaces, streams or bodies of water

Measurement of selective clearing and thinning will be based on the actual number of acres which receive the required attention. Approximate locations will be shown on the plans or detail sheets and as designated in the field by DCR, the Engineer or Landscape Architect.

Trees and stumps, regardless of size, that fall within an area to be selectively cleared and thinned shall not be measured separately for payment. Only trees that have a shortest diameter of at least 9 in. and less than 2 ft shall be included in Item 103. Trees Removed (Diameter Under 2 feet).

Only trees that have a shortest diameter of 2 ft or more shall be included in the Item 104. Trees Removed (Diameter 2 feet and Over).

BASIS OF PAYMENT

ITEM 102. SELECTIVE CLEARING AND THINNING will be paid at the contract unit price per ACRE and shall include the removal of all trees as directed, brush, dead, dying and diseased trees, previously fallen trees, branches, uprooted stumps and other debris within the designated area. No separate payment will be made for any individual trees or stumps removed within the area.

The contract unit price shall include the cost of all arrangements and methods required to protect from harm all existing overhead or underground installations. No payment shall be allowed for preparation and spreading of wood chips.

ITEM 102.3 HERBICIDE TREATMENT OF INVASIVE PLANTS HOUR

This work must be performed by persons who meet the qualifications below and are approved by the Landscape Design Section.

Work under this item consists of herbicide treatment of invasive plants currently existing within the project limits and as directed. An Invasive Plant Management Strategy (IPMS) shall be submitted to the Engineer for review and approval and the IPMS shall be implemented on-site. The IPMS shall be written and submitted per Item 102.33 Invasive Plant Management Strategy and shall be measured and paid for under that Item.

Work under this item shall be coordinated with work and schedule for Selective Clearing, Clearing and Grubbing, Mowing, Tree Removal, Planting, and Wetland Mitigation items.

Payment is per hour on-site and shall be compensation for a minimum crew of 2 licensed applicators, 2 back-pack sprayers and mist-blowers, a properly equipped spray truck with spray hoses, and a tank with sufficient capacity for a full day of work. If there is only one applicator, hourly payment shall be adjusted to 50 percent of the unit price.

Date and time stamped photos indicating start and stop time of work must be submitted if requested.

This item is not intended for manual removal of plants.

Management of plants determined to have been introduced to the site via imported loam, compost, mulch, plants, equipment, or other construction activities will be the Contractor's responsibility and at the Contractor's expense.

Herbicide shall be applied during daytime hours only.

Measures to prevent the introduction of invasive plant species to the site and to address introduction due to construction-related activities shall be covered under the Standard Specifications, Division I - Subsections 7.01(D) Plant Pest Control and 7.13 Protection and Restoration of Property as amended in these Special Provisions.

Plant species targeted for management under this item shall be as determined in the field per the site walk and as specified in the IPMS.

The definition of invasive plant species shall be as described by Massachusetts Invasive Plant Advisory Group (MIPAG): "non-native species that have spread into native or minimally managed plant systems in Massachusetts, causing economic or environmental harm by developing self-sustaining populations and becoming dominant and/or disruptive to those systems."

Control of invasive plants shall begin immediately with the initiation of construction activities and prior to any clearing or site disturbance. Treatment areas shall include stockpile locations and may, upon approval of the Engineer, extend outside the project limit. Treatment shall be done each consecutive year for the duration of the contract unless specified otherwise in the IMPS or unless directed otherwise by the Owner, Engineer or Landscape Architect. Work shall be done during the growing season from May – October unless otherwise specified in the IPMS.

Areas identified for vegetation control measures shall be as shown on the plans and as determined in the field by the Owner, Engineer and Landscape Architect.

QUALIFICATIONS

The applicators shall submit and meet the qualifications outlined below:

Requirements

1. Company must provide proof of qualifications by providing the following:
    a. Narrative describing company, its expertise and experience with invasive plant control.
    b. Demonstrate experience with herbicide treatment as part of restorations and in sensitive areas.
    c. Describe company's technical qualifications and past performance.

2. Company must meet licensing requirements:
    a. All crew applicators must have a Massachusetts Commercial Applicator License (CORE).
    b. At least one or more applicator must have a ROW certification, if required for work.
    c. Company must provide name(s) of applicator(s) and Applicator License/Certification number for all contractor crew leaders working on the project.
    d. Company must provide documentation of any warnings, penalties or fines received in the last three (3) years.

3. Company must provide proof of experience with invasive plant control and include following:
    a. At least five (5) references from prior invasive plant control work completed in last five (5) years. Provide contact information including address, phone number and email.
    b. Provide a summary of each of these projects including nature of the problem, specific invasive vegetation treated, dates and period of treatment, methodologies used, and summary of success or not in terms of meeting performance objectives. Include summary of equipment used.
    c. Photo documentation of these projects.
    d. GPS coordinates of project locations, if available.

4. Crew leader must have expertise with invasive plant control and provide the following:
    a. Have held Core license for at least five (5) years.
    b. Resume listing five (5) or more years of experience applying pesticides with the company or with another company specializing in vegetation management.

The following companies have been approved for the work of providing an Invasive Plant Management Strategy per Item 102.33 and implementing that strategy under Item 102.3 Herbicide Treatment of Invasive Plants:

Ecological Land Management 300 Conway Road Deerfield, MA 01373 Contact: Brian Colleran Brian@ecologicallandmanagement.com Phone: 978-358-1423	***Essex Horticulture*** 70 Washington Street, Suite 214 Salem, MA 01970 Contact: Zachary Navarro znavarro@essexhorticulture.com Phone: 978-548-8258
Groundscapes Express, Inc. P.O. Box 737 Wrentham, MA 02093 Contact: Butch Goodwin butch@groundscapesexpress.com Phone: 508-400-5366	***Land Stewardship, Inc.*** PO Box 511 Turner Falls, MA 01376 Contact: Chris Polatin info@landstewardshipinc.com Phone: 413-367-5292
Native Habitat Restoration P.O. Box 582 Stockbridge, MA 01262 Contact: Jess M. Toro nativehabitatrestoration@gmail.com Phone: 413-394-0277	***SWCA Environmental Consultants*** 15 Research Drive Amherst, MA 01002 Contact: Scott Fisher sfisher@swca.com Phone: 413-658.2056
Ruby Environmental Services, Inc. 20 Old Providence Road Sutton, MA 01590 Contact: Richard Ruby Rich.rubyenvironmental@gmail.com Phone: (508) 808-0166	***Solitude Lake Management*** 590 Lake Street Shrewsbury, MA 01545 Contact: Keith Gazaille kgazaille@solitudelake.com Phone: 508-885-0101
Vegetation Control Service, Inc. 2342 Main St. Athol, MA 01331 Contact: Andrew Powers apowers@vegetationcontrol.com Phone: 800-323-7706	***Water and Wetland*** 115 South Street Upton, MA 01568 Contact: Colin Gosselin Colin@waterandwetland.com Phone: (508) 259-3153

SUBMITTALS

No work shall begin without approval of the submittals.

Submittals include the following items:

Invasive Plant Management Strategy (IPMS)

At least thirty (30) days prior to proposed treatment the IPMS shall be submitted for approval by the Engineer and Landscape Architect. All chemicals, methods and work done under this item shall be consistent with the IPMS. The IPMS shall be as described under Item 102.33.

Herbicide Use Report

Within two (2) weeks after each application, the Contractor shall provide to the Owner, Engineer and the Landscape Architect a completed and signed Herbicide Use Report.

Photo Documentation

Digital photos with date and time of herbicide application work, showing start time and completion time, are required and must be submitted for measurement of payment upon request.

MATERIALS

All proposed herbicides shall be as approved in the IPMS. Herbicides shall be labeled for the method of treatment and shall meet all federal, state and local regulation requirements. Application rates will depend on herbicide proposed and shall be per the manufacturer's label for specific application.

METHODS

All methods used shall be as approved in the IPMS which shall be determined during the Initial Site Walk as described under Item 102.33 Invasive Plant Management Strategy.

The Contractor shall be responsible for marking delineated areas and plants to be preserved, removed, or otherwise treated. Fencing or other materials needed for marking and delineating protected areas shall be incidental to this item.

The Contractor shall notify the Engineer a minimum of 3 days prior to date of expected herbicide application. Applicators shall notify the Engineer upon arriving on-site and upon leaving the site.

Herbicide Applications

All herbicide application shall conform to Massachusetts Pesticide Laws and Regulations per the Massachusetts Department of Agricultural Resources (MDAR) Pesticide Bureau.

Mixing, applying and/or disposing of herbicides shall always be in accordance with instructions on their labels and all applicable federal, state, and local regulations. Mixing shall not occur within sensitive areas, wetlands, or buffer zones.

Contractor shall not spray 2 hours prior to precipitation, during rain, or during windy conditions. The Contractor shall be responsible for monitoring weather conditions and adjusting the work schedule as appropriate for the herbicide and application method to be used.

Targeted vegetation shall be identified and marked prior to treatment. Plants treated by foliar spray, injection or glove application or other methods that leave standing vegetation, as opposed to cut-stump application, shall remain clearly marked for identification through the contract period.

Desirable vegetation shall be protected from both spray and other physical damage.

Contractor is responsible for any damage to vegetation not designated for removal or treatment. Vegetation damaged shall be restored. Cost of replacement plants and/or restoration shall be borne by the Contractor.

Contractor shall ensure that the public does not enter a work area while herbicide application or spraying is underway.

Disposal Of Invasive Plant Material

All material to be cleared shall become the property of the Contractor. The satisfactory disposal of all cleared plant material (seeds, roots, woody vegetation, associated soils, etc.) shall be the Contractor's responsibility.

The Contractor shall take measures to prevent viable plant material from leading to further infestations (seeds, roots, woody material, etc.) while stockpiled, in transit, or at final disposal locations. All precautions shall be taken to avoid contamination of natural landscapes with invasive plants or invasive plant material.

Chipping, shredding, or on-site burning of plant material must be approved by the Engineer and included in the IMPS.

For plant material taken to an incinerating facility per the IPMS, a receipt from that facility shall be submitted to the Engineer as proof of disposal.

Where feasible, it is preferable to dispose of plants on-site or to bury them on-site with on-going monitoring for re-sprouting. Disposal locations and methods must be approved and included in the IPMS. Site work such as grading and seeding to stabilize and restore disposal area shall be incidental to this item.

The Contractor shall be responsible for treating or otherwise managing areas of re-growth due to improper disposal. Treatment shall be at the Contractor's expense.

Follow-Up Treatment

Plants and areas shall be re-treated as necessary and as appropriate to the time of year. Treatment shall be for the duration of the contract and per the IPMS.

MEASURE OF SUCCESS

The expectation is a minimum of 85-95 percent control achieved after the first treatment, depending on plants targeted and extent of population, and based on the expectations laid out in the IPMS. The expectation for the contract duration is 95-100% eradication by the end of the treatment period, unless otherwise specified in the IPMS.

METHOD OF MEASUREMENT

Item 102.3 will be measured for payment by the Hour of verified crew time spent on the project doing herbicide application as and where specified herein and in the IPMS. A crew shall be defined as a minimum of two licensed applicators each equipped with (at minimum) back-pack sprayer and mist blower. The crew shall also have a properly equipped spray truck with hoses and a tank with sufficient capacity for a full day of work.

BASIS OF PAYMENT

Item 102.3 will be paid at the contract unit price per Hour, which price shall include all labor, materials, equipment, tools, and all incidentals required to complete the work.

Payment will be based upon verified time spent on the project doing herbicide application as and where specified in the IPMS and upon receipt and approval of submittals. Payment will not include travel time to and from the Contractor's place of business and nor time for investigative field trips.

If there is only one applicator, hourly payment shall be adjusted to 50 percent of the unit price.

The Invasive Plant Management Strategy will be paid for under Item 102.33.

ITEM 102.33 INVASIVE PLANT MANAGEMENT STRATEGY HOUR

This item consists of providing an Invasive Plant Management Strategy (IPMS) for the control of invasive plants currently existing on the project site and/or as directed and shall be coordinated with Item 102.3 Herbicide Treatment of Invasive Plants. Unless otherwise approved, the IPMS shall be submitted in the form of the Invasive Plant Management Strategy Report Form.

The IPMS shall be submitted for review and approval by the Owner, Engineer and Landscape Architect, and the IPMS shall be implemented on-site.

The Invasive Plant Management Strategy Report Form is available online at https://www.mass.gov/lists/landscape-design-and-roadside-maintenance under Invasive Plant Management.

Herbicide treatment for invasive plants shall be as described under Item 102.3 Herbicide Treatment of Invasive Plants and shall be compensated per that Item.

Work under this item shall be coordinated with work and schedule for Selective Clearing, Clearing and Grubbing, Mowing, Tree Removal, Planting, and Wetland Mitigation as relevant to the project.

Individual attending the site walk and determining the Invasive Plant Management Strategy must demonstrate expertise with vegetation management and invasive plant control and submit qualifications as described below.

QUALIFICATIONS

Individual shall be from the same company as that providing services for Item 102.3 Herbicide Treatment of Invasive Plants and shall submit the following, if not submitted under Item 102.3:

- Submit copy of current Core license.
- Submit a resume listing five (5) or more years of experience managing invasive plants with a company specializing in vegetation management.
- References shall be submitted if requested.

SUBMITTALS

Task Summary & Reports

For measurement of payment, the contractor shall submit the total sum and a breakdown of hours for the tasks performed. At a minimum, the tasks shall include the Initial Site Walk, submittal of an approved IPMS, and if requested to accommodate project or site changes, a Follow-up Site Inspection and accompanying IPMS Amendment.

Invasive Plant Management Strategy (IPMS)

At least thirty (30) days prior to construction activities and/or any proposed treatment, the contractor shall submit the IPMS for approval by the Engineer and Landscape Architect. All chemicals and methods proposed shall be consistent with applicable Massachusetts Wetlands Protection Act Order of Conditions.

The IPMS shall be completed in coordination with the Prime Contractor and the Engineer and shall include the following as appropriate and applicable to the project and to the IPMS Report Form questions and Guidance:

I. Project Information

a. Company writing the IPMS and performing the herbicide application.
b. Date of site walk

c. Attendees at site walk
d. Expected end date of contract and expected last treatment (month/season)

II. Brief Description of Conditions

a. Provide a free-hand sketch on construction plans or aerial image showing species, location, and as relevant, show or note extent of population as relevant to Strategy (i.e., population extends off ROW preventing eradication, small population and eradication deemed feasible within contract schedule, etc.).

III. Coordination with Roadway Contractor regarding other work

a. Tree Work: Note coordination to be implemented with tree removal, clearing, and clearing and grubbing as applicable to the project.
b. Wetland Mitigation - Include management proposed for wetland mitigation areas in the IPMS, if and as required.
c. Planting: If there will be planting in areas proposed for treatment, propose treatment and schedule to avoid herbicide damage to plants.
d. Mowing: If coordination is required with state mowers, note need in IPMS.

IV. Soil Management

a. Provide specifics on how soil with invasive plant roots (in particular) or seeds will be handled (i.e., separate stockpiles, plant material will be buried on-site, re-used on-site, disposed off-site and if so, where?).
b. Show stockpile locations on plan and include treatment schedule.
c. Note measures that will be implemented to avoid spread through equipment, including how and where equipment will be cleaned.

V. Invasive Plant Treatment & Management

a. Proposed chemical and methods of treatment for each species or area.
b. Time of treatment based on target plant species.
c. Submit product label including application methods and rates (entire MSDS information need not be submitted if available online).
d. Proposed performance metrics or measure of treatment success if different from that specified under Item 102.3.
e. Method for disposing invasive plant material. This includes material that may result in spread (i.e., seeds, roots) and material that has been treated and/or is not viable (foliage, dead wood, etc.). Methods may include grinding in place, stockpiling and treating, and incinerating offsite.
f. Expected follow-up treatment for duration of contract.

VI. Monitoring Schedule

Note: The IPMS is critical for identifying pre-construction conditions as well as strategies for minimizing import or spread of invasive plants. Failure to provide an approved IPMS may jeopardize this item, in which case, the contractor will be responsible for management of invasive plants found on-site at no cost to the contract.

Photo Documentation

Digital photos of site conditions, typical species, and extent of infestation must be provided with the IPMS and with any follow-up monitoring or reporting. Photos of follow-up monitoring and reporting must be date and time stamped for acceptance.

METHODS

Initial Site Walk

Prior to any construction activities and soil disturbance, the Contractor shall walk the site with the Owner, Engineer and Landscape Architect to determine the IPMS. During the site walk the Contractor shall identify limits of work and, as necessary, mark locations of areas designated for treatment and individual plants targeted for treatment or removal. The Contractor shall be responsible for marking delineated areas and plants to be preserved, removed, or otherwise treated. Fencing or other materials needed for marking and delineating protected areas shall be incidental to this item.

IPMS Follow-up Amendment

The IPMS may be amended to address additional concerns or adjust to conditions if required by the Owner or Landscape Architect. The amended IPMS shall be submitted to the Owner, Engineer and Landscape Architect for approval at least fourteen (14) days prior to any proposed treatment.

Interim Site Monitoring Inspection Reports

If required by the Owner, Interim Site Monitoring and an accompanying report shall be conducted. Interim Reports must include time and date stamped photos showing treated locations and species.

Final Inspection

A final inspection and report documenting the status of the invasive control may be required for regulatory purposes or for instances where control will be continued by others. The report shall include photo documentation of pre-construction (existing) and post-treatment conditions, notations on a plan or aerial image of area treated, summary of treatment performed, and control achieved. Final reports submittal must include time and date stamped photos.

METHOD OF MEASUREMENT

Item 102.33 will be measured for payment by the Hour. The basis for measurement shall be per the completion of tasks as approved under the Task Summary submittal and acceptance of submittals and photos described above.

BASIS OF PAYMENT

Item 102.33 will be paid at the contract unit price per Hour, which price shall include all labor, materials, equipment, tools, and all incidentals required to complete the work. Payment shall not include travel time to and from the Contractor's place of business.

ITEM 102.51 INDIVIDUAL TREE MAINTENANCE EACH

DESCRIPTION

General

The work to be done under this Section shall require the Contractor to provide all labor, materials, equipment, and transportation necessary for maintenance of trees to remain and be protected that will be impacted by construction and as shown on the Drawings and as specified hererin.

The intent of Individual Tree Maintenance of trees to remain is to eliminate and/or reduce the negative impacts of construction to trees adjacent to construction. Best management practices (BMPs) shall be implemented in the field to eliminate or mitigate undesirable consequences to trees that may result from adjacent construction. Negative impacts to prevent, limit and/or mitigate include but are not limited to:
Physical injury to trunk and/or crown with construction equipment, material storage or vehicles.

Soil compaction in the root zone with equipment and/or materials storage and vehicles parking over root systems.

Severing and/or damaging of roots with equipment excavation inside of tree protection fencing and/or pulling feeder roots at excavation edge with backhoe or excavator.

Smothering roots with added soil and/or fill over root zone not previously reviewed and approved by the Landscape Architect, Field Engineer, and Arborist.

Split or broken branches in crown from excavating equipment overhead.

Dust on leaves remaining for more than 1 week or construction debris or materials dumped or stored in and around trees.

Loss of soil/loam in root zone that could threaten root systems and undermine tree stability.
Individual Tree Maintenance, Item 102.51, shall be used when construction activities are likely to occur within the canopy of individual trees scheduled to remain and be protected or where there may be any risk of damage to trees.

The Contractor shall be solely responsible for judging the full extent of the work requirements, including, but not necessarily limited to any equipment and materials necessary for providing tree maintenance.
Prior to any construction activities, the Contractor and Arborist shall walk the site with the Engineer, DCR Arborist and Landscape Architect to identify which trees will require protection and to determine approved measures. The Arborist shall make recommendations as to appropriate methods to trees. The Engineer will have final decision as to trees and methods.

The Contractor is responsible for the protection of all existing trees and plants within and immediately adjacent to the construction area that are not designated to be removed for the length of the construction period.

Personnel Qualifications

All pruning, aeriation, fertilizing and documentation of trees to remain shall be performed by an Arborist currently certified in Massachusetts and hired by the Contractor with prior review and approval of the City, Engineer and Landscape Architect before construction begins. Arborist shall have at least 10 years of experience in tree care and shall demonstrate a familiarity with the American National Standards Institute (ANSI) A300 Standard Practices for Tree, Shrub, and Other Woody Plant Maintenance Part 5 Construction Management Standards, Part 8 Root Management and Part 9 Tree Risk Assessment.

The Contractor shall regularly educate their workers and subcontractors before they start work on site and for the duration of the project about the Owner/City's requirements to *'Save the Trees*' including the stringent requirements in the Contract Documents for ongoing existing tree maintenance and the potential liability should they breach, dump, park or store materials inside the fencing.

Damage Reporting and Mitigation

Any damage to trees within the construction zones within limits of project or adjacent Right of Way that could result in a safety hazard to the public shall be documented and reported by the Contractor immediately to the City Authorities, the Field Engineer, Landscape Architect, and Arborist.

Should it be determined that the damage is the result of the Contractor's operations, measures shall be taken by the Contractor at the Contractor's expense and with the Field Engineer's, Landscape Architect's and Arborist's review to eliminate or prevent risk of additional damage to people or property at no cost to the City.

Non safety related damage to trees or vegetation, including herbaceous plants, lawns and shrubs within project limits or outside of the Right of Way that occurs as a result of construction (other than damage to roots during controlled hand digging and root pruning specified herein), shall be documented by photographs and reported to the Field Engineer within 24 hours with a proposal for mitigation and remediation at no cost to the City.

Damage to tree canopies or branches larger than 2-inch diameter from construction equipment by the Contractor shall be documented and reported within 24 hours of occurrence and shall be pruned by the certified Arborist at no cost to the city. Tree paint shall not be used and collar cuts per National Arborist Standards shall be implemented.

Liability for existing trees that decline and die during construction

If it is determined, solely by the Arborist with consultation by the Landscape Architect, that an existing tree to remain and be protected has declined and died as 'an act of God' or has become a safety hazard over time and whose structural instability, illness or death was not due to damage caused by the Contractor outside of the tree protection zones, negligence or not following the requirements of the Contract Documents, the Contractor shall not be held liable for the decline and death of the tree.

The affected tree shall be removed with care not to damage root systems of other trees or landscape areas adjacent, and finished grade loamed and seeded with specified lawn as described in the Contract Documents.

The price for removal and disposal shall be negotiated as a change order and shall reflect the unit price for tree removal in the contract or if not listed as such in the Bid price, the price shall reflect the standard tree removal prices of similar size tree in Cambridge MA during the year of removal.

Liability for construction damage to trees to be protected

The Contractor shall be liable for all damage to existing trees during construction that are protected or inside of tree protection fencing, not designated for clearing and removal. Actual penalties for damage to trees shall be in accordance with the schedules defined herein, with assessed damages to be deducted from sums payable under the Construction Contract.

The Field Engineer, Landscape Architect and Arborist will decide if the damage is or will significantly impact the health and/or viability of the tree. If a tree impacted is so evaluated, the Contractor will be assessed for the damage to a large tree - DBH or Diameter at Breast Height is >/= 8-inch - at a cost of not less than five hundred dollars ($500.00) per caliper inch at breast height (DBH). If the Contractor disputes the assessed amount by this calculation, the damaged tree will be assessed by the Arborist and/or Landscape Architect in accordance with the trunk size method that assesses tree value by species, size, replacement tree size available in locale, tree health before damage and importance/location as described in the "Guide for Plant Appraisal", latest edition, as published by The Council of Tree and Landscape Appraisers. Assessment by this method typically results in a higher assessed value per DBH for large deciduous ornamental or shade trees.

Assessed damage for replacing smaller trees between 2-inch caliper and 6-inch caliper (diameter taken 6 inches above finished grade) shall be replacement value for the total caliper inches of the tree damaged, as one tree or multiple trees. Tree replacements shall measure not less than 2-inch caliper or greater than 4-inch caliper. Species and locations for tree replacements shall be determined by the City of Cambridge.

Removal of the roots and trunk of trees so damaged that they require removal and repair to meet the requirements of the contract documents and shall be the responsibility of the Contractor at no additional cost to the City of Cambridge. Tree pruning of branches damaged by construction operations shall be pruned according to Arborist standards and under the Arborist's review at the Contractor's cost. Damage to branches larger than ½-inch diameter shall be assessed at $150 per caliper inch penalty to be paid for by the Contractor.

Tree bark that is damaged by construction activities shall be repaired with clean trace cutting by clean knife to live cambium and per recommendation and review by the Arborist at the Contractor's cost. Damage to bark at or larger 3 square inches shall be assessed at $100 per 3 square inch injury per occurrence.

Removal or relocation, even if temporary, of tree protection fencing for one tree pit and/or tree way without prior review and approval of the Field Engineer AND Landscape Architect will result in a fine of $250 per occurrence, even if no tree damage occurs from removal or relocation.

Storing of materials or dumping of debris or concrete washouts inside of tree root zones will result in a minimum penalty of $500 per occurrence. This fine would be incurred in addition and/or separate from fines for tree damages that may be assessed.

The Contractor shall be held responsible for the health and survival of the existing trees in the immediate vicinity of the of the construction area. Damage that, in the Engineer's opinion, can be remedied by corrective measures shall be repaired immediately. Broken limbs shall be pruned according to industry standards. Wounds shall not be painted. Trees or shrubs that are damaged irreparably shall, at the Engineer's discretion, be replaced per the requirements of Division I of these Special Provisions. Cost of replacement trees shall be borne by the Contractor.

References and Applicable Standards

Where references are made in these Specifications to standard specifications, codes, etc., of the U.S. Government, State or local authorities, or professional and industrial societies and associations, the applicable portions thereof shall govern as fully as if they were printed in their entirety, herein, and shall include all revisions thereto issued as of the date of the Notice to Contractors pertaining hereto. Comply with the requirements of the following codes and industry standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. The following references are used herein and shall mean:

MassDOT Standard Specifications: Commonwealth of Massachusetts, Massachusetts Department of Transportation/Highway (formerly Massachusetts Highway Department and Department of Public Works), "Standard Specifications for Highways and Bridges," latest edition and including
all applicable Supplemental Specifications, Standard Special Provisions and Special Provisions.

NAA: National Arborist Association Standards, National Arborist Association, 124 Route 101, Bedford, NH 03102.

AAN: American Association of Nurserymen "American Standard for Nursery Stock," ANSI Z60.1, latest edition.

TCIA: Tree Care Industry Association, Pruning Standards: "Standards for Pruning Shade Trees," and " Standards for Pesticide Application Operations" latest editions, NAA, P.O. Box 1094, Meeting Place Mall, Route 101, Amherst, NH 03031.

Related Work

Examine all other Items of the Special Provisions and all Drawings for the relationship of the Work under this Item and the Work of other trades. Cooperate with all trades and coordinate all Work under this Item herewith.

Submittals

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 Engineer, Landscape Architect, Arborist, and DCR reserves the right to reject, on or after delivery, any material that does not meet these Specifications.

Slow-Release Injectable Tree Root Fertilizer: Submit product literature of root fertilizer and three (3) certificates showing composition and analysis. Submit fertilization type, rates and timing of injections for fertilizer product based upon soil testing, analysis, and recommendations by Arborist. Submit the purchasing receipt showing the total quantity purchased for the project prior to installation. Submit (1) sample packet of Tree Root Fertilizer.

Water: Submit schedule for watering and source of water to Engineer for approval. Schedule for watering shall be determined in consultation with the arborist.

The Contractor shall submit throughout the duration of the contract and (2) year maintenance period monthly water logs to DCR and the Landscape Architect showing the metered record of water quantity used and date of each watering occurrence.

The Contractor shall provide to the Engineer one (1) copy American National Standards Institute (ANSI) Standard Z-133.1 and A300 Standard Practices for Tree, Shrub, and Other Woody Plant Maintenance, Part 1: Pruning. These references shall be kept by the Engineer at his office for the length of the Contract.

MATERIALS

Slow-Release Injectable Tree Root Fertilizer

Slow-Release Injectable Tree Root Fertilizer shall be an Organic Mix consisting of the following ingredients:

Fish Hydrolysate: Must be cold processed with a macronutrient analysis of 2-3-1 (N-P-K)
Seaweed Extract: Must be cold processed powdered extract of Ascophyllum Nodosum.
Humic Acid: Must be 90% soluble powder with a minimum of 85% Humic acids.
Molasses: Must be high-quality, unsulfured, food-grade blackstrap molasses.
Earth Ambrosia is a liquid Humic Acid and colloidal organic nutrient solution.
Earth Nectar is a broad spectrum of soil-based enzymes made by microbes.
Yucca Extract: Must be cold processed with 20% saponins.

Cleaning Solution shall be white vinegar with 12% acetic acid content.

Insect and Disease Controls

Chemicals for tree insect and disease controls shall only be those permitted by the City of Cambridge for use on public street trees and only with permission of the City and as reviewed and approved by the state licensed Arborist before construction.

Water

Contractor shall provide water for maintaining plants in the construction area that will have exposed root systems for any period during construction. Water shall be potable and suitable for use on planting.

Contractor shall be responsible to furnish a supply of water to the site at no extra cost to the Owner. If metered municipal water is available at the site at the time of planting, Contractor may request to use this source but shall accept the cost of water, materials, equipment, and labor
for using that water. All work injured or damaged due to the lack of water, or due to the use of too much water, shall be Contractor's responsibility to correct. Water used shall be potable quality, free from impurities injurious to vegetation. Water shall not be drawn from the Charles River or its canals for use in planting operations.

Watering equipment shall be approved by the Engineer prior to watering under this item. Equipment shall have no water leaking from the tank, hoses, or any other parts. Water shall be pumped and have a minimum flow of 95 PSI. Gravity fed watering shall not be accepted under this item.

CONSTRUCTION METHODS

Site Visit

Regular Inspections shall be required to review the health of the trees to be protected and maintained that are impacted by Construction. Inspections shall occur monthly during construction adjacent to the trees, whether the trees are in leaf or dormant, and during the growing season (April 15 – November 15) during and after construction adjacent is complete until Final Acceptance included.

The requests to applicable parties shall be submitted by the Contractor at least one to two weeks before scheduled field visits except for structural root encounters and/or safety hazards which should be identified addressed by the Contractor as soon as possible.

An unscheduled site visit may be required such as for Damage Reporting, safety event and/or unknown Structural Root is encountered that may need to be protected.

Mandatory site visits to review the progress of construction

Scheduled Site Visit #1: The Contractor shall request that the Landscape Architect, the approved certified Arborist, the DCR arborist, and the field engineer visit the site and review in the field the specific trees to remain and/or be protected and maintained and removed before construction begins. Tree trunk root protection fencing details and locations and maintenance operations and scheduling of subsequent field visits will be reviewed in the field with the Contractor on the first site visit.

Scheduled Site Visit #2: A second site visit shall be arranged by the Contractor for the Landscape Architect, the approved certified Arborist, the DCR arborist, and the field engineer after the tree protection fencing and trunk protection is installed to review, add to and/or adjust the location and extents of the protections and coverings.

Scheduled Site Visit #3: A third site visit shall be arranged by the Contractor for the Landscape Architect, the approved certified Arborist, the DCR arborist, and the field engineer after the paving demolition and/or excavation limits to review relocation of tree protection fencing to limits of proposed limits of work to review tree roots at extents of adjacent areas in order to determine if tree spading and root relocation is desired or if trenching or hand excavation is preferred at excavation limits, and to review loaming, fine grading and mulching required.

Tree root protection

Existing tree pits of trees to remain and be protected shall be mulched with 3 inches of approved shredded bark mulch before construction/demolition commences. Wood chips from trees removed shall not be permitted to be spread on site.

Tree pits shall be deep root watered once per week with potable water, soaking the soil in tree pit to a minimum depth of 12 inches between May 15 – September 15 unless 1 inch of rain has fallen during that period in which case watering may not be required.

Concrete dust shall be blown clean from top and out of tree areas so as not to increase the pH of the soil from concrete dust leaching into the soil around the roots. Tree root zones shall be watered down thoroughly within 24 hours after cleanup of concrete debris should this occur, and exposed roots inspected and treated for mechanical damage by the Arborist.

Watering

The trees to remain and be protected shall be deep root watered to moisten a minimum 12" inch depth or 1 inch of water throughout the tree protection fenced areas once per week inclusive of rain from May 15 through September 15, unless otherwise directed by the Arborist. Watering can be done by hand or with soaker hoses evenly spread around tree root zones. Take care not to under or overwater trees to remain.

If water runs off root zone area due to slope, too high a flow rate, slow infiltration, or any other reason, water will not be approved for payment.

Watering method shall not damage plants or seeded areas or cause erosion. All damages shall be repair at the Contractor's expense.

Deep Root Fertilizing

Trees impacted by construction shall be deep root fertilized by a licensed Arborist with a slow-release organic fertilizer between November and April after impacts during the previous growing season but only after review and direction of the Landscape Architect and Arborist. The Contractor shall assume one deep root fertilization of all trees scheduled to remain and be protected.

Organic soil amendments shall be applied using a hydraulic sprayer with a soil probe or lance.

Dry ingredients shall be reconstituted with water before adding to the spray tank. Beginning with about half the total volume of water, add ingredients to the tank with agitation. When all ingredientshave been added, add water to the desired level. Agitation should continue during application to prevent materials from settling.

Ingredient amounts for 300 gallons of water shall be as follows:

Fish Hydrolysate:	5 gallons
Seaweed extract powder:	3 pounds
Humic acid powder:	2 pounds
Molasses:	64 fluid ounces
Yucca extract:	32 fluid ounces
Earth Ambrosia:	32 fluid ounces
Earth Nectar:	32 fluid ounces

Application rate for Organic Soil Amendment mix shall be as indicated below or as recommended bythe Arborist for the various sized plants:

1 Gallon Plant	4 fluid ounces
2 Gallon Plant	8 fluid ounces
5 Gallon Plant	20 fluid ounces
10 Gallon Plant	40 fluid ounces
20 Gallon Plant	80 fluid ounces
2-inch Caliper	96 fluid ounces
3-inch Caliper	112 fluid ounces
4-inch + Caliper	128 fluid ounces

Products shall be mixed on site with a third-party present (owner, Engineer, site supervisor). Copies ofreceipt shall be required with date and product information to match with required products. Moisten soils prior to applying fertilizer.

Clean up: Do not leave any mixture in spray tank for extended periods of time without agitation. Spraytanks and hoses shall be cleaned at the end of each day by flushing out with clean water and vinegarsolution 50/50 mix; with a final rinse of clean water to ensure equipment is clean and ready for the nextapplication. Do not use equipment if it has been used to spray any pesticides or herbicides.

Insect and Disease Control

The Arborist may also recommend any approved remedial insect or disease control measures that may be required for trees to remain to preserve their health and vigor if they are subject to infestation or illness. Trees to remain shall be inspected for insect and disease controls before during and at the end of construction as a condition of acceptance and recommendations and measures shall be taken by the Contractor to remedy the problems with review and approval of the City, Landscape Architect and Arborist.

Root Zone Mulching

Tree roots that are disturbed by construction and are exposed during the growing season (April 15 – November 15) shall be covered with approved shredded bark mulch to a minimum depth of 3 inches within two days of exposure. Tree pits that once included granite cobbles or sets shall have approved Planting Loam spread over exposed roots to original finished grade, to be adjusted to final grades with review and approval of Field Engineer, Arborist and Landscape Architect.

Deep Root Aeration and Loaming of Root Zones

The treed areas shall be deep root aerated to a minimum of 12" inch depth, with holes 12" on center staying 6" - 12" inches from existing tree trunks and lateral structural roots to remain and with review of Arborist before aeration operations begins. Aeration shall occur before mulching or loaming. Aeration holes shall be filled with approved compost and well-watered in. The finished grade, loam and mulch at the edges shall be finished cleanly after fencing is removed for final acceptance.

Dust Control on Tree Canopies in Leaf

The canopies of trees to remain and be protected during construction that are in leaf shall be inspected by the Field Engineer and Landscape Architect for dust accumulation every two weeks between May 15 – November 15. The Arborist may require that the canopies be regularly sprayed with clean, potable water to clean the leaves of accumulated construction dust on a regular basis.

If trees to remain display water stress that is not alleviated by watering, the leaves shall be sprayed with an approved anti-desiccant and watering operations reevaluated (possibly increased) as reviewed and approved by the Arborist and Landscape Architect.

Weeding, Mulching and/or Lawn Mowing inside Tree Protection Fencing

Regular monthly weeding of areas inside tree protection fencing shall be done by hand (herbicides not permitted but pre-emergents are permitted to be spread to keep weeds down) with re-spreading of mulch to 3 inches minimum cover over finished grade Legally dispose of all weedy debris. If lawn exists, it shall be mowed to keep height below 4 inches and no shorter than 3 inches with care not to damage trunks of trees to remain.

Duration of work

The maintenance of trees to remain shall extend until initial acceptance as a condition of Final Acceptance of this item.

COMPENSATION

METHOD OF MEASUREMENT

ITEM 102.51 INDIVIDUAL TREE MAINTENANCE shall be measured per EACH tree shown on the plans or as directed by the Landscape Architect, including materials, labor, equipment and legal disposal of all materials off site.

BASIS OF PAYMENT

Item 102.51 Individual Tree Maintenance shall be paid at the contract unit bid price per each. This item shall include full compensation for all labor, equipment, materials, and incidentals for the satisfactory completion of the work, water, fertilizer, weeding, mulching, dust control, aeration, insect and disease control, and any miscellaneous items required for the maintenance of trees to remain.

Where the plans show specific individual trees to remain and where grading or other disturbance is shown within the drip line of these trees or where the Engineer determines that an individual tree must be protected, these trees shall be maintained and paid for under Item 102.51 Individual Tree Maintenance per each tree protected and maintained.

Payment under this items shall be scheduled throughout the length of contract: 30 percent of value shall be paid one third of the way through construction period, 30 percent of value shall be paid at two thirds of the way through construction period, and the remainder to be paid at the time of Initial Acceptance upon completion of construction operations that would disturb plants.

ITEM 102.513 AIR EXCAVATION AND ROOT PRUNING FOOT

Item 102.513 Air Excavation and Root Pruning is for the services of excavating soil with an air pressure tool in order to expose tree roots, and for associated services and materials necessary to complete the work of pruning, backfilling with existing soil, watering, mulching, and fertilizing. This item shall include the furnishing and operating the air excavating tool.

Trees to be air spaded shall be those shown on the plans and/or as determined necessary by the Engineer, Landscape Architect, and DCR per the recommendations of the Arborist.

REFERENCES

The standards from American National Standards Institute (ANSI): A300 (Part 8)-2013 Root Management with special attention to Section 84 shall apply to this work. If requested, the Contractor shall provide to the Landscape Architect one copy of this reference. Provision of reference shall be incidental to this item.

METHODS

Air excavation and pruning work shall be or overseen by the Arborist.

Air excavation of soil and root pruning shall occur any time prior to equipment work within the root zone of marked trees.

Air excavation shall be done along the limit of proposed excavation. Trench shall be of sufficient width to observe and cut roots and shall be to the depth of proposed excavation. Immediately following air excavation, roots shall be pruned.

Following pruning, roots shall immediately be fully covered with backfill and immediately watered. Roots shall continue to be watered and fertilized as directed by the Arborist.

COMPENSATION

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 102.513 will be measured and paid per foot where air spading, pruning, watering, and fertilizing are performed. This item will include full compensation for all labor, the services of a certified arborist equipment, materials, and incidentals required for the satisfactory completion of the work.

ITEM 102.52 TEMPORARY TREE PROTECTION FENCE FOOT

DESCRIPTION

General

The work to be done under this Section shall require the Contractor to provide all labor, materials, equipment, and transportation necessary for individual tree protection of trees to remain and be protected as shown on the Drawings and as specified hererin.

Examine all other Items of the MassDOT Standard Specifications, Standard Special Provisions and Special Provisions for requirements that may affect the Work of this Item whether or not such work is specifically mentioned.

Temporary Tree Protection Fence, Item 102.52 shall be used to protect areas of existing trees or other areas of quality vegetation that is to remain and as shown on the Drawings.

The Contractor shall be solely responsible for judging the full extent of the work requirements, including, but not necessarily limited to any equipment and materials necessary for providing tree protection fencing.

Prior to any construction activities, the Contractor and Arborist shall walk the site with the Engineer, DCR Arborist and Landscape Architect to identify which trees will require protection and to determine approved measures. The Arborist shall make recommendations as to appropriate methods for trees. DCR will have final decision as to tree protection and methods.

The Contractor is responsible for the protection of all existing trees and plants within and immediately adjacent to the construction area that are not designated to be removed for the length of the construction period.

Related Work

Examine all other Items of the Special Provisions and all Drawings for the relationship of the Work under this Item and the Work of other trades. Cooperate with all trades and coordinate all Work under this Item herewith.

References

Where references are made in these Specifications to standard specifications, codes, etc., of the U.S. Government, State or local authorities, or professional and industrial societies and associations, the applicable portions thereof shall govern as fully as if they were printed in their entirety, herein, and shall include all revisions thereto issued as of the date of the Notice to Contractors pertaining hereto. Comply with the requirements of the following codes and industry standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. The following references are used herein and shall mean:

MassDOT Standard Specifications: Commonwealth of Massachusetts, Massachusetts Department of Transportation/Highway (formerly Massachusetts Highway Department and Department of Public Works), "Standard Specifications for Highways and Bridges," latest edition and including all applicable Supplemental Specifications, Standard Special Provisions and Special Provisions.

NAA: National Arborist Association Standards, National Arborist Association, 124 Route 101, Bedford, NH 03102.

AAN: American Association of Nurserymen "American Standard for Nursery Stock," ANSI Z60.1, latest edition.

TCIA: Tree Care Industry Association, Pruning Standards: "Standards for Pruning Shade Trees," and " Standards for Pesticide Application Operations" latest editions, NAA, P.O. Box 1094, Meeting Place Mall, Route 101, Amherst, NH 03031.

MATERIALS

Temporary Tree Protection Fence

Fence and temporary fence posts shall be subject to the approval of the Landscape Architect.

Tree Protection fencing shall be: 3/8" X 1-1/2" #1 grade spruce min. 4’ ht. snow fence secured to posts with 8-gauge galvanized wire. Posts shall be min. 6’ ht. steel channel posts or 4”x4”x6’ pressure treated wood posts to limit of canopy. Fence shall form an enclosure around trees and shrubs to be protected as designated on the Drawings. **ORANGE PLASTIC FENCING WILL NOT BE PERMITTED.**

Trunk protection shall be 2x4 cladding, at least 8 feet in length, clad together with wire. Alternative materials shall be at the approval of the Engineer. Alternative materials shall provide adequate protection from anticipated construction activities and shall not injure or scar trunk. Trunk protection shall include burlap to separate trunk cladding from bark.

Wood Chip Mulch

Wood Chip Mulch shall be dark colored shredded pine bark, aged six months minimum.

Water

Water shall be potable and suitable for use on plants.

CONSTRUCTION METHODS

Temporary Tree Protection Fence

The location of the tree protection fencing shall be reviewed and approved by the Landscape Architect in the field before and after fencing installation. Trees and shrubs to remain and be protected and to be removed or pruned shall be flagged in the field before fencing is erected.

Fencing shall be erected before construction of any kind begins. Fencing shall be securely erected, be vertically plumb and be maintained for the duration of the project and shall protect individual trees or shrubs or groups of trees or shrubs as shown on the Drawings and reviewed and adjusted in the field.

Tree protection fencing shall be located at minimum at the edge of the drip line of the tree or around shrubs or beyond this limit, as indicated on the Drawings. The closest limit shall be at the limit of excavation or filling coordinated with the grading requirements and as approved by Landscape Architect.

No material shall be stored or demolition operations carried out within the fence limits or drip line of any tree or shrub that is to be saved. No concrete washouts shall be permitted within the fencing limits.

Heavy equipment, storage or littering including liquid disposals of any materials, snow storage, parking of any type of vehicle or foot traffic will not be permitted within the tree protection fencing zones.

Utility lines and structures, footings or foundations including design/build irrigation system lines and components shall not be installed within the Tree Protection Fencing. The Contractor may choose to submit a Request for Clarification (RFI) documenting a request to work within the Fencing limits to the Field Engineer, Landscape Architect, Arborist and Owner at least two weeks before the work is scheduled to occur. The Contractor shall not proceed without written permission is given by the Owner, Field Engineer, Landscape Architect and Arborist to work within the fencing. If the permissions are not granted, alternate routings may be proposed for review that do not conflict with Trees to Remain an be Protected inside the fencing.

To the extent possible, to avoid soil compaction within the root zone, construction activities including, but not limited to, vehicle movement, excavation, embankment, staging and storage of materials or equipment shall not occur underneath the canopy (drip line) of trees to remain.

The Contractor shall wrap the area of the trunk of the tree with burlap prior to armoring with 2x4 cladding. Cladding for tree trunks shall extend from the base of the tree to at least 8 feet from the base.

Contractor shall set posts and fencing at the limits of the tree canopy. Where construction activities closer to the trees is unavoidable, the Contractor shall tie branches out of the way as directed and overseen by the Arborist and place wood chips to a depth of 6 inches on the ground to protect the root systems.

The Contractor shall make every effort to avoid demolition debris from outside tree protection zones falling inside fencing and prepare ahead of demolition for means and methods on how to achieve this. Debris from demolition that falls within tree protection zones shall be removed from tree root system as soon as possible or no later than 24 hours.

The Contractor shall be held responsible for the health and survival of the existing trees in the immediate vicinity of the of the construction area. Damage that, in the Arborist's opinion, can be remedied by corrective measures shall be repaired immediately. Broken limbs shall be pruned according to industry standards. Wounds shall not be painted. Trees or shrubs that are damaged irreparably shall, at the DCR's discretion, be replaced per the requirements specified herein. Cost of replacement trees shall be paid by the Contractor.

Fencing shall not be removed or adjusted, except to reinstall if damaged, and shall be kept in good repair to approved limits or penalties may ensue. Tree Protection Fencing repaired and wood chip mulch replaced as required during the duration of the Contract shall be at no additional cost to the Owner.

Tree Root Protection

The Contractor shall assume that the majority of tree roots extend to the tree drip line or edge of canopy. Any disturbance within this zone shall result in root reduction. Tree protection fencing shall be located at minimum at the tree's drip line and in some instances further away to protect the maximum area possible around trees to remain that is close to construction.

If excavation has to occur within the tree's drip line, this construction impact shall be reviewed by the Landscape Architect in the field before impact occurs. Refer to Item 102.513 Air Excavation and Root Pruning for construction procedures if disturbance to root zone area will occur.

If filling occurs within the drip line of the tree, no more than 12 inches of sandy loam shall be filled and no filling within five feet of the trunk of the tree is permitted. If more fill is required, a system of crushed stone and perforated piping under approved loam shall be installed in the filled area over tree roots at no additional cost to the Owner.

Removal of Protection and Duration of Work

After all other construction activities are complete, but prior to final seeding, wood chips, temporary fencing, branch protection, and trunk protection materials shall be removed and legally disposed of offsite by the Contractor at no additional cost.

Tree protection fencing may be removed only with written permission of the Landscape Architect, Field Engineer, and Arborist before Final Acceptance of the project if construction work has been completed and if the Owner agrees in writing to take responsibility for maintenance of the landscape and trees to remain.

COMPENSATION

METHOD OF MEASUREMENT

ITEM 102.52 TEMPORARY TREE PROTECTION FENCE shall be measured by linear FOOT installed and complete in place as shown on the plans or as directed by the Landscape Architect, including all repairs and legal disposal of all materials off site upon completion of the contract.

BASIS OF PAYMENT

Item 102.52 TEMPORARY TREE PROTECTION FENCE shall be paid at the contract unit bid price per FOOT. This item shall include full compensation for all labor, equipment, materials, repair, removal and

legal disposal of the protective materials upon completion of the contract and any other incidentals required for the satisfactory completion of the work

Payment under these items shall be scheduled throughout the length of contract: 30 percent of value shall be paid upon installation, 30 percent approximately halfway through the contract, and the remainder to be paid at the end of the contract after completion of construction operations that would disturb plants and after the protection materials have been removed and properly disposed of off-site by the Contractor.

Cost of wood chip mulch, as required, shall be incidental to these items.

ITEM 102.531 TREE CARE - PRUNING EACH

The work under this item shall conform to the relevant provisions of Sections 771 and shall be for when specialized or significant limb pruning is required. Pruning shall be to prevent injury to the tree from construction equipment and activities, pruning of dead limbs, and/or pruning for health and balance of the tree to mitigate impacts of construction activities on the root zone. Evaluation and determination for pruning shall be made utilizing the services of a MA Certified Arborist.

All work under this Item shall be executed by a Massachusetts Certified Arborist familiar with industry accepted arboricultural practices and the requirements of urban forestry management and urban tree care methods. Arborist shall have at least 10 years of experience in tree care and shall demonstrate a familiarity with the American National Standards Institute (ANSI) A300 Standard Practices for Tree, Shrub, and Other Woody Plant Maintenance Part 5 Construction Management Standards, Part 8 Root Management and Part 9 Tree Risk Assessment.

Trees to be pruned shall be those as indicated on contract drawings.

QUALIFICATIONS

Individuals performing the work must have, at a minimum, an ISA Certified Tree Worker or demonstrate equivalent training and experience. Certification shall be submitted to the Engineer and Landscape Architect for approval prior to work.

REFERENCES

If requested, the Contractor shall provide to the Engineer one copy of the latest edition of the American National Standards Institute (ANSI) A300 Standard Practices for Tree, Shrub, and Other Woody Plant Maintenance: Part 1-Pruning and Part 5-Construction Management Standard. Provision of reference shall be incidental to this item.

METHODS OF WORK

Prior to construction activities, the Contractor, Engineer, Landscape Architect, DCR, and the Arborist shall review trees noted on the plans and listed herein to be pruned. Final decision as to trees pruned shall be per the Arborist.

Arborist shall inspect all trees prior to pruning for evidence of fungal disease such as canker stain and contactor shall disinfect tools between each cut to prevent cross contamination between branches and trees if disease is present. Pruning of limbs shall conform to the techniques and standards of the most recent ANSI A300 standards.

COMPENSATION

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 102.531 TREE CARE – PRUNING will be measured and paid at the contract unit price per EACH. This will include full compensation for all labor, equipment, tools, materials and incidentals for the satisfactory completion of the work.

ITEM 102.55 ARBORIST HOUR

DESCRIPTION

The work under this Item is for the services of a Certified Arborist. Arborist shall be an International Society of Arboriculture (ISA) Certified Arborist or a Massachusetts Certified Arborist. The Arborist shall have at least 10 years of experience in tree care, including tree protection during construction, and shall demonstrate a familiarity with the American National Standards Institute (ANSI) A300 Standard Practices for Tree, Shrub, and Other Woody Plant Maintenance Part 1Pruning, Part 5 Construction Management Standards, and Part 9 Tree Risk Assessment.

The Arborist's general responsibilities include protecting high priority trees within and adjacent to the project limits, stating areas, and access routes; recommending removal of diseased, damaged or otherwise unhealthy trees that pose a potential safety hazard; evaluating effects of construction on future health of trees close to proposed work; and recommending and/or overseeing tree work amd care. A comprehensive list of minimum required Arborist site visits is included in section 102.51 Tree Maintenance. Additional visits will be arranged throughout construction on a case by case basis as determined by the Contractor, DCR, and Landscape Architect.

The Arborist for this item shall not be from the same company as the company responsible for selective clearing or tree removal work.

For projects with multiple phases, projects where construction activities (work or stockpiling) shifts, or when otherwise directed by the Engineer, the Arborist shall re-evaluate conditions and provide follow-up recommendations.

Submittals

Contractor shall submit to the Engineer for approval by MassDOT Landscape Design the qualifications and experience of the Arborist. Submittal shall include copy of current certification and a resume summarizing specific construction experience (including relevant MassDOT projects) for a minimum of five projects.

Arborist's Report documenting recommendations shall be submitted to the Engineer and an electronic copy forwarded to MassDOT Landscape Design Section. Report shall include the following:

Scope of Work

The Arborist shall be responsible for the following tasks:

Initial Evaluation and Report:

Recommend, prioritize trees, and clearly identify/tag trees that require removal as appropriate to contract scope, project limits, and project intent;

Review and modify, if necessary, tree protection measures shown on the drawings

Review and mark limits of protective fencing for trees and groups of trees to be retained;

Review and recommend protection measures for high priority trees;

Review and recommend extents of Selective Clearing and Thinning, see section 102.00 Selective Clearing and Thinning.

Submit a marked-up Construction Plan that briefly notes recommendations and decisions made in the field;

Submit a corresponding report including photo documentation;

Oversight:

Direct or execute pruning of branches and/or roots, air spading, and/or other tree care operations throughout entire construction period.

Monitoring and Inspections:

Periodically inspect fencing and ensure root zones are properly protected and clear of equipment and materials as required by the Engineer

Reevaluate tree protection measures for various phases of a project

Submit inspection notes with relevant and dated photos to the Engineer throughout entire construction period until Final Acceptance.

Special Care:

Oversee tree pruning for health and aesthetics

Recommend fertilization and amendments

Recommend and oversee pest control

Oversee watering program as outlined in section 102.51 Individual Tree Maintenance.

Oversee and provide recommendation for all tree care activties as outlined in section 102.51 Individual Tree Maintenance.

METHODS

Prior to any work, the Arborist shall walk the site with the Contractor, the Engineer, the DCR Arborist, and, the Landscape Architect, to review trees, limits of construction activities, and other concerns. Where required for proper assessment of tree impacts, limits of work shall be staked or otherwise marked in the field prior to the site walk.

Trees to be removed shall be painted or otherwise clearly marked.
Trees to be retained shall be marked such that it does not mar or damage the tree and such that marker is not easily removed. As applicable to the work and scope of the project, trees designated for removal or to be retained shall be noted on the plan and/or in the arborist's report and photographed.

Trees designated to remain that are damaged or removed by construction activities shall be noted and photographed for inclusion in inspection reports submitted to the Engineer.
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COMPENSATION

METHOD OF MEASUREMENT

Item 102.55 Arborist will be measured for payment by the Hour of time spent onsite. Travel time shall not be reimbursed.

BASIS OF PAYMENT

Item 102.55 will be paid at the contract unit price per hour upon submittal and acceptance of Reports described above.

ITEM 103. TREE REMOVED – DIAMETER UNDER 24 INCHES EACH

ITEM 104. TREE REMOVED – DIAMETER 24 INCHES AND OVER EACH

All work performed under these Items shall be in accordance with the relevant provisions of MassDOT Sections 100 and 101 of the Standard Specifications for Highways and Bridges and the following:

DESCRIPTION

Examine all other Items of the MassDOT Standard Specifications, Standard Special Provisions and Special Provisions for requirements that may affect the Work of this Item whether or not such work is specifically mentioned.

Contractor is to notify the Landscape Architect of schedule for removal at least 1 week prior to performing any work on tree removal.

CONSTRUCTION METHODS

Prior to any construction, Contractor shall arrange a conference on the site with the Engineer, Landscape Architect, DCR, and Arborist to review trees to be saved, pruned, fertilized and watered. Additionally, all trees to be removed shall be tagged by the Contractor and reviewed prior to any removals with the Engineer, Landscape Architect, Arborist, and City Conservation Committee Agent.

The Contractor shall conduct his operations in a cautious and workman like manner to prevent damage or defacement of all trees, shrubs and grasslands scheduled to remain within or adjacent to the project limits, specifically those areas in close proximity to residential locations.

Holes and depressions resulting from the tree and stump removal operations shall be suitably backfilled by the Contractor with material to be reviewed by Engineer and/or Landscape Architect. All branches, roots and trunks on trees that are scheduled to remain that are damaged shall be treated as required by the Arborist at no extra cost to DCR.

Shrubs and trees to be protected shall be flagged by the Arborist and reviewed by Engineer, Landscape Architect, DCR, and City Conservation Committee Agent. All tree limbs and branches overhanging the State Highway Layout shall be trimmed and their wounds treated as directed by the Landscape Architect and the Arborist.

COMPENSATION

METHOD OF MEASUREMENT

ITEM 103 TREE REMOVED – DIAMETER UNDER 24 INCHES shall be measured per EACH tree shown on the plans or as directed by the Landscape Architect, including legal disposal of all materials off site.

ITEM 104 TREE REMOVED – DIAMETER 24 INCHES AND OVER shall be measured per EACH tree shown on the plans or as directed by the Landscape Architect, including legal disposal of all materials off site.

BASIS OF PAYMENT

Item 103 shall be paid at the contract unit bid price per each . The contract unit bid price shall include the stump and major root systems and be full compensation for all labor, equipment and incidentals necessary to complete the work required and proper disposal of all material off the job site.

Item 104 shall be paid at the contract unit bid price per each. The contract unit bid price shall include the stump and major root systems and be full compensation for all labor, equipment and incidentals necessary to complete the work required and proper disposal of all material off the job site.

ITEM 127. **CONCRETE EXCAVATION** **CUBIC YARD**

DESCRIPTION

The work to be done under this Item consists of, but is not limited to, excavating and removing existing concrete for the removal of existing concrete pads at existing park benches and existing concrete walkways to be removed as well as any other location as required by the Engineer.

The Contractor shall remove and legally dispose of all concrete as indicated on the plans.

CONSTRUCTION METHODS

Concrete bench pads and walkways shall be removed to their full depth and in their entirety

The Contractor will repair at their expense any portion of existing concrete that is to remain that is damaged by their actions.

METHOD OF MEASUREMENT

Item 127., Concrete Excavation, shall be measured per cubic yard for the actual number of cubic yards of concrete actually removed.

BASIS OF PAYMENT

Item 127., Reinforced Concrete Excavation, shall be paid at the contract unit price bid per cubic yard, which payment shall be considered as full compensation for all labor, tools, equipment, materials, and incidental work required to complete the work as required.

Removal of existing benches shall be paid for under Item 707.17, Shurcliff Bench Removed and Stacked.

ITEM 153. CONTROLLED DENSITY FILL - EXCAVATABLE CUBIC YARD

The work under this Item shall conform to the relevant provisions of Section 150 of the Standard Specifications and the following:

DESCRIPTION

This material shall be used to backfill drainage pipe, water pipe, and traffic signal and lighting conduit trenches in the roadway surface, and as required by the Engineer.

MATERIALS

Controlled Density Fill – Excavatable (CDF) shall conform to the requirements of Section M4.08.0 for Type 2E. CDF shall be batched at a concrete plant, shall be flowable, require no vibration, and the finished product must be excavatable without the use of power tools. The material shall flow under and around the pipe, conduit, or structure sufficiently to hold it in place before backfilling. CDF shall be discharged from the mixer in a controlled manner by chute, or other means acceptable to the Engineer, into the excavation area to be filled.

METHOD OF MEASURMENT AND BASIS OF PAYMENT

Item 153. Controlled Density Fill – Excavatable will be measured and paid for by the Cubic Yard (volume) of CDF, complete in place. The cubic yard price includes all labor, materials, equipment, and all incidental costs required to complete the work.

ITEM 156.13 CHOKER COURSE CUBIC YARD

Choker course for dry swales shall conform to the relevant provisions of Section 150 and the following:

DESCRIPTION

This work shall consist of constructing a stone choker course layer within the proposed dry swale along within the project limits in accordance with the details shown on the Contract Drawings, as specified in these Specifications and as required by the Engineer.

MATERIALS AND CONSTRUCTION METHODS

Stone dust materials shall consist of crushed stone or gravel fines conforming to the following gradation:

U.S. Standard Sieve Size	Percent Passing by Weight
½" (12.5 mm)	100
3/8" (9.5 mm)	85-100
No. 4 (4.75 mm)	10-30
No. 8 (2.36 mm)	0-10
No. 16 (1.18 mm)	0-5

Choker course gradation shall be submitted to the Engineer for approval.

METHOD OF MEASUREMENT

Choker Course shall be measured for payment by volume in Cubic Yards (CY) complete in place.

BASIS OF PAYEMENT

Choker course shall be paid for at the Contract unit price bid per Cubic Yard (CY), which shall include all labor, materials, equipment, and incidental costs required to complete the work.

ITEM 180.01 ENVIRONMENTAL HEALTH AND SAFETY PROGRAM LUMP SUM

GENERAL

The work under this Item shall consist of ensuring the health and safety of the Contractor's employees and subcontracting personnel, the Owner, the Engineer, their representatives, the environment, and public welfare from any on-site chemical contamination present in air, soil, water and sediment.

The Contractor shall prepare and implement a site-specific Environmental Health and Safety Plan (EHASP) which has been approved and stamped by a Certified Industrial Hygienist (CIH) and includes the preparer's name and work experience. The EHASP shall include appropriate components required by OSHA Standard 29 CFR 1910.120(b) and the Massachusetts Contingency plan (MCP) 310 CMR 40.0018 and must comply with all applicable state and federal laws, regulations, standards and guidelines, and provide a degree of protection and training appropriate for implementation on the project. The EHASP shall be a dynamic document with provision for change to reflect new information, new practices or procedures, changing site environmental conditions or other situations which may affect site workers and the public. The EHASP shall be developed and implemented independently from the standard construction HASP required per MassDOT standard specifications.

Health and safety procedures provided by the Contractor shall comply with all the appropriate regulations that address employee working conditions, including but not limited to standards established by OSHA and National Institute for Occupational Safety and Health (NIOSH). Equipment used for the purpose of health and safety shall be approved by and meet pertinent standards and specifications of the appropriate regulatory agencies.

A copy of the most up-to-date version of the EHASP shall be maintained on-site at all times by the Contractor. The on-site copy shall contain the signature of the Engineer and each on-site employee of the Owner, Contractor, and Subcontractors involved with on-site activities. The employee's signature on the EHASP shall be deemed prima facie evidence that the employee has read and understands the plan. Updated copies of signature sheets shall be submitted to the Engineer.

The EHASP shall specify a Contractor Site Safety and Health Officer responsible for implementation of the EHASP and to oversee all construction activities, including handling, storage, sampling and transport, which require contact with or exposure to potentially hazardous materials.

The level of protection, required to ensure the health and safety of on-site personnel will be stipulated in the EHASP. The Site Safety and Health Officer shall implement the EHASP based on changing site and weather conditions, type of operation or activity, chemical compounds identified on-site, concentration of the chemicals, air monitoring data, physical state of the hazardous materials, potential duration of exposure to hazardous materials, dexterity required to perform work, decontamination procedures, necessary personnel and type of equipment to be utilized.

During implementation of the EHASP, a daily log shall be kept by the Site Safety and Health Officer and a copy shall be provided weekly to the Engineer. This log shall be used to record a description of the weather conditions, levels of personal protection being employed, screening data and any other information relevant to on-site environmental safety conditions. The Site Safety and Health Officer shall sign and date the daily log.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Preparation and implementation of the Environmental Health and Safety Program, including the monitoring, protection and storage of all contaminated materials, as well as subsequent modifications to the EHASP, will be measured and paid for at the Lump Sum Bid Price.

Payment of 50% of the Environmental Health and Safety Program contract price will be made upon the initial acceptance of the EHASP by the Engineer. Payment of the remaining 50% of the Environmental Health and Safety Program contract price will be made upon completion of the work. The bid price shall include preparation and implementation of the EHASP as well as the cost for its enforcement by the Site Safety and Health Officer along with any necessary revisions and updates. The work of implementing the Environmental Health and Safety Program includes work involving, but not limited to, the monitoring, protection, and storage of all contaminated materials.

ITEM 180.02 PERSONAL PROTECTION LEVEL C UPGRADE HOUR

GENERAL

The work under this Item shall consist of providing appropriate personal protective equipment (PPE) for all personnel in an area either containing or suspected of containing a hazardous environment.

Contingencies for upgrading the level of protection for on-site workers will be identified in the EHASP and the Contractor shall have the capability to implement the personal protection upgrade in a timely manner. The protective equipment and its use shall be in compliance with the EHASP and all appropriate regulations and/or standards for employee working conditions.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Personal Protection Level C Upgrade will be measured and paid for only upon upgrade to Level C and will be at the contract unit price, per Hour, per worker, required in Level C personal protection. No payment will be made to the Contractor to provide Level D PPE.

ITEM 180.03 LICENSED SITE PROFESSIONAL SERVICES HOUR

GENERAL

Within limited areas of the project site, soils, sediments and/or groundwater may be contaminated. A Licensed Site Professional (LSP) shall be required to provide the services necessary to comply with the requirements of the Massachusetts Contingency Plan (MCP). These services may include sampling, analysis and characterization of potentially contaminated media, preparation of Immediate Response Action (IRA) Plans, Utility-Related Abatement Measure (URAM) and Release Abatement Measure (RAM) Plans, Imminent Hazard Evaluations, status reports, transmittal forms, release notification forms, risk assessments, completion statements, and related documents required pursuant to the Massachusetts Contingency Plan (MCP). LSP hours related to the characterization and disposal of contaminated soil and/or sediment are incidental to the disposal items. An estimate of LSP services to be provided shall be submitted to the Engineer for approval before any LSP activity begins.

The name and qualifications of the LSP and all environmental technicians to be assigned to the project shall be submitted to the Engineer for approval at least four weeks prior to initial site activities. The LSP shall have a current, valid license issued by the Massachusetts Board of Registration of Hazardous Waste Site Cleanup Professionals. The LSP shall have significant experience in the oversight of MCP activities at active construction sites. Qualification packages for the LSP and each technician shall include a resume, all recent work assignments with responsibilities identified (previous 5 years), and applicable training and certifications. A list of all Notices of Noncompliance, Notice of Audit Findings and Enforcement Orders issued by the DEP shall be submitted for all work assignments listed for the LSP and environmental technicians.

The LSP shall evaluate soil and/or sediment with discoloration, odor, and presence of petroleum liquid or sheening on the groundwater surface, or any abnormal gas or materials in the ground which are known or suspected to be oil or hazardous materials. Excavated soil and sediment which is suspected of petroleum contamination shall be field screened using the jar headspace procedures according to established DEP Guidance. All field screening equipment must be pre-approved by the Engineer. The LSP shall ensure proper on site calibration of all field screening instrumentation.

The Engineer shall be contacted immediately when observations or any field screening results verify contamination requiring further analysis, and/or enhanced management of suspect soil and/or sediment. Any enhanced management of contaminated soil to ensure proper stockpiling and storage is incidental to the LSP Services item. The LSP shall adequately characterize subsurface conditions prior to backfill in areas where contaminated material has been excavated. The Engineer shall approve the locations of the testing sites prior to the sampling.

Contaminated soil, sediment and/or groundwater shall be handled in accordance with all applicable state and federal statutes, regulations and policies. The LSP shall adequately characterize contaminated media for comparison to the requirements of the MCP. The Contractor and the LSP shall be aware of the reporting requirements for releases of oil and/or other hazardous material (OHM) as set forth in federal and state laws and regulations, and shall both be held responsible for performing the work in accordance with all applicable Federal and State laws and regulations. The LSP shall maintain written records in a clear and concise format which tracks the excavation, stockpiling, analysis and reuse/disposal of all suspect contaminated soils, sediments and groundwater. These records shall be up-to-date and available to the Engineer on a bi-weekly basis. The LSP shall review and summarize the laboratory data from any analyses performed on

contaminated media. A report shall be delivered to the Engineer outlining the material sampling methods, laboratory analysis results and proposed course of action. The laboratory report together with Chain of Custody forms for all analytical results shall be submitted to the Engineer within 14 days after completion of such analyses.

The LSP and Contractor shall be held responsible for the submission of all MCP-related documents to the Engineer at least 14 days in advance of any timeframe specified in the MCP and for the timely submission of data and tracking information as noted within this Item. All documents prepared under this Item must be reviewed and signed by the approved LSP. The Contractor and LSP shall be responsible for all fines, penalties and enforcement requirements imposed by applicable regulatory agencies for failure to meet regulatory and contract timeframes. No compensation will be provided for such fines, penalties and enforcement actions.

The Contractor and the LSP shall be aware of the reporting requirements for releases of oil and/or other hazardous material (OHM) as set forth in federal and state laws and regulations, and shall both be held responsible for performing the work in accordance with all applicable Federal and State laws and regulations.

If the Contractor causes a release of OHM, the Contractor shall be responsible for assessing and remediating the release in accordance with all pertinent State and Federal regulations, including securing the services of a LSP, at his own expense.

The LSP shall coordinate all activities involving both the Owner and the DEP through the Engineer. Any notification of release shall be approved by the City before submittal to the DEP, except if an imminent hazard condition exists as defined in 309 CMR 4.03(4)(b).

LABORATORY TESTING IN SUPPORT OF LSP SERVICES

Laboratory testing provides for analytical testing in support of LSP services related to maintaining MCP compliance, such as delineating the extent and type of contamination present. Sampling and testing for disposal purposes are not included.

In order to maintain compliance with the MCP or other regulatory requirements, the LSP shall request approval from the Engineer to obtain samples from various locations and depths within the project area and to perform laboratory analyses on those samples. The samples shall be delivered to a DEP-certified laboratory using proper chain-of-custody documentation for analyses which, depending upon site conditions and suspected and/or identified contaminants of concern, may include, but are not limited to, metals, polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, polycyclic aromatic hydrocarbons (PAHs), extractable petroleum hydrocarbons (EPHs) and volatile petroleum hydrocarbons (VPHs). Subsequent testing, depending upon initial results, may be required for Toxicity Characteristic Leaching Procedure (TCLP) analyses (EPA Method 1311) for metals.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

LSP Services for work under this Item will be measured per person, per Hour of service provided by LSP, Environmental Technicians and other approved personnel. Travel time shall not be included in the billable

hours. LSP hours related to soil/sediment disposal (disposal characterization, landfill acceptance, disposal package preparation, etc.) shall be incidental to disposal items.

The quantity and type of laboratory tests must be approved by the Engineer beforehand. The contractor will be reimbursed upon satisfactory written evidence of payment. The contractor may be required to obtain cost estimates from three DEP certified laboratories for the Engineer to choose the service provider. Laboratory testing related to soil/sediment disposal (disposal characterization, landfill acceptance, disposal package preparation, etc.) shall be incidental to disposal items.

LSP Services will be paid for at the Contractor unit bid price for each Hour, or fraction thereof, spent to perform the work as described above. The unit bid price shall be a blended rate that includes the cost of the LSP, environmental technicians and other personnel in the performance of all work tasks and field screening, including required equipment, materials and instrumentation, and production of all documentation described above. All requests for payment must be accompanied by the following information: the names of the personnel associated with the work charged under LSP Services, dates and hours worked, work conducted, including, where appropriate, locations as identified on the construction plans, and a copy of the field diary for the dates submitted.

Laboratory Testing will be reimbursed upon receipt of paid invoices for testing approved by the Engineer.

ITEM 181.11	**DISPOSAL OF UNREGULATED SOIL**	**TON**
ITEM 181.12	**DISPOSAL OF REGULATED SOIL – IN STATE FACILITY**	**TON**
ITEM 181.13	**DISPOSAL OF REGULATED SOIL – OUT-OF-STATE FACILITY**	**TON**
ITEM 181.14	**DISPOSAL OF HAZARDOUS WASTE**	**TON**

GENERAL

The work under these Items shall include the transportation and disposal of contaminated material excavated, or excavated and stockpiled. It shall also include the cost of any additional laboratory analyses required by a particular disposal facility beyond the standard disposal test set.

Excavation of existing subsurface materials may include the excavation of contaminated soils. The Contractor shall be responsible for the proper coordination of characterization, transport and disposal, recycling or reuse of contaminated soils. Disposal, recycling or reuse will be referred to as "disposal" for the purposes of this specification. However, regardless of the use of the term herein, there will be no compensation under these items for reuse within the project limits. The Contractor will be responsible for coordinating the activities necessary for characterization, transport and disposal of contaminated soils. Such coordination will include the Engineer and his/her designee overseeing management of contaminated materials. Contaminated soils must be disposed of in a manner appropriate for the soil classification as described below and in accordance with the applicable laws of local, state and federal authorities. The Contractor shall be responsible for identifying disposal facility(ies) licensed to accept the class of contaminated soils to be managed and assure that the facility can accept the anticipated volume of soil contemplated by the project. The Contractor shall be responsible for hiring a Licensed Site Professional (LSP) and all ancillary professional services including laboratories as needed for this work. The Contractor will be responsible for obtaining all permits, approvals, manifests, waste profiles, Bills of Lading, etc. subject to the approval of the Engineer prior to the removal of the contaminated soil from the site. The Contractor and LSP shall prepare and submit to the Engineer for approval all documents required under the Massachusetts Contingency Plan (MCP) and related laws and environmental regulations to conduct characterization, transport, and disposal of contaminated materials.

CLASSES OF CONTAMINATED SOILS

The Contractor and its LSP shall determine if soil excavated or soil to be excavated is unregulated soil or contaminated soil as defined in this section. Such materials shall be given a designation for purposes of reuse or disposal based on the criteria of the MCP. Soils and sediments which are not suitable for reuse will be given a designation for purposes of off-site disposal based on the characterization data and disposal facility license requirements. The Classes of Contaminated Soils are defined as follows:

Unregulated Soil consists of soil, fill and dredged material with measured levels of oil and hazardous material (OHM) contamination at concentrations below the applicable Reportable Concentrations (RCs) presented in the MCP. Unregulated soil consists of material which may be reused (or otherwise disposed) as fill within the Commonwealth of Massachusetts subject to the non-degradation criteria of the MCP (310 CMR 40.0032(3), in a restricted manner, such that they are sent to a location with equal or higher concentrations of similar contaminants. Disposal areas include licensed disposal facilities, approved industrial settings in areas which will be capped or covered with pavement or loamed and seeded, and for purposes of this project should be reused as fill within the project site construction corridor whenever possible. The material cannot be placed in residential and/or environmentally sensitive (e.g. wetlands) areas.

Under no circumstances shall contaminated soils be placed in an uncontaminated or less contaminated area (including the area above the groundwater table if this area shows no sign of contamination).

The Contractor shall submit to the Engineer the proposed disposal location for unregulated soils for approval. If such a disposal location is not a licensed disposal facility, the Contractor shall submit to the Engineer analytical data to characterize the disposal area sufficiently to verify that the unregulated material generated within the construction project limits is equal to or less than the contaminant levels at the disposal site and meets the non-degradation requirements of the MCP. In addition, the Contractor shall provide written confirmation from the owner of the proposed disposal location that they have been provided with the analytical data for both the materials to be disposed as well as the disposal site characterization and that s/he agrees to accept this material. A Material Shipping Record or Bill of Lading, as appropriate, shall be used to track the off-site disposal of unregulated soil and a copy, signed by the disposal facility or property owner, shall be provided to the Engineer in order to document legal disposal of the unregulated material.

The cost of on-site disposal of unregulated soil within the project area will be considered incidental to the item of work to which it pertains.

Regulated Soil consists of materials containing measurable levels of OHM that are equal to or exceed the applicable Reportable Concentrations for the site as defined by the MCP, 310 CMR 40.0000. Regulated soil which meets the MCP reuse criteria of the applicable soil/groundwater category for this project area may be reused on site provided that it meets the appropriate geotechnical criteria established by the Engineer. Regulated Soil may be reused (as daily or intermediate cover or pre-cap contouring material) or disposed (as buried waste) at lined landfills within the Commonwealth of Massachusetts or at an unlined landfill that is approved by the Massachusetts Department of Environmental Protection (DEP) for accepting such material, in accordance with DEP Policy #COMM-97-001, or at a similar out-of-state facility. It should be noted that soils which exceed the levels and criteria for disposal at in-state landfills, as outlined in COMM-97-001, may be shipped to an in-state landfill, but require approval from the DEP Division of Solid Waste Management and receiving facility. An additional management alternative for this material is recycling into asphalt. Regulated Soils may also be recycled at a DEP approved recycling facility possessing a Class A recycling permit subject to acceptance by the facility and compliance with DEP Policy #BWSC-94-400. Regulated Soil removed from the site for disposal or treatment must be removed via an LSP approved Bill of Lading, Manifest or applicable material tracking form. This type of facility shall be approved/permitted by the State in which it operates to accept the class of contaminated soil in accordance with all applicable local, state and federal regulations.

Hazardous Waste consists of materials which must be disposed of at a facility permitted and operated in full compliance with Federal Regulation 40 CFR 260-265, Massachusetts Regulation 310 CMR 30.000, Toxic Substances Control Act (TSCA) regulations, or the equivalent regulations of other states, and all other applicable local, state, and federal regulations. All excavated materials classified as hazardous waste shall be disposed of at an out-of-state permitted facility. This facility shall be a RCRA hazardous waste or TSCA facility, or RCRA hazardous waste incinerator. This type of facility shall be approved/permitted by the State in which it operates to accept hazardous waste in accordance with all applicable local, state and federal regulations and shall be permitted to accept all contamination which may be present in the soil excavate. The Contractor shall ensure that, when needed, the facility can accept TSCA waste materials i.e. polychlorinated biphenyls (PCBs). Hazardous waste must be removed from the site for disposal or treatment via an LSP approved Manifest.

MONITORING/SAMPLING/TESTING REQUIREMENTS

The Contractor shall be responsible for monitoring, sampling and testing during and following excavation of contaminated soils to determine the specific class of contaminated material. Monitoring, sampling and testing frequency and techniques should be performed in accordance with Item 180.03 – LSP Services. Additional sampling and analysis may be necessary to meet the requirements of the disposal facility license. The cost of such additional sampling and analysis shall be included in the bid cost for the applicable disposal items. The Contractor shall obtain sufficient information to demonstrate that the contaminated soil meets the disposal criteria set by the receiving facility that will accept the material.

No excavated material will be permanently placed on-site or removed for off-site disposal until the results of chemical analyses have been received and the materials have been properly classified. The Contractor shall submit to the Engineer results of field and laboratory chemical analyses tests within seven days after their completion, accompanied by the classification of the material determined by the Contractor, and the intended disposition of the material. The Contractor shall submit to the Engineer for review all plans and documents relevant to LSP services, including but not limited to, all documents that must be submitted to the DEP.

WASTE TRACKING:

Copies of the fully executed Weight Slips/Bills of Lading/ Manifests/Material Shipping Records or other material tracking form received by the Contractor from each disposal facility and for each load disposed of at that facility, shall be submitted to Engineer and the Contractor's LSP within three days of receipt by the Contractor. The Contractor is responsible for preparing and submitting such documents for review and signature by the LSP or other appropriate person with signatory authority, three days in advance of transporting soil off-site. The Contractor shall furnish a form attached to each manifest or other material tracking form for all material removed off-site, certifying that the material was delivered to the site approved for the class of material. If the proposed disposition of the material is for reuse within the project construction corridor, the Contractor shall cooperate with the Engineer to obtain a suitable representative sample(s) of the material to establish its structural characteristics in order to meet the applicable structural requirements as fill for the project.

All material transported off-site shall be loaded by the Contractor into properly licensed and permitted vehicles and transported directly to the selected disposal or recycling facility and be accompanied by the applicable shipping paper. At a minimum, truck bodies must be structurally sound with sealed tail gates, and trucks shall be lined, and loads covered with a liner, which shall be placed to form a continuous waterproof tarpaulin to protect the load from wind and rain.

DECONTAMINATION OF EQUIPMENT

Tools and equipment which are to be taken from and reused off site shall be decontaminated in accordance with applicable local, state and federal regulations. This requirement shall include, but not be limited to, all tools, heavy machinery and excavating and hauling equipment used during excavation, stockpiling and handling of contaminated material. Decontamination of equipment is considered incidental to the applicable excavation item.

REGULATORY REQUIREMENTS

The Contractor shall be responsible for adhering to regulations, specifications and recognized standard practices related to contaminated material handling during excavation and disposal activities. The Owner shall not be responsible at any time for the Contractor's violation of pertinent State or Federal regulations or endangerment of laborers and others. The Contractor shall comply with all rules, regulations, laws, permits and ordinances of all authorities having jurisdiction including, but not limited to, Massachusetts DEP, the U.S. Environmental Protection Agency (EPA), Federal Department of Transportation (DOT), Massachusetts Water Resources Authority (MWRA), the Commonwealth of Massachusetts and other applicable local, state and federal agencies governing the disposal of contaminated soils.

All labor, materials, equipment and services necessary to make the work comply with such regulations shall be provided by the Contractor without additional cost to the Owner. Whenever there is a conflict or overlap within the regulations, the most stringent provisions shall apply. The Contractor shall reimburse the Owner for all costs it incurs, including penalties and/or for fines, as a result of the Contractor's failure to adhere to the regulations, specifications, recognized standard practices, etc., that relate to contaminated material handling, transportation and disposal.

SUBMITTALS

I. Summary of Sampling Results, Classification of Material and Proposed Disposal Option.

The following information, presented in tabular format, must be submitted to the Engineer for review and approval prior to any reuse on-site or disposal off-site. This requirement is on-going throughout the project duration. At least two weeks prior to the start of any excavation activity, the Contractor shall submit a tracking template to be used to present the information as stipulated below. Excavation will not begin until the format is acceptable to the Engineer.

Characterization Reports will be submitted for all soil, sediment, debris and groundwater characterized through the sampling and analysis program. Each report will include a site plan which identifies the sampling locations represented in the Report. The Construction Plan sheets may be used as a base plan to record this information.
The Sampling Results will be presented in tabular format. Each sample will be identified by appropriate identification matching the sample identification shown on the Chain of Custody Record. The sample must also be identified by location (e.g. grid number or stockpile number). For each sample, the following information must be listed: the classification (unregulated, regulated, etc.), proposed disposal option for the stockpile or unit of material represented, and all analytical results.

Each Characterization Report will include the laboratory analytical report and Chain of Custody Record for the samples included in the Report.

II. Stockpiling, Transport, and Disposal.

At least two weeks prior to the start of any excavation activity, the Contractor shall submit, in writing, the following for review and shall not begin excavation activity until the entire submittal is acceptable to the Engineer.

Excavation and Stockpiling Protocol:

Provide a written description of the management protocols for performing excavation and stockpiling and/or direct loading for transport, referencing the locations and methods of excavating and stockpiling excavated material.

Disposal and Recycling Facilities:

1. Provide the name, address, applicable licenses and approved waste profile for disposal and/or recycling location(s) where contaminated soil will be disposed.

   Present information substantiating the suitability of proposed sites to receive classifications of materials intended to be disposed there, including the ability of the facility to accept anticipated volumes of material.

2. Provide a summary of the history of compliance actions for each disposal/recycling facility proposed to be used by the Contractor. The compliance history shall include a comprehensive list of any state or federal citations, notices of non-compliance, consent decrees or violations relative to the management of waste (including remediation waste) at the facility. Material should not be sent to facilities which are actively considered by the DEP, USEPA or other responsible agency to be in violation of federal, state or local hazardous waste or hazardous material regulations. The Engineer reserves the right to reject any facility on the basis of poor compliance history.

Transportation:

The name, address, applicable license and insurance certificates of the licensed hauler(s) and equipment and handling methods to be used in excavation, segregation, transport, disposal or recycling.

III. Material Tracking and Analytical Documentation for Reuse/Disposal.

The following documents are required for all excavation, reuse and disposal operations and shall be in the format described. At least two weeks prior to the start of any excavation or demolition activity, the Contractor shall submit the tracking templates required to present the information as stipulated below. Excavation or demolition will not begin until the format is acceptable to the Engineer.

All soils, sediments and demolition debris must be tracked from the point of excavation to stockpiling to onsite treatment/processing operations to off-site disposal or onsite reuse as applicable.

Demolition Debris:

Demolition debris must be tracked if the debris is stockpiled at a location other than the point of origin or if treatment or material processing is conducted. Identification of locations will be based on the station- offset of the location. The tracking table will identify date and point of generation, any field screening such as PID or dust monitoring, visual observations/comments, quantity, and stockpile ID/processing operation location. For each unit of material tracked, the table will also track reuse of the material on- site, providing reuse date, location of reuse as defined by start and end station, width of reuse location by offset, the fill elevation

range, quantity, and finish grade for said location. For demolition debris, which is not reused on site, the table will also track disposal of the material as defined by disposal date, quantity and disposal facility. The table must provide a reference to any analytical data generated for the material.

Soil/Sediment:

Soil excavation will be identified based on the station-offset of the excavation location limits. The tracking table will identify date and point of generation, any field screening such as PID or dust monitoring, visual observations, quantity, and stockpile number/location. For each unit of material tracked, the table will also track reuse of the material on-site and disposal of the material off-site using the same categories identified for demolition debris above.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Disposal of contaminated soil shall be measured for payment by the Ton of actual and verified weight of contaminated materials removed and disposed of. The quantities will be determined only by weight slips issued by and signed by the disposal facility. The most cost-effective, legal disposal method shall be used. The work of the LSP for disposal under all of these items shall be incidental to the work with no additional compensation.

Item 181.11 Measurement and Payment for Disposal of Unregulated Soil shall be under the Contract Unit Price by the weight, in Tons, of contaminated materials removed from the site and transported to and disposed of at an approved location or licensed facility, and includes any and all costs for approvals, permits, fees and taxes, additional testing/characterization required by the facility beyond the standard disposal test set, decontamination procedures, transportation and disposal.

Item 181.12 Measurement and Payment for Disposal of Regulated Soil – In-State Facility shall be under the Contract Unit Price by the weight, in Tons, of contaminated materials removed from the site and transported to and disposed of at an approved in-state facility, and includes any and all costs for approvals, permits, fees and taxes, testing/characterization required by the facility beyond the standard disposal test set, decontamination procedures, transportation and disposal.

Item 181.13 Measurement and Payment for Disposal of Regulated Soil - Out-of-State Facility shall be under the Contract Unit Price by the weight, in Tons, of contaminated materials removed from the site and transported to and disposed of at an approved out-of-state facility, and includes any and all costs for approvals, permits, fees and taxes, testing/characterization required by the facility beyond the standard disposal test set, decontamination procedures, transportation and disposal.

Item 181.14 Measurement and Payment for Disposal of Hazardous Waste shall be under the Contract Unit Price by the weight, in Tons, of hazardous waste removed from the site and transported to and disposed of at the licensed hazardous waste facility, and includes any and all costs for approvals, permits, fees and taxes, testing/characterization required by the facility beyond the standard disposal test set, decontamination procedures, transportation and disposal.

ITEM 183.1 **TREATMENT OF CONTAMINATED GROUNDWATER** **GALLON**

This Item addresses the treatment and disposal of contaminated groundwater encountered during excavation operations. The work generally consists of furnishing the materials, equipment, labor, services, testing/sampling, waste characterization, transportation, disposal, permits and agreements necessary to perform the work required for the collection, treatment and disposal of contaminated groundwater.

The Contractor is advised that contaminated groundwater may be encountered during dewatering activities. The levels and nature of contamination may vary depending on location and/or depth. No data has been provided in this specification indicating the types of contaminants that may be found in groundwater encountered during this work. It will be the responsibility of the Contractor to ensure that water removed during dewatering operations is treated and disposed of in accordance with all applicable laws and regulations and in accordance with this specification.

The Contractor shall monitor the quantity of groundwater collected for treatment using an in-line totalizer flowmeter or an alternate method approved by DCR and the Engineer. The Contractor shall, at all times, minimize the quantity of groundwater removed from the excavations. All groundwater determined to be contaminated will be managed in accordance with all applicable local, state and federal regulations.

It is not the intent herein for the DCR to design for or specify to the Contractor which particular treatment is to be used, if necessary. Rather, it is DCR's intent to provide guidance to the Contractor for informational and bidding purposes only. It is, therefore, the Contractor's responsibility to use a treatment method to allow him/her to meet any and all laws, regulations, policies, guidelines and permit requirements. Treatment of contaminated groundwater for dewatering operations is generally performed using a mobile treatment trailer equipped with one or more granular-activated carbon (GAC) canisters, although other techniques are also used.

It is likely that treatment of the contaminated groundwater using granular-activated carbon will be required to complete the work under this Contract. The Methods described under Item 183.1 provides for the identification, testing, management and treatment or disposal of contaminated groundwater and shall be implemented, at a minimum and as necessary by the Contractor via Methods under Item 183.1.

The overall handling and management of contaminated groundwater is regulated under the provisions of 310 CMR 40.0000, 314 CMR 3.00 and 5.00, NPDES and other applicable laws. The unpermitted discharge of contaminated dewatering effluent into the environment (storm drain, surface water body, onto the ground) is a violation of federal and state laws and regulations. Should dewatering of contaminated groundwater be necessary, approvals must be sought from the appropriate federal, state, or local regulatory jurisdiction. The USEPA will not specify a treatment system or method, but normally requires that the treated discharge meet Massachusetts Drinking Water Standards.

The discharge standards are normally met by treating the dewatered groundwater through granular-activated carbon canisters, or similar techniques. Longer term discharges to surface waters or storm drains, and any discharges to the ground, require approval and/or issuance of a permit from the DEP Division of Water Pollution Control. The Contractor shall be responsible for applying for, paying all fees for and obtaining all permits required for treatment and/or disposal of contaminated groundwater. Additional requirements may be mandated by local/regional sewer authorities for discharge to sanitary sewer or Publicly Owner Treatment Works (POTW). Copies of permit applications and correspondence from federal and state

ITEM 183.1 (Continued)

agencies and sewer authorities shall be supplied to the Engineer prior to dewatering activities. EPA regulations published in the Federal Register on September 9, 2005 (70 FR 53663) require a National Pollutant Discharge Elimination System (NPDES) Remediation & Miscellaneous Contaminated Sites General Permit (RGP) for all contaminated construction site dewatering activities in Massachusetts (MAG910000) that will involve the discharge of water to classes of receiving waters designated in the Massachusetts Water Quality Standards (314 CMR 4.00). The application requires that operators of proposed new discharges seeking coverage under this general permit submit a Notice of Intent (NOI) to EPA New England post-marked at least 14 days prior to commencement of discharge. The Contractor is solely responsible for applying for and obtaining coverage under the NPDES Remediation General Permit from EPA and, if applicable, DEP, including the costs associated with sampling and analysis of groundwater and any application fees. The Contractor is required to submit a completed copy of the NOI to the Engineer and the Director of Environmental Programs, Construction Division, 10 Park Plaza, Boston, prior to commencement of discharge.

Upon permanent cessation of the discharges authorized by the RGP, the Contractor shall be responsible for submitting a Notice of Termination (NOT) to EPA New England within 30 days of the permanent cessation. The Contractor is required to submit to DCR a completed copy of the NOT within 14 days of the permanent cessation of the discharges authorized by the RGP. All costs and fees associated with the submission of the NOT will be the responsibility of the Contractor.

The Contractor shall be responsible for adhering to regulations, specifications, and recognized standard practices related to contaminated groundwater handling during dewatering activities. DCR shall not be responsible at any time for the Contractor’s violation of pertinent local, state or federal regulations or endangerment of laborers and others. The Contractor shall comply with all rules regulations, laws, permits and ordinances of all authorities having jurisdiction including, but not limited to, Massachusetts Department of Environmental Protection (DEP), the U.S. Environmental Protection Agency (EPA), Federal Department of Transportation (DOT), Massachusetts Water Resources Authority (MWRA), the Commonwealth of Massachusetts and other applicable local, state and federal agencies governing this work.

The Contractor shall be responsible for determining compliance with the requirements of any permit and for any sampling, testing, and disposal required in connection with said permits. DCR and the City/Town reserve the right to collect additional samples of dewatered groundwater to determine the Contractor's compliance with the Permit's requirements. All laboratory testing is to be performed by a DEP certified laboratory for all parameters being tested. Copies of all field and laboratory testing results, reports, etc. required by the permits must be supplied to the Engineer. DCR, DEP, and the permit-granting agency, where applicable, reserve the right to collect additional samples of discharged groundwater to verify compliance with permit requirements.

For the purpose of these specifications and to establish a basis for the bid, it is anticipated that granular-activated carbon will be the treatment medium for dewatered contaminated groundwater. The bidder shall factor into the payment item all costs associated with the testing and analyses that may be required by the permitting agency. In addition, any laboratory testing of groundwater is to be performed by a DEP certified laboratory for the parameters being tested. Copies of all field and laboratory testing results will be supplied to the Engineer. Bid price shall also include full compensation for labor, materials, maintenance, mobilization, rental and other related costs. Item 183.2 will be used for disposal of used granular-activated carbon canisters.

ITEM 183.1 (Continued)

SUBMITTALS

Prior to initiating work, the Contractor shall submit an excavation dewatering plan to the DCR that includes a detailed description of the approach to dewatering, a description of methodology for sealing the excavation to minimize infiltration of groundwater, if deemed applicable to the work, anticipated treatment, discharge points, sampling frequency, required permits, transporters and waste facilities complete with license numbers, permit numbers, contact person, and address and telephone number that the Contractor plans to utilize for waste disposal. The plan shall be submitted for the record.

The Contractor shall submit to DCR for review, the proposed methods for dewatering and groundwater treatment and disposal for the various portions of the work to be done. The review shall be for methods only. The Contractor shall remain responsible for the maintenance, performance, structural integrity and safety of the systems installed for this work as well as regulatory compliance of the applicable local, state and federal discharge standards. The contractor shall provide all groundwater sampling and analyses, results and reports required by all applicable local, state and federal agencies. The Contractor shall submit to DCR for review all plans and documents that must be submitted to the EPA and DEP, including NOI, NOT, treatment system analytical reports and correspondence. Copies of all permits and approvals and lab analyses and test results associated with groundwater treatment and disposal must be submitted to DCR within 3 days of receipt by the Contractor.

ESTABLISHMENT OF TREATMENT PROCEDURE

Since concentrations of contaminants in groundwater cannot be easily assessed in the field, all groundwater extracted from the ground will be considered contaminated and will be initially pumped and stored into open settling tank(s) or a fractionation tank until it can be sampled and analyzed, unless otherwise directed by DCR. The Contractor will perform initial sampling and analyses of the groundwater to determine the need for a permit to dispose of contaminated groundwater. Based on the results of the initial sample analysis, which must be provided to the Engineer within twenty-four (24) hours of the time the samples are received by the laboratory, the Contractor will determine the necessity for treatment(s) and disposal procedures. Sampling must also be performed to meet applicable discharge criteria as set by the appropriate regulatory agencies for the permit obtained for disposal. All discharges must meet regulatory standards set forth in the permits required for discharge. For the purposes of the bidding process, it is anticipated that the treatment system will consist of sedimentation tanks, an oil water separator and liquid-phase granular activated carbon as the primary on-site treatment medium for dewatered contaminated groundwater. DCR may require additional treatment processes if such is determined necessary during the groundwater testing procedure. The Contractor shall integrate the additional treatment process into the treatment system, if necessary.

The Contractor shall provide all labor, equipment and appurtenances required to treat the groundwater, subject to the approval of DCR. Groundwater stored and tested but not requiring treatment or off-site disposal shall be discharged to a location subject to the approval of DCR without payment to the Contractor.

ITEM 183.1 (Continued)

TREATMENT UNITS

The Contractor shall furnish all labor and materials and shall install and operate temporary groundwater treatment and disposal system(s) as necessary to treat contaminated groundwater pumped from excavations during construction activities under the Contract. Such systems shall be capable of treating groundwater to meet applicable discharge criteria as set by the appropriate regulatory agencies.

The Contractor or their Environmental Consultant shall operate, maintain and modify the selected treatment system, and conduct the necessary monitoring and reporting of influent, midpoint and effluent results, as required by the discharge permit for the disposal option selected.

METHOD OF MEASUREMENT

Provide a treatment system that meets permit discharge requirements, mobilize it to the site, provide copies of laboratory analytical data indicating that the system is performing appropriately to meet permit requirements, and demobilize it from the site. This includes management and disposal of wastes generated during treatment prior to discharging such as activated carbon, etc. Work under Item 183.1 is based upon the number of gallons disposed or contaminated groundwater pumped through the granular-activated carbon (Item 183.2) as the medium for the treatment of contaminated groundwater that is found in pipe trenches, manhole excavations, catch basin excavations, that need to be dewatered.

BASIS OF PAYMENT

Payment shall be made at the unit price bid per gallon of groundwater pumped, stored, treated as needed and tested as required by discharge permits and regulatory requirements, which price shall be full compensation for all necessary labor and materials, mobilization, maintenance, demobilization of the appropriate unit(s), freight, rental costs, field and laboratory testing costs and permits. Costs associated with the disposal of granular-activated carbon shall be covered under Item 183.2.

ITEM 183.2 **DISPOSAL OF GRANULAR-ACTIVATED CARBON** **POUND**

GENERAL

Work under Item 183.2 is based upon the disposal of used granular-activated carbon as the treatment medium for contaminated groundwater (Item 183.1) that is found during excavations in which contaminated groundwater is encountered.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Measurement shall be made per pound of carbon that is properly disposed and replaced, as necessary, to meet treated water discharge requirements during dewatering operations at the site. Payment shall be made per the unit price per pound for Disposal of Granular Activated Carbon shall include compensation for all labor, equipment, materials, permits, characterization, sampling and on-site or laboratory analysis as needed or required by permits, for replacement and disposal of liquid-phase activated carbon for the on-site contaminated groundwater pumping, collection, treatment and treated water discharge system during the time period required to complete the work.

No payments shall be made for replacing carbon which is spent due to the Contractor's failure to remove floating petroleum product or excess sediments prior to the groundwater entering the carbon treatment units.

All other costs associated with treatment of contaminated groundwater will be covered under Item 183.1, Treatment of Contaminated Groundwater.

ITEM 188.3 DISPOSAL OF MERCURY CONTAINING LAMPS EACH

The work under this Item shall conform to the relevant provisions of Section 150 of the Standard Specifications and the following:

DESCRIPTION

This Item shall apply to the disposal of all mercury-containing lamps that qualify as universal waste, and shall include all costs for accumulation, loading, transportation, and disposal of the lamps.

The lamp components of the existing lighting are suspected to contain mercury. The Contractor shall arrange for the loading and transportation of the lamps to an appropriate disposal facility at the time of demolition, and shall submit evidence of proper disposal to the Engineer prior to the completion of the project. All aspects of this Item are to be completed in accordance with all applicable state and federal regulations, including but not limited to 310 CMR 30.1000.

METHOD OF MEASUREMENT

Disposal of Mercury Containing Lamps shall be measured for payment by the Each (EA) complete in place.

BASIS OF PAYMENT

Disposal of Mercury Containing Lamps shall be paid for at the Contract Unit Price by the Each (EA) mercury containing bulb disposed from the site and shall be considered full compensation for all labor, tools, equipment, materials, loading, transportation, approvals, and permits necessary for the completion of the work.

ITEM 191.	**DRIVE SAMPLE BORING**	**FOOT**
ITEM 191.10	**HOLLOW STEM AUGER BORINGS**	**FOOT**
ITEM 191.11	**CORE BORING**	**FOOT**

The work to be done under these items shall conform to the relevant provisions of Section 190 of the Standard Specifications and the following.

CONSTRUCTION METHODS

Hollow stem auger borings for traffic signal mast arm foundations shall be taken at the location of each proposed mast arm foundation as shown on the drawings. The borings shall be located at the center of the foundation for each proposed mast arm foundation. Locations shall be marked in the field and approved by the Engineer prior to any boring operations. The Contractor will calculate the ground moment on each support. From the ground moment the Contractor will determine the highest bottom elevation (HBE) for each foundation. Unless bedrock is encountered before the HBE, the borings shall be taken to a depth 10 feet below the HBE. If a sampling at the 10 feet below the HBE indicates 50% or more silt, clay, or organic soil, then the boring will be continued an additional 10 feet below the HBE.

Standard Sample

A standard penetration test using a split spoon sampler will be made at the ground surface, and at every change in soil stratum, but the sampling intervals shall not exceed 5 feet in a continuous stratum. The auger hole will terminate at the specified bottom elevation and split spoon sample will be taken at the bottom of the hole.

Supplemental Sample

A volume sample will be taken at 5 foot intervals in order to classify the subsurface soils with respect to grain size and visual classification as required. Each sample shall consist of the remainder of the spoon sample and shall be contained in 6 inch jars, appropriately labeled.

The purpose of this method along with its sampling procedure is to determine the visual properties, arrangement and thickness of the various soil strata as they exist in the ground. The elevations/depths at which any change in stratification occurs shall be located and recorded on the log by the driller. Detection of stratum changes should be made by careful observation of the soil as it exits the augured hole and by the rate of penetration of the auger during drilling.

The auger casing I.D. shall be a minimum of 2 ¾ inches for all holes in which split spoon samples are required. The O.D. shall be a maximum of 7 inch in order to limit the size of the resulting hole.

Due to the size of the resulting auger hole it is particularly important that upon completion, all borings shall be backfilled with clean, well-graded sand and tamped in order to fill all voids created during the auguring procedure.

Advancing the Boring for Soil Sampling

As the boring is advanced, care shall be taken to note and record the depth where wet soil is encountered if this should occur.

If groundwater is encountered then the water level in the hollow stem shall be maintained at the top of the casing at all times during the sampling operation in order to avoid unequal hydrostatic pressure which may result in a blow-in of fine granular soils and inaccurate blow counts.

In each boring the driller shall record the water level prior to backfilling and whenever possible, prior to the start of each day's work.

Each boring shall be advanced by using a hollow stem auger with cutting head and center rod and plug assembly. The hollow stem auger will advance and case the hole simultaneously to the required sampling levels. The center rod and plug assembly is held in place by the cap and inside drill rod connecting the auger and its assembly to the rotating spindle on the drill in order to prevent soil from entering the mouth of the auger. Upon reaching the sampling level, the plug is to be retracted by withdrawing the center rod to permit lowering of the sampler through the auger. The sample shall be obtained by driving the sampling into the undisturbed material below the bottom of the auger. The sampling and handling procedure will be as specified under Section 190.62 of the Standard Specifications.

After the sampling operations are completed and the sampler has been retracted, the plug is re-inserted and held in place by the center rod; another auger section is connected to the first, together with one additional center rod to secure the plug to the cap, and the hole is advanced.

This procedure may be repeated until the specified bottom elevation is reached. The auger shall be stopped at any depth level to allow normal sampling practices upon request by the Engineer.

If in the judgement of the Engineer; the borehole cannot be advanced by the hollow stem auger method due to the material encountered (with the exception of bedrock); and every attempt has been made by the driller to advance the hole; then the Engineer may direct the driller to complete the boring using the conventionally cased, drive sample, wash boring method as specified in Section 191.61 of the Standard Specifications.

Supplemental Samples

The sample jars shall have positive identification of the contents by typewritten, glued on labels.

The following information shall be shown:

1. Name and address of boring contractor.

2. Date sample was taken.

3. Location and name of project.

4. Location of borehole by station and offset or identifying number of borehole, if so identified on plan.

5. Depth below ground surface at which sample was obtained and recorded blow counts per of 6 inches penetration of the sample.

6. Samples and boring logs shall be delivered to the Department's Materials Laboratory in South Boston for soil classifications.

Obstructions

Obstructions shall be considered according to Section 190.60E of the Standard Specifications.

Rock Core

If rock is encountered at an elevation above the specified highest bottom elevation then a rock core boring will be made in accordance with Section 190.63 of the Standard Specifications.

Practical Refusal

Practical refusal of the sample spoon or 'refusal' is as defined by Section 190.60E of the Standard Specifications.

Boring Logs

Copies of the final boring logs shall be submitted to the Engineer.

METHOD OF MEASUREMENT

Drive Sample Borings and Hollow Stem Auger Borings when completed as such, will be measured by the foot of borehole made in original and trial borings below the ground surface, regardless of the type of materials encountered, such as boulders, “Practical Refusal” material, rockfill, etc. with the exception of bedrock.

Core Borings will be measured by the foot cored into bedrock.

BASIS OF PAYMENT

Drive Sample Borings, Hollow Stem Auger Borings, Core Borings will be paid at the contract unit price per foot for the kind of boring completed as required: payment to include installation of casing as required, including telescoping and spinning of casing when necessary, recovered cores and drive samples.

The cost of any materials required to restore the site to its original condition will be included in the unit price of the item.

Mobilization and Dismantling of boring equipment will be paid for at the contract lump sum price for Item 193.

ITEM 203.6 SPECIAL MANHOLE – 6 FT DIAMETER EACH

DESCRIPTION

The work to be done under this Item consists of constructing special manhole structure in accordance with the detail shown on the Contract Drawings, as specified herein and as required by the Engineer.

MATERIALS AND CONSTRUCTION METHODS

Materials and construction methods shall conform to the relevant provisions and requirements of Section 201 the Standard Specifications, except where amended as follows:

Cast iron frame and cover shall be as specified under Item 221. of these Specifications.

Excavation, dewatering and sheeting and shoring operations where required shall conform to the relevant provisions and requirements specified in Section 140 of the Standard Specifications.

METHOD OF MEASUREMENT

Measurement for special manhole shall be as constructed complete-in-place, on a unit basis regardless of depth, in accordance with the Drawings.

BASIS OF PAYMENT

Payment for Item 203.6, Special Manhole – 6 FT Diameter, shall be at the contract unit price bid, per Each, installed in place, which price shall be full compensation for all excavation (except Class B Trench Excavation and Class B Rock Excavation) and backfill; for furnishing all materials including: filter fabric, cement concrete, cement concrete block, precast cement concrete drain manhole sections, bricks, and mortar; for setting new cast iron frames and cover; and for furnishing all labor, tools and equipment, and all else in connection therewith and incidental thereto.

New Frame and cover furnished shall be measured and paid for separately at the unit price each under Item 221., Frame and Cover.

Crushed stone base for special manhole structure will be paid for under Item 156., Crushed Stone, where required by the Engineer.

Over-depth excavation below the normal grade line of excavation (6 inches below the bottom of the base slab of the structure) to obtain a stable foundation shall be paid for under Item 142. Class B Trench Excavation.

ITEM 203.12 WATER QUALITY SWALE OUTLET CONTROL STRUCTURE EACH

The work under this Item shall include excavation and backfilling, furnishing, and setting precast concrete structure, cast-iron frame and grate, and any other incidental work required to construct the stormwater basin outlet structure in accordance with the requirements herein, where indicated, and as detailed on the Plans or as required by the Engineer.

MATERIALS

Materials shall conform to the relevant provisions and requirements of Section 201 of the Standard Specifications.

Stormwater basin outlet structure shall consist of a precast reinforced concrete structure as shown on the Plans. Concrete shall have a minimum 28-day strength of 4000 psi, with steel reinforcement meeting the requirements of ASTM A-615 Standards, Grade 60 1 inch minimum cover. The structure shall have a design loading of AASHTO HS20-44.

CONSTRUCTION METHODS

Construction methods shall conform to the relevant provisions and requirements of Section 201 of the Standard Specifications and the following:

Construction joints between sections of the structure shall be sealed with 1-inch diameter butyl rubber seal. Openings in the precast structure as indicated on the Plans shall be fabricated at the Manufacturers plant. Precast concrete structure shall be as manufactured by Rotondo and Sons, Inc., Field Concrete Pipe Company Inc., Concrete Systems Inc., Raynham Precast, or an approved equivalent. Shop Drawings shall be submitted to the Engineer for review.

Cast iron frame and grate shall have a square opening of 24 inches x 24 inches (approximately); the combined weight shall not be less than 475 pounds, comparable models as manufactured by East Jordan Iron Works; Neenah Foundry Co.; Campbell Foundry Co., or an approved equivalent.

Excavation, dewatering, sheeting, and shoring operations where required shall conform to the relevant provisions and requirements specified in Section 140 of the Standard Specifications.

METHOD OF MEASUREMENT

Item 203.12, Water Quality Swale Outlet Control Structure, shall be measured as a complete unit, per each outlet structure actually installed.

BASIS OF PAYMENT

Item 203.12, Water Quality Swale Outlet Control Structure, shall be paid at the contract unit price bid, per each, installed in place, which price shall be full compensation for all labor, tools, equipment, and materials required to complete the work as described above including, but not limited to, the frame and grate, excavation and backfilling, furnishing and setting precast concrete structure, cast-iron frame and grate, and any other incidental work required to construct the stormwater basin outlet structure in accordance with the requirements herein, where indicated and as detailed on the Plans, or as required by the Engineer. Transportation, delivery, and installation of the frame and grate shall be included in the contract unit price bid for the item listed herein.

Extra depth excavation below the bottom of the crush stone base required to obtain a stable foundation for the structure shall be paid for under Item 142, Class B Trench Excavation.

If the material for backfill is obtained from borrow it shall be paid for at the contract unit price per cubic foot or ton for the kind of borrow required.

ITEM 220. DRAINAGE STRUCTURE ADJUSTED EACH

The work under this Item shall conform to the relevant provisions of Section 220 of the Standard Specifications and the following:

DESCRIPTION

This material shall be used to backfill drainage pipe, water pipe, and traffic signal and lighting conduit trenches in the roadway surface, and as required by the Engineer.

The Contractor will be required to install "DON'T DUMP" plaques (plaques) at all existing and proposed catch basin locations, or as required by the Engineer. These signs shall be installed in accordance with the Drainage Details, and will incidental to the installation of all frame and grates.

Contract shall use the "Drains to the Charles River" sign. These plaques will be supplied by the Boston Water and Sewer Commision, and shall be picked up at the Commission's storage yard at 980 Harrison Avenue, Boston.

MATERIALS

Controlled Density Fill – Excavatable (CDF) shall conform to the requirements of Section M4.08.0 for Type 2E. CDF shall be batched at a concrete plant, shall be flowable, require no vibration, and the finished product must be excavatable without the use of power tools. The material shall flow under and around the pipe, conduit, or structure sufficiently to hold it in place before backfilling. CDF shall be discharged from the mixer in a controlled manner by chute, or other means acceptable to the Engineer, into the excavation area to be filled.

"DON'T DUMP" plaques shall be 8 inch by 14 inch cast iron as specified in Drainage Details.

Concrete for plaques to be cast in concrete blocks shall be 4,000 psi 28-day compressive strength, one-half inch maximum size aggregate conforming to the requirements of section 901. 4000 PSI, 1.5 inch., 565 Cement Concrete. Concrete shall be air-entrained 5 to 7 percent with a one-inch slump.

Mortar materials for setting plaques shall conform to the requirements of ASTM C270 except that no lime shall be included. Mortar shall consist of one part Portland cement (ASTM C150, Type 1) and no less than 2 ¼ nor more than 3 parts sand (ASTM C144) by volume, with sufficient water to form a workable mixture.

All mortar for setting plaques shall meet the following physical requirements:

Compressive Strength	3,000 psi minimum
Water Absorption	4.0 percent maximum
Bond Strength	500 psi minimum

CONSTRUCTION METHODS

Concrete casting for plaques to be cast in concrete block prior to installation in paving shall have straight and true sides and bottom. Maximum variation from dimensions shown on Drainage Details shall be ¼ inch over the length or width of any cast concrete surface. Plaques cast in concrete shall be fully seated in the concrete block with no seams or cracks between the bottom of the plaque and the concrete base.

Plaques to be set in grass strip shall be placed in position using concrete form "chairs" or leveling spacers. The surface of installed plaques shall be flush with the surrounding pavement surface, shall slope parallel to the to the surrounding pavement, and shall not create a high point or low point in the pavement.

METHOD OF MEASURMENT AND BASIS OF PAYMENT

Item 153. Controlled Density Fill – Excavatable will be measured and paid for by the Cubic Yard (volume) of CDF, complete in place. The cubic yard price includes all labor, materials, equipment, and all incidental costs required to complete the work.

ITEM 222.3 FRAME AND GRATE (OR COVER) EACH
MUNICIPAL STANDARD

All work performed under this Item shall be in accordance with the relevant provisions of Section 220 of the Standard Specifications for Highways and Bridges and the following:

The Contractor will be required to install "DON'T DUMP" plaques (plaques) at all existing and proposed catch basin locations, or as required by the Engineer. These signs shall be installed in accordance with the Drainage Details, and will incidental to the installation of all frame and grates.

Contract shall use the "Drains to the Charles River" sign. These plaques will be supplied by the Boston Water and Sewer Commision, and shall be picked up at the Commission's storage yard at 980 Harrison Avenue, Boston.

MATERIALS

All iron castings for frames, grates and covers shall be in accordance with the dimensions shown on the plans and shall conform to the requirements of ASTM A48, Class 35 gray iron castings.

Frames and Grates shall be capable of withstanding AASHTO HS-20 loading unless otherwise indicated or specified.

Catch Basin frames and grates shall be D-frame style and similar to a style typified by East Jordan Iron Works Product No. 726811 (frame) and Product No. 726831 (grate). Frames and grates shall be East Jordan Iron Works, Neenah Foundry, Olympic Foundry or equal.

"DON'T DUMP" plaques shall be 8 inch by 14 inch cast iron as specified in Drainage Details.

Concrete for plaques to be cast in concrete blocks shall be 4,000 psi 28-day compressive strength, one-half inch maximum size aggregate conforming to the requirements of section 901. 4000 PSI, 1.5 inch., 565 Cement Concrete. Concrete shall be air-entrained 5 to 7 percent with a one-inch slump.

Mortar materials for setting plaques shall conform to the requirements of ASTM C270 except that no lime shall be included. Mortar shall consist of one part Portland cement (ASTM C150, Type 1) and no less than 2 ¼ nor more than 3 parts sand (ASTM C144) by volume, with sufficient water to form a workable mixture.

All mortar for setting plaques shall meet the following physical requirements:

Compressive Strength	3,000 psi minimum
Water Absorption	4.0 percent maximum
Bond Strength	500 psi minimum

CONSTRUCTION METHODS

Concrete casting for plaques to be cast in concrete block prior to installation in paving shall have straight and true sides and bottom. Maximum variation from dimensions shown on Drainage Details shall be ¼ inch over the length or width of any cast concrete surface. Plaques cast in concrete shall be fully seated in the concrete block with no seams or cracks between the bottom of the plaque and the concrete base.

Plaques to be set in grass strip shall be placed in position using concrete form “chairs” or leveling spacers. The surface of installed plaques shall be flush with the surrounding pavement surface, shall slope parallel to the to the surrounding pavement, and shall not create a high point or low point in the pavement.

METHOD OF MEASUREMENT

Item 222.3, Frame and Grate (or Cover) Municipal Standard, shall be measured by the each, complete and in place.

BASIS OF PAYMENT

Item 222.3, Frame and Grate (or Cover) Municipal Standard, shall be paid at the contract unit price bid per each, which payment shall be considered as full compensation for all labor, tools, equipment, materials, and incidental work required to complete the work as required including furnishing and installing the frame and grate (or cover), “DON’T DUMP” plaque, excavation and backfill, as required by the Engineer.

ITEM 223.4 FRAME AND GRATE REMOVED AND RESET EACH

The work under this Item shall conform to the relevant provisions of Section 220 of the Standard Specifications for Highways and Bridges and the following:

DESCRIPTION

Frames and Grates designated on the Plans or by the Engineer to be removed and reset shall be carefully removed, transported, stored, and protected by the Contractor. Contractor shall reinstall Frames and Grates at locations of new catch basin structures as designated on the plans or elsewhere on within the project as required by the Engineer.

The Contractor will be required to install "DON'T DUMP" plaques (plaques) at all existing and proposed catch basin locations, or as required by the Engineer. These signs shall be installed in accordance with the Drainage Details, and will incidental to the removal and resetting of all frame and grates.

Contract shall use the "Drains to the Charles River" sign. These plaques will be supplied by the Boston Water and Sewer Commision, and shall be picked up at the Commission's storage yard at 980 Harrison Avenue, Boston.

MATERIALS

"DON'T DUMP" plaques shall be 8 inch by 14 inch cast iron as specified in Drainage Details.

Concrete for plaques to be cast in concrete blocks shall be 4,000 psi 28-day compressive strength, one-half inch maximum size aggregate conforming to the requirements of section 901. 4000 PSI, 1.5 inch., 565 Cement Concrete. Concrete shall be air-entrained 5 to 7 percent with a one-inch slump.

Mortar materials for setting plaques shall conform to the requirements of ASTM C270 except that no lime shall be included. Mortar shall consist of one part Portland cement (ASTM C150, Type 1) and no less than 2 ¼ nor more than 3 parts sand (ASTM C144) by volume, with sufficient water to form a workable mixture.

All mortar for setting plaques shall meet the following physical requirements:

Compressive Strength	3,000 psi minimum
Water Absorption	4.0 percent maximum
Bond Strength	500 psi minimum

CONSTRUCTION METHODS

Concrete casting for plaques to be cast in concrete block prior to installation in paving shall have straight and true sides and bottom. Maximum variation from dimensions shown on Drainage Details shall be ¼ inch over the length or width of any cast concrete surface. Plaques cast in concrete shall be fully seated in the concrete block with no seams or cracks between the bottom of the plaque and the concrete base.

Plaques to be set in grass strip shall be placed in position using concrete form “chairs” or leveling spacers. The surface of installed plaques shall be flush with the surrounding pavement surface, shall slope parallel to the to the surrounding pavement, and shall not create a high point or low point in the pavement.

METHOD OF MEASUREMENT

Item 223.3, Frame and Grate Removed and Reset, shall be measured for payment by each frame and grate actually removed and reset.

BASIS OF PAYMENT

Item 223.3, Frame and Grate Removed and Reset, shall be paid for at the contract unit price per each, which payment shall be considered as full compensation for removing and resetting existing frames and grates, furnishing and installing “DON”T DUMP plaques all labor, transportation, storage, protection, tools, equipment, materials, and incidentals required to complete the work as required.

ITEM 225.10 10 INCH HOOD – HIGH DENSITY POLYETHYLENE EACH

The work under this Item shall conform to the relevant provisions of Section 200 of the Standard Specifications for Highways and Bridges and the following:

DESCRIPTION

Catch basins installed as per the Plans or by direction from the Engineer shall have hoods installed.

Hoods installed shall be 10" in diameter at the outlet and shall be comprised of high density polyethylene.

METHOD OF MEASUREMENT

Item 225.10, 10 Inch Hood – High Density Polyethylene, shall be measured for payment by EACH hood and grate actually installed.

BASIS OF PAYMENT

Item 225.10, 10 Inch Hood – High Density Polyethylene, shall be paid for at the contract unit price per EACH, which payment shall be considered as full compensation for all labor, transportation, storage, protection, tools, equipment, materials, and incidentals required to complete the work as required.

ITEM 252.08 8 INCH HIGH DENSITY POLYETHYLENE PIPE FOOT
ITEM 252.10 10 INCH HIGH DENSITY POLYETHYLENE PIPE FOOT

DESCRIPTION

All work performed under this Item shall be in accordance with the relevant provisions of Section 230 of the Standard Specifications for Highways and Bridges and the following:

This work shall consist of furnishing and installing Corrugated Polyethylene drainage pipe, in accordance with the details shown on the Contract Drawings, as specified in the Specifications and as directed by the Engineer.

MATERIALS

Item 252.08 - 8 Inch High Density Polyethylene Pipe shall be 8 inch inside diameter and Item 252.10 – 10 Inch High Density Polyethylene Pipe shall be 10 inch inside diameter as called for on the Plans.

Pipe material shall meet AASHTO M 252 - Standard Specification for Corrugated Polyethylene Drainage Pipe 3 Inch-10 Inch.

Trenches containing high density polyethylene pipe shall include crushed stone as called for on the Plans. Crushed stone shall meet the requirements of Section 150 of the Standard Specifications for Highways and Bridges and M2.01.0.

Geotextile fabric shall be a non-woven, synthetic, permeable material conforming to MassDOT Standard Specification M9.50.0. The fabric shall be resistant to degradation from exposure to ultraviolet light, soil chemicals, mildew, and insects.

METHOD OF MEASUREMENT

Item 252.08 - 8 Inch High Density Polyethylene Pipe and Item 252.10 - 10 Inch High Density Polyethylene Pipe, shall be measured for payment by FOOT in accordance with Section 230 of the Standard Specifications for Highways and Bridges

BASIS OF PAYMENT

Item 252.08 – 8 Inch High Density Polyethylene Pipe and Item 252.10 - 10 Inch High Density Polyethylene Pipe, shall be paid for at the contract unit price per FOOT, in accordance with Section 230 of the Standard Specifications for Highways and Bridges.

ITEM 261.14 SUBDRAIN CLEANOUT EACH

The work under this item shall conform to the relevant provisions of Sections 201, 240, and 900 of the Standard Specifications for Highways and Bridges, as amended, and as follows.

The work shall consist of constructing a subdrain cleanout in accordance with the details shown on the Contract Drawings, as specified herein and as required by the Engineer.

MATERIALS AND CONSTRUCTION METHODS

Materials and construction methods shall conform to the relevant provisions and requirements of Section 240 of the Standard Specifications for Highways and Bridges, as amended, except as follows:

Cement concrete for concrete collars shall be 4000 psi, 1.5 inch, 565 cement concrete as specified in Section 900 of the Standard Specifications for Highways and Bridges, as amended.

Cast iron frames and covers for cleanouts shall be as specified Section 201 of the Standard Specifications for Highways and Bridges, as amended and the following:

Cleanout frames shall be flanged and bolted assembly.

Crushed stone, if required by the Engineer, shall conform to the requirements specified in Subsection M2.01.5, Crushed Stone of Division III Materials, of the Standard Specifications.

METHOD OF MEASUREMENT

Measurement for cleanouts shall be on a unit basis per EACH for the actual number of cleanouts constructed, complete-in-place, in accordance with the Drawings, and as required by the Engineer.

BASIS OF PAYMENT

Payment for Item 261.14. Cleanout shall be at the contract unit price bid, per EACH, installed in place, which price shall be full compensation for all excavation (except Class B Trench Excavation and Class B Rock Excavation) and backfill; for furnishing all materials including: filter fabric, PVC riser, fittings, bricks, and mortar; for setting new cast iron frames and grates; and for furnishing all labor, tools and equipment, and all else in connection therewith and incidental thereto.

ITEM 272.12 12 INCH AND UNDER PIPE REMOVED AND DISCARDED FOOT

The work under this Item shall conform to Section 230 of the Standard Specification and as follows.

MATERIALS AND CONSTRUCTION METHODS

Pipe trench shall be excavated to expose the pipe. The pipe shall then be neatly separated from pipe or structure to remain, removed, and properly disposed of. The trench shall be backfilled with select material and any additional material made up for with Gravel Borrow, Type b.

METHOD OF MEASUREMENT

Pipe to be removed will be measured by the FOOT of actual pipe removed.

BASIS OF PAYMENT

Payment under this Item shall be considered full compensation for all labor materials tools and equipment required to uncover, remove, and dispose of the pipe, and backfill the trench as required by the Engineer.

Gravel borrow required for additional fill shall be paid for under this Item.

ITEM 390. DRINKING FOUNTAIN REMOVED AND DISCARDED EACH

The work under this Item shall be in accordance with the relevant provisions of Section 300 of the Standard Specifications for Highways and Bridges and the following:

DESCRIPTION

Contractor shall remove, cap, and discard existing drinking fountain system components that are to be removed. Removed system components shall be removed in their entirety, including base, supports, hose bibb, drinking fountain head, tubing, etc.

METHOD OF MEASUREMENT

Item 390., Drinking Fountain Removed and Discarded, will be measured per unit Each.

BASIS OF PAYMENT

Item 390., Drinking Fountain Removed and Discarded, will be paid at the contract unit price bid per Each which payment shall include furnishing all required materials, tools, equipment and labor required to remove the existing system, cap the existing system, and discard system components.

ITEM 506.2 CURB CUT WITH ROCK ENERGY DISSIPATER EACH

DESCRIPTION

General

Granite curb cut with rock energy dissipater shall be constructed to the dimensions, shape, and workmanship shown in the Plans.

Positive drainage shall be provided to the curb cuts.

Any finished paving that does not provide positive drainage to these points shall be repaired to the satisfaction of the Owner by the Contractor at no additional expense.

Clean washed River Rock for energy dissipater shall be as described in the Plans. D50 of six inches and no sizes smaller than four inches in diameter and no sizes larger than eight inches in diameter.

A sample of the River Rock must be submitted to Owner for approval prior to installation.

METHOD OF MEASUREMENT

Curb Cut with Rock Energy Dissipater shall be measured for payment by each unit installed.

BASIS OF PAYMENT

Curb Cut with Rock Energy Dissipater shall be paid for at the contract unit price per each. Said price shall include full compensation for all labor, transportation, tools, materials and equipment required for the installation of these items.

ITEM 507.	**MOUNTABLE CURB - STRAIGHT**	**FOOT**
ITEM 507.1	**MOUNTABLE CURB - CURVED**	**FOOT**

Work to be done under this item shall be done in accordance with Subsection 501 of the Standard Specifications and the following:

The Mountable Curb shall be used at reinforced lawn areas and cut to the dimensions shown on the Plans. The curb shall be finished as required for VA curb in section M9.04.1. Where the radius of the curb is 100 feet or less, the curb shall be cut to the required curvature as indicated on the Plans.

METHOD OF MEASUREMENT

Item 507. and Item 507.1. will be measured for payment by the FOOT, complete in place along the front arris line of the curb.

BASIS OF PAYMENT

Item 507. and Item 507.1. will be paid for at the Contract unit price per FOOT, which price shall include all labor, materials, including concrete, if needed, equipment, and incidental costs required to complete the work.

ITEM 513.2 GRANITE EDGING AT BENCH PAD FOOT

DESCRIPTION

Granite Items and all gravel borrow, concrete base and all granite accessories for Granite Landscape Edge and Blocks shall be supplied and placed according to these special provisions. Granite Items and accessories as shown on the Drawings consist of but are not limited to the following components:

Granite Landscape Edge and Blocks (various types)
Gravel Borrow Base
Stainless Steel Dowels and Setting Grout
Mortar Setting Bed and Joints

Reference Standards

Contractor shall comply with applicable requirements of the following codes and industry standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. The following references are used herein and shall mean:

ACI - American Concrete Institute,
AISI – American Iron and Steel Institute,
ASTM - American Society for Testing and Materials,
MHD Standard Specifications - Commonwealth of Massachusetts, Massachusetts Highway Department (formerly Department of Public Works), "Standard Specifications for Highways and Bridges," latest metric or non-metric edition and all Supplemental Specifications,
NBGQA: National Building Granite Quarries Association, Inc., "Specifications for Architectural Granite."
STHP: “Standards for the Treatment of Historic Properties”, current edition, published by the U.S. Secretary of the Interior.

Related Work

Examine all other Items of the Special Provisions and all Drawings for the relationship of the Work under this Item and the Work of other trades. Cooperate with all trades and coordinate all Work under this Item herewith.

Submittals and Shop Drawings

Contractor shall submit all shop drawings, manufacturer's product data, and samples for each Item and type of material herein.

Some of these submittals may be required in other Items. One submittal is acceptable if all components of the Work that apply to the submittal are included.

Design mix submittals and shop drawings: Submit plans, materials description, proportions and mechanical sieve sizes of aggregates as applicable for the following:

Gravel base

Shop drawings of the following showing limits, installation details, layout, sizes and patterns of:

Granite Edging at Bench Pad

Manufacturer's Literature: Submit product data, including details of construction, materials, dimensions, analysis, hardware preparation, color charts and specific finishes, and label compliance. Submit manufacturer's material descriptions and/or installation instructions for the following items:

Granite of all types and uses, provide ASTM test results:

ASTM C-97-83: Absorption and Bulk Specific Gravity,
ASTM C-99-85: Modulus of Rupture (parallel and perpendicular to rift),
ASTM C-170-85: Compressive Strength wet and dry (parallel and perpendicular to rift).

Samples: Furnish to the Landscape Architect the following materials. Approval shall be received prior to Contractor's ordering or delivering any of these materials to the site. Samples shall show the complete range of colors, surfaces, textures and gradations to be supplied for the materials necessary to complete the project (minimum size requirements are indicated). All samples shall be retained by the Landscape Architect and used as a reference to compare to the completed mock-up and final construction:

Granite Edging: one sample Square Corner Block, one sample Square End Block, and one sample Straight Edge specified with thermal finish on top, bullnose edge, and chamfered edge,

Field Mock-Up of Granite Items

Field mock-ups of all granite items shall be installed at locations reviewed by the Engineer and Landscape Architect. Mock-ups shall remain on site until acceptance and may become part of the finish work if acceptable to the Engineer and Landscape Architect. A minimum 4’ length of Granite Landscape Edge with one Square Corner Block, one Square End Block, and one Straight Edge shall be constructed utilizing all materials indicated for the Work.

Mock-ups shall be rebuilt until they conform to the Drawings and these Special Provisions meet the approval of the Engineer and the Landscape Architect. All final construction shall match approved mock-up.

MATERIALS

Granite

Granite for all Benches shall meet NBGQA Granite Building Stone Standard: ASTM C 615, unless otherwise accepted by the Landscape Architect.

Granite shall conform to the grain size, pattern and color range of “Chester” granite, as provided by:

Williams Stone
1158 Lee-Westfield Road, P.O. Box 278
East Otis, MA 01029
Phone: 1-413-269-4544 or 1-800-832-2052
Fax: 1-413-269-6148
Email: granite@williamsstone.com
Website: http://williamsstone.com

or approved comparable, color and performance matched equal. Other granites of same shade and grain size and patterning may be submitted by the Contractor for use only after review and acceptance of the color, grain pattern, and ASTM testing results by the Landscape Architect. Any submitted granite shall meet the overall requirements for new granite specified herein and be acceptable to the Landscape Architect.

Fabrication of all granite components for the granite edging shall conform to the lines and grades indicated on the Drawings and be as indicated on the Shop Drawings approved by the Landscape Architect.

All granite shall be sawcut by an approved fabricator to the dimensions and radii shown on the Drawings and approved Shop Drawings. Bullnose edges shall be cut on stones at locations indicated on the Drawings. All exposed surfaces shall be “Thermal” or “Hydro/Thermal" finished and all exposed edges shall have an eased edge unless otherwise indicated as chamfered or bullnose on the Drawings.

Granite shall not have spalled or cracked surfaces or edges and shall be free from damage, visible blemishes caused during delivery, storage, or construction. Stones with errant color and iron stains, deposits or seams, rust stains, visible iron rods or cores from previous use will be rejected. After fabricated stone is accepted upon delivery to the site, any defects found in the stone during and after installation and before Final Acceptance may be cause for rejection and replacement of stone(s) at General Contractor's expense.

Gravel Borrow Base: Gravel Borrow for Setting Base shall conform to MassDOT Standard Specifications, M Gravel Borrow Type b.

Water: Clean, non-alkaline, and potable.

Dowels: AISI Type 304 Stainless Steel complying with requirements of ASTM A193. Sizes as indicated on the Drawings.

Expansion Joints:

Penetrating protective sealer for granite: Shall be a clear, penetrating silane compound with oil repellency additives that eliminates the penetration of salt, water, deicing chemicals, acids, and oils. Sealer shall not produce any visible color change to stone, after sealer dries. Sealer shall contain not less than 90% alkyl alkoxysilane, with a specific gravity of 0.94 with not less than 380 grams volatile organic compounds per liter.

CONSTRUCTION METHODS

General

All items located on the Drawings shall be fabricated and installed by Contractor as detailed on the Drawings, as per fabricator's written installation procedures and as directed by the Engineer and Landscape Architect. All fabrication and installation work shall be accomplished using the highest standards of workmanship and shall include all excavation, gravel borrow base, labor, transportation and incidentals to make the work complete. Contractor shall install all items level and with plumb vertical alignment, or as indicated otherwise on the Drawings.

Granite edging shall be located where shown on the Contract Drawings. If any location that is discovered to be impossible due to utilities or other obstruction then the Landscape Architect shall be notified immediately to discuss alternate locations.

Granite shall be delivered to the site by the fabricator, unloaded by Contractor and then immediately inspected with the Landscape Architect present to determine acceptability of all granite edging. All granite shall then be protected and stored in a secured location until fabrication is completed. Granite must be protected during transport, delivery, storage, and installation. Any damage or failure such as chipping, scratches, or cracking of any kind in granite before acceptance may be cause for rejection of stone and replacement at Contractor's expense.

Contractor shall coordinate the schedule of delivery of items with granite fabricator and assure that all necessary equipment and hardware arrive at the site in a timely manner to comply with construction schedule and minimize on-site storage time. Items delivered to the site prior to scheduled installation time shall be stored in a secured staging area with all small components retained separately by Contractor. Protect all items from weather, careless handling, construction in the vicinity, vandals or pilferers.

Any incidence of damage, vandalism, or theft of any item during installation shall be reported immediately to the Landscape Architect, remedial action shall be decided, and repairs made to the satisfaction of the Landscape Architect. The Contractor is required to secure all items of the Work from access by the Public until Final Acceptance, unless otherwise permitted by the Landscape Architect.

Obtain inspection and approval of Landscape Architect for all granite edging layout and installation and cleaning. Stake locations of all items in the field for approval by the Engineer and Landscape Architect before commencing any excavation or footing installations.

Project Conditions: Installation of granite items shall follow granite fabricator's guidelines for project conditions during installation. Mortar and grout installation shall conform to the manufacturers' guidelines for the project conditions encountered during installation. Submit to the Engineer a proposed written work schedule and printout of weather forecast from the National Weather Service (for website, enter: www.noaa.gov then enter: city and state where project is located). Obtain Engineer's approval to execute any operation of granite installation after weather forecast printout and schedule is reviewed.

Excavation

Excavate according to MassDOT Standard Specifications Sections 120 – Excavation, and Section 140 – Excavation for Structures, as applicable. If unsuitable bearing material is encountered for the sub-grade, Contractor shall obtain instructions from the Landscape Architect and Engineer before proceeding.

After approval of all shop drawings, execute all excavations in accordance with the specifications proceeding within work area so as to avoid disruption of existing trees and materials to remain or newly installed items. Any items damaged by excavation which are to remain or newly installed shall be replaced or repaired to existing conditions by Contractor at no cost to the Owner. All excavations shall be to the depths indicated based upon finished grades indicated on the Drawings and excavation requirements. The Engineer shall inspect the excavations for geotechnical considerations of the sub-grade material encountered before Contractor continues with installation of gravel borrow base. Sub-base shall be undisturbed or compacted to 95% before gravel borrow is installed.

Gravel Borrow Base

Placement and fine grading of gravel borrow, where indicated on the Drawings, shall be in accordance with Item 151-000. Engineer shall approve gravel base before installation of any granite pieces.

Granite Installation

Contractor shall coordinate all trades, granite fabricator, and gravel borrow installer to insure that Granite Edging is installed as designed, as shown in the Contract Drawings, approved Shop Drawings, and as specified herein.

Granite shall be fabricated, shipped, handled, and installed only by skilled stone masons and stone fitters.

Preparation of Stone: Clean and dry all stone and surfaces before installing. Use only mild cleaning compounds and brushes that do not scratch, abrade, or otherwise damage the surfaces.

All granite items for edges shall be shop cut and pre-drilled in the Shop to verify dimensions before delivery to the site. All dimensions shall be verified by the stone supplier in the field, and shop drawings and samples of fabricated granite approved by the Landscape Architect before remainder of stone is fabricated. Contractor shall coordinate stone fabrication, excavation and gravel borrow base.

Granite fabricator shall clearly label and number stone pieces, with accompanying key drawings and locations, for installation in the field.

Construction tolerances for granite items shall be the following:

A. All granite items shall be plumb. Maximum variation shall be 1/4 inch in 10 feet vertical.
B. Variation from horizontal shall not exceed 1/2 inch in 20 feet, or 3/4 inch in 40 feet. Slopes of granite paving shall be as indicated on the Drawings.
C. Edge alignments shall not exceed 1/8-inch offset of adjacent panels across any joint unless indicated in the Drawings.

Set granite to comply with requirements of the Contract Drawings and approved Shop Drawings. Install all specified dowels indicated or necessary to secure stonework in place. Shim and adjust anchors, supports, and accessories to set stones with uniform joints, edges and faces aligned according to specified tolerances and shown in the Drawings.

Grout shall not be used for setting dowels installed in cores of Granite Edging. Joints between stones shall be installed butt-tight and shall not be grouted, but shall remain un-grouted.

Granite Sealer

All granite items shall be protected and cleaned after installation. All granite shall be protected with application of clear penetrating silane sealer per manufacturer's instructions for appropriate environmental conditions, mortar curing time, surface preparation, applications, equipment, and protection after application.

Completed Granite Landscape Edges and Square Corner and Square End Blocks shall be level and plumb and shall function as designed.

Completed Granite Setts shall be at the grades indicated on the Drawings and function as designed.

COMPENSATION

METHOD OF MEASUREMENT

Measurement for Item 513.2 - Granite Edging at Bench Pads shall be per FOOT, complete in place. Gravel Borrow base, pinning dowels in the joints will not be measured separately, but will be included in the item.

BASIS OF PAYMENT

Payment for the Work of this Item will be made at the Contract unit price per FOOT, complete in place.

Payment will include all labor, delivery, and materials required to complete the installation of Granite Edging at Bench Pads including but not limited to excavation, materials, labor, fine grading and compacting of sub-base, concrete base including transition slabs, installation and fine grading of gravel borrow, installation of granite pieces, grouting dowels in place, mortar joints, expansion joints, cleaning granite and applying sealer, as indicated. Permitting and protection of personnel, passers-by and land/water from contamination of hazardous material(s) and legal disposal of surplus materials will be included in these Items.

ITEM 655. CEDAR RAIL FENCE FOOT

Work under this item consists of furnishing and installing Cedar Rail Fence at the locations specified on drawings or as required by the Engineer.

DESCRIPTION

Submittals

Prior to ordering materials, submit information to Landscape Architect for approval as follows. Do not order materials until Landscape Architect's approval has been obtained. Delivered materials shall closely match the approved shop drawings.

Submit manufacturer's material descriptions, product data, color charts with specific finishes, and installation instructions for Cedar Rail Fence

Cedar Rail Fence to match existing fence on site. Verify all dimensions of existing fence including sizes of posts, rails and fence and rail height and submit dimensioned shop drawings for materials, material sizes, design, layout, and installation for review and approval of Cedar Rail Fence including dimensioned plans, sections, and details.

Quality Assurance

Contractor shall have at least five (5) years of experience in Landscape Work similar in materials, design, and extent to that indicated for this project and with a record of successful landscape establishment. Installer shall maintain an experienced supervisor on the project site during all times that landscape construction is in progress. Provide written qualification data for firms and persons to be responsible for Work, to demonstrate their capabilities and experience. Include lists of completed projects, with project names, addresses, phone numbers, and names and address of Landscape Architect or Engineers and clients.

Contractor shall submit verification to the Landscape Architect, which states that all proposed manufacturers have produced products of a similar nature and quality to that which is specified and that each manufacturer is capable of producing the quantity required by the contract within the time allocated in the project schedule.

Contractor shall conduct pre-landscape construction conference at Project site as directed by the Landscape Architect, to review landscape construction procedures, site conditions, and submittal requirements required in the Work of this Section, before any products are submitted for review and approval, or landscape construction commences.

Product Handling and Storage

Take all necessary precautions to protect all items from moisture, chipping, cracking, or other damage, during the transportation of these materials to the awarded contractor, unloading and storage at yard or site. After delivery take all necessary precautions to prevent all items from chipping, cracking, construction dust and debris, or damage of any kind. Store materials under waterproof covers on planking clear of ground and protect from handling damage, dirt, stains, water and wind. Damaged units will not be allowed to be installed, and should any damaged units be found in constructed work, such units shall be removed immediately and replaced with new units, and the Contractor shall assume all expenses incurred.

Stored materials shall be adequately protected against moisture by (1) stacking in such a manner as to allow a complete circulation of air under each stack, and (2) covering each stack, top and sides with a waterproof paper or membrane. Coverings shall remain in place at all times, when not working from the particular stack.

Warranty

Cedar Rail Fence shall be free from defects in material and/or workmanship for a period of three years from the date of final acceptance.

MATERIALS

Cedar Rail Fence

Wood posts and rails shall be sawn structural lumber made of Northern White Cedar or equivalent as approved by the Engineer.

All fence posts shall be treated with a waterborne wood preservative suitable for the intended use. The preservative shall be applied to all sides of the posts and extending for a minimum distance of 32” from the bottom of the post. Rails and posts shall be cut to length. Holes for rails shall be pre-cut.

Fence sections shall be 12’ – 0” in length with sawn posts and rails matching the look of the existing fence. Fences shall be 30” exposed height with one rail. The bottom of the rail shall be set at 20” above grade.

Gravel Borrow Base

Gravel Borrow for Base shall conform to MassDOT Standard Specifications, M1.03.0 Gravel Borrow Type b.

CONSTRUCTION METHODS

Excavation

Contractor shall excavate to the lines and grades shown on the project grading plans. Contractor shall take precautions to minimize over-excavation. Over-excavation shall be filled with specified and approved compacted infill material as reviewed by the Landscape Architect or Engineer.

Contractor shall verify location of existing structures and utilities prior to excavation and to contact DIGSAFE before construction. Contractor shall ensure all surrounding structures are protected from the effects of excavation. Excavation support, if required, is the responsibility of the Contractor.

General

Cedar Rail Fence shall be fabricated and installed by the Contractor as detailed on the Drawings, as per manufacturers' written installation procedures and as reviewed by the Landscape Architect or Engineer. Contractor shall schedule delivery of items and all necessary equipment and hardware so as to arrive at the site in a timely manner to comply with construction schedule and minimize on-site storage time. Protect all items from weather, careless handling, and construction in the vicinity, and from vandals or pilferers.

Mark locations of all items in the field for approval by the Landscape Architect or Engineer before commencing installations.

Contractor shall install all items level and with plumb vertical alignment, or as indicated otherwise on the drawings.

Any incidence of damage, vandalism, or theft of any item during installation shall be reported immediately to the Landscape Architect or Engineer, remedial action shall be decided, and repairs made to the satisfaction of the Landscape Architect or Engineer. The Contractor is required to secure all items of the Work from access by the Public until Final Acceptance, unless otherwise permitted by Owner.

Cedar Rail Fence Installation

Cedar Rail Fence shall be installed at the locations and according to the details as shown on the Plans. Wood fence posts shall be set plumb in augered holes, backfilled, as required, and compacted to the lines and grades shown on the Plans. Posts shall not be driven.

The Contractor is cautioned that within the limits of this project, buried utilities, which may be energized, may be present.

The Contractor shall be required to furnish extra length posts at transition areas or where field conditions warrant. These posts shall be of such length that the minimum depth in the ground, as shown on the Plans, is maintained.

Cedar Rail Fence shall be installed with a continuous horizontal and vertical line parallel with finish grade to the dimensions indicated on the Plans.

Where preservative-treated members must be cut during erection, apply a field-treatment preservative to comply with AWPA M4. Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.

Acceptance

Cedar Rail Fence shall be clean, undamaged, completely and securely installed as shown in the Drawings and in approved field mock ups, adjusted as required in the field with review by Landscape Architect as conditions of acceptance.

Guarantee

Cedar Rail Fence shall be guaranteed against defects in installation for three years after final acceptance. The Contractor shall replace, repair, recoat or otherwise make satisfactory to the Owner any unacceptable equipment defects due to improper installation at no additional cost to the Owner.

COMPENSATION

METHOD OF MEASUREMENT

Item 655. Cedar Rail Fence will be measured in place and paid by the FOOT as measured from center to center of end posts.

BASIS OF PAYMENT

Work under Item 655. CEDAR RAIL FENCE will be paid at the contract bid price per FOOT, which payment shall include all labor, materials, excavation, grading, fine grading, compaction, base materials, freight, equipment, and miscellaneous items necessary to complete the Work as specified and as shown on the Drawings.

ITEM 655.3 BICYCLE SAFETY RAIL FOOT

Work shall consist of furnishing and installing timber rail fence fastened to wood posts at locations where indicated on the Plans and as required by the Engineer in conformance with the dimensions and details shown on the Plans and the relevant provisions of Section 600 of the Standard Specifications and the following:

MATERIALS

All timber posts and rail components shall conform with the following:

- Commercial lumber grade No. 1 or better after treatment;
- AASHTO M 133;
- All timber shall be Southern Yellow Pine, seasoned and pressure treated as specified herein. Posts shall be square with nominal dimensions as indicated on the Plans, surfaced four sides (S4S) and shall conform to the requirements of the "Standard Grading Rules for Southern Yellow Pine" of the Southern Products Association. Variations in the size of any dimension shall not be more than + ¼"
- All timber components shall be pressure treated with waterborne preservative according to requirements of AWPA U1. Use Category UC3b for exterior construction not in contact with the ground and Category UC4a for items in contact with the ground.
- Do not use preservative chemicals containing arsenic or chromium. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not contain colorants, bleed through, or otherwise adversely affect finishes;
- All timber components shall be fabricated (including but not necessarily limited to cutting, drilling, dapping and chamfering) prior to treatment.
- Use a process that includes water-repellent treatment.
- After treatment, redry materials using a Kiln or air dry to a maximum moisture content of 19%;
- Mark treated materials with treatment quality mark of an inspection agency certified by the American Lumber Standard Committee's (ALSC) Board of Review.
- Pressure treated wood shall be marked in accordance with AASHTO M133 standards.
- Round head bolts including nuts and washers shall be sized as indicated and hot dipped galvanized
- Damaged post and rail elements will not be accepted.

CONSTRUCTION METHODS

Bicycle Safety Rail shall be installed at the locations and according to the details as shown on the Plans. Wood rail fence posts shall be set plumb in augered holes located to miss MSE Wall Reinforcing Tiebacks, backfilled with material shown on the Contract Drawings, as required, and compacted to the lines and grades shown on the Plans. Posts shall not be driven.

The Contractor is cautioned that within the limits of this project, buried cables for illumination or utilities, which may be energized, may be present.

The Contractor shall be required to furnish extra length posts at transition areas or where field conditions warrant. These posts shall be of such length that the minimum depth in the ground, as shown on the Plans, is maintained.

Rails shall be butt joined together and securely bolted with lag bolts to the posts.

Carriage bolts shall be countersunk into smaller predrilled holes. Finish head of carriage bolt shall be round and have less than 1/8 inch of head protruding above the face of rail.

Where preservative-treated members must be cut during erection, apply a field-treatment preservative to comply with AWPA M4. Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.

METHOD OF MEASUREMENT

Bicycle Safety Rail shall be measured by actual fence installed and accepted from outside to outside of end posts approximately parallel to the ground by the foot.

BASIS OF PAYMENT

Payment will be made at the contract unit price per FOOT, complete in place. This payment shall be considered as full compensation for all labor, tools, equipment and materials, including all required excavation, backfill, wire mesh, fasteners, bolts, nuts, and washers necessary to complete the work as required by the Engineer.

ITEM 655.4 ORNAMENTAL FENCE FOOT

The work under this Item shall consist of fabricating and installing new Ornamental Fence, and all preparation work required for the installations. The work shall also include protection and restoration of any damaged adjacent surfaces, materials, or plantings, providing approved protective measure for the safety of workers and pedestrians and related items as indicated by the Engineer and/or as specified herein.

The work under this Item shall conform to the Standard Specifications, Section 960, and the Contractor shall also comply with applicable requirements of the following codes and industry standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. The following references are used herein and shall mean:

A. ASTM - American Society for Testing and Materials:
A27 Steel Castings, carbon, for General Application
A36 Structural Steel
A47 Ferritic Malleable Iron castings
A48 Grey Iron Castings
A53 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
A123 Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strips
A153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware
A167 Stainless and Heat-Resisting Chromium Nickel Steel Plate, Sheet, and Strip
A307 Carbon Steel Externally Threaded Standard Fasteners
A312 Seamless and Welded Austenitic Stainless Steel Pipe
A325 High Strength Bolts for Structural Steel Joints
A386 Zinc Coating (Hot-Dip) on Assembled Steel Products
A666 Austentenitic Stainless Steel, Sheet, Strip, Plate, and Flat Bar

B. AWS - American Welding Society:
D1.1 Structural Welding Code – Steel

C. AASHTO- American Association of Slate Highway and Transportation Officials

D. ANSI/NFPA - American National Standards Institute. National Fire Protection Act

E. SSPC - Steel Structures Painting Council.

Examine all other Items of the Special Provisions and Plans for the relationship of the Work under this Item and the Work of other trades. Cooperate with all trades and coordinate all Work under this Item herewith.

Environmental and Hazardous Material Control: All metal components and coatings shall be fabricated and applied under environmental and job conditions according to all relevant environmental code requirements and by requirements of these Specifications. Contractor shall obtain all necessary and relevant permits before conducting any work. Provide approved schedule for protection of personnel, passers-by, land/water environment from contamination by all caustic and/or hazardous materials used in the operations and methods of construction indicated in this Section.

Exposed surfaces shall have smooth finishes and sharp, well defined lines and arises. Sections shall be well formed to shape and size with sharp lines and angles; curved work shall be sprung evenly to dimensioned radii curves. Castings shall have sharp corners and edges, and shall be clean, smooth, and true to pattern. Welding shall be in accordance with the AWS D1.1 Structural Welding Code - Steel. All welding, except as otherwise indicated, shall extend the entire length of joints. All welded face joints shall be ground flush and smooth. All welds shall be watertight. Ornamental metalwork shall be cut, drilled, countersunk, and tapped as required for the attachment of other work as shown on the Plans or when instructions for such work are given on the shop drawings. Ornamental 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.

Individual steel pieces shall be saw cut and carefully fit together. All connections shall be fully welded and ground flush and smooth. All fabricated steel items shall be fine sanded throughout to produce a high standard of surface smoothness. All surfaces and connections shall be without visible grinding marks, surface differentiation or variation.

Galvanizing Quality: Conform to the galvanizing criteria under “Materials” herein. Galvanized surfaces damaged by welding or other causes shall be wire brushed to remove all loose or cracked zinc coating and re-galvanized with a 95 percent zinc cold galvanizing coating prior to finishing.

Provide labels to each replacement-in-kind piece to facilitate field assembly. Assemble the new components to the greatest extent possible in the shop with minimum field assembly required.

SUBMITTALS

Permits: Copies of all required and relevant permits shall be submitted to the Engineer prior to conducting any of the work in this Item.

Material samples: Submit samples for the following items before ordering or installation:

A. All rail components (one unit)
B. Paint sample (primer and two coats finish paint indicating final color and surface finish on one foot typical pipe for fence)

Manufacturers' product literature: Submit manufacturers' product data and information on all components, including, but not limited to:

A. Iron casting
B. Steel Pipe
C. Galvanizing process and certificate
D. Paint manufacturer's literature for primer and finish paint.

Shop Drawings

A. Contractor shall submit shop drawings of every new Item. Include dimensioned drawings and schedules of all components with dimensions verified in the field where appropriate. Drawings shall show size and thickness of each member, type of material, method of connection and assembly, fabrication and erection tolerances for all connections, cuts, holes, bolts, welds, galvanizing and painting, and relation to finished grade along bottom of component.

B. Verify all dimensions in the field, if required for fabrication to meet those conditions, before issuing shop drawings for review by Engineer.

Galvanizing Certification:

A. Furnish to the Engineer notarized certificates of compliance with ASTM and AASHTO requirements for each item specified in this section.

B. Each certificate shall be signed by the galvanizer and fabricator and list a detailed description of all material and methods used, including shop conditions followed.

C. Certification shall state that the galvanizing is at or above conformance with this Section.

Warranty:

Provide warranty that all materials furnished and work executed under this Section complies with Specifications and authorized changes.

Structural Certification:

Provide written certification that structural requirements meet or exceed specified requirements included in "Performance Requirements" herein.

Schedule for Environmental and Hazardous Material Control: Provide to Engineer for approval a written schedule indicating:

A. Any and all proposed operations and methods of construction that results in caustic or hazardous materials and/or byproducts that come in contact with personnel, passers-by, or the land/water environment.

B. All action and/or equipment that Contractor proposes to utilize as remedial.

Qualifications of Painter:
Contractor shall submit verification to the Engineer stating, at a minimum, the following:

A. Painter is capable of producing the quantity of completed product required by the contract within the time allocated in the project schedule.

B. Metal Fabricator shall have demonstrated experience in successfully producing metal fabrications similar to the fencing specified in comparable projects.

C. Welders shall be certified and shall have passed the AWS Qualification Test within the past 12 months.

Mock-Ups:
Provide the following types of mock-ups. Mock-ups shall show the proposed complete new fabrication, including but not limited to all ground welds, fastenings, coatings and finishes.

A. Ornamental Fence (to match existing railing on Moody Street bridge over the Charles River) – One Section

Redo sample installation as many times as necessary for approval before fabrication of remainder of railing. Construct all subsequent rail fabrications to conform to approved sample mock-up.

Approved sample mockup shall become part of the completed Work for the entire item.

Performance Requirements:
All steel and cast iron components and completed panels shall conform to the "Example Panel" where indicated on the Plans. All panels shall meet the Structural Performance for New Assemblies: provide completed assemblies which, when installed, comply with the following minimum requirements for structural performance without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each respective component of each metal fabrication and record testing data.

A. Rails: Rails shall be capable of withstanding at minimum the following loads applied as indicated: Concentrated load of 200 pounds applied at any point, non-concurrently, vertically downward or horizontally, and uniform load of 50 pounds per linear foot applied non-concurrently, vertically downward, or horizontally.

B. Panel: Panels shall be capable of withstanding uniform side loads of 50 pounds per linear foot without compromising post anchorage. Panels shall also be capable of withstanding concentrated side loads of 200 pounds applied at any point, non-concurrently.

C. Post Connection: Ensure that side rail/flange assembly provides maximum support (overlap) at post sleeves and still allow for line and grade adjustments, as well as expansion, at joint during field assembly.

METAL MATERIALS

All metal used in the fabrication indicated in this Section shall conform to the following specifications:

A. Steel Pipe: conform to ASTM A 53, Schedule 80. As shown on the Plans, or as finalized in shop drawing structural calculations.

B. Steel Bar Stock: solid steel flat bar stock shall conform to ASTM A36. As shown on the Plans, or as finalized in shop drawing structural calculations.

C. Stainless Steel anchor bolts, elements and hardware shall conform to ASTM A666. AISI Type 304 conforming to the requirements of ASTM A193.

D. Miscellaneous Bolts, Screws, and Fasteners: ASTM A307 (smaller than 5/8 inch) and ASTM A325 (greater than 5/8 inch).

1. Bolts and Nuts: Regular hex Head extending 1/2 inch min. beyond nut when tight.
2. Machine Screws: Flat Head, square drive.
3. Plain Washers: Round.
4. Lock Washers: Helical Spring type.

E. Cast Iron: ASTM A 47, or ASTM A 48, Class 30 minimum. Components shall match existing, according to the Plans and as approved by the Engineer. Iron castings shall be primed and painted as specified herein, but shall not be galvanized.

F. Galvanizing: New steel components shall be hot-dipped galvanized steel and shall conform to dimensions and shapes as indicated on the Plans, or per approved shop drawings. Components shall be primed and painted as specified herein. Cast iron components are not to be galvanized. All new steel to be galvanized shall be hot-dipped galvanized after fabrication, in accordance with the Standard Specifications and Supplemental Specifications, M7.10.0 and as indicated herein. Pickle steel surfaces before hot-dipped galvanizing in accordance with SSPC-SP8 - Pickling.

G. General Surface Preparation:

1. Treatment of Steel in the Field: SPC-SP1 solvent cleaning plus cleaning-SSPC-SP3 power tool cleaning.
2. Treatment of Steel in the Shop: SSPC-SP1 solvent cleaning plus cleaning-SSPC-SP6 commercial blast cleaning.

3. Treatment of Galvanized Steel (or Aluminum) in the Shop: SSPC-SP1 solvent cleaning plus cleaning* SSPC-PC-PT3 basic zinc chromate vinyl butyryl washcoat. Coating shall meet MassDOT Specifications M7.04.10.
   *alternate to wash primer - use in field: SP-1 to clean
   Prime with TT-P-641G, Type II. Final Coats: IT-E-489F.

Paint for Metal Components, including anchor bolts

All surface preparation, application and touch-ups shall conform to recommendations of the Manufacturer.

First coat (2.5 to 3.0 mils DFT): Tnemec 66 Hi-Build Epoxoline Primer, DuPont 823 HP; or Carboline 190 High Build Epoxy Primer, or approved equivalent.

Second and third coats: Aliphatic Polyester Polyurethane (4 mil thickness), for a total dry thickness of 8 mils. Coating materials of primer, intermediate, and finish paint coats shall conform to quality standards of Tnemec Co., Inc., or approved equivalent. Second and third (finish) coat color shall be black (Federal Standard Color # 27038) and have a gloss finish. All surface preparation, application and touch-ups shall conform to recommendations of the Manufacturer.

All hardware and anchor bolts shall be painted.

CONSTRUCTION METHODS

Metal shall be fabricated and fastened as indicated on the Plans or per approved shop drawings. All site furnishings shall be installed in a level, plumb condition, true to the lines and grades shown on the Plans.

Welding procedures shall conform to the current standards of the AWS D1.1 - AWS 01.4, as applicable. All welds shall be as designated on the Plans or shop drawings and shall be ground smooth and flush to a neat finish. All welds shall be watertight and care shall be taken to minimize distortion due to heat. Metal components shall not be galvanized or painted before welding. Cast Iron components shall not be welded, but affixed by an approved mechanical fastener.

Contractor shall be responsible for timing the delivery of all items so as to minimize on-site storage time prior to installation. All stored materials and items shall be protected from weather, careless handling and vandalism.

Contractor shall coordinate and furnish anchorage devices, setting drawings, diagrams, templates, instructions, and directions for installation of sleeves, bolts and other miscellaneous items to be embedded or attached to concrete work. Fabricator shall provide all coordination required with installers to ensure proper assembly and erection in the field.

The Contractor shall undertake this work in consultation with the Engineer to ensure that the owners and operators of impacted facilities are informed of the intent and layout of the finished work.

The Contractor shall prepare and submit shop drawings of the proposed rail layout, based on the surveyed dimensions and coordination previously completed, to the Engineer for approval. Rail layout shall conform to the following guidelines:

1. Standardized panel dimensions shall be used to the maximum extent possible.
2. Panels shall be of non-standard, but equal, length on each side of a bearing change, or opening. Non-standard panel length shall be less than standard panel length. The typical picket and metal ring spacing shall be used to establish the length of nonstandard panels.
3. There shall be no spaces within the rail or between the rail and any other new or existing structures or the concrete cap where a four-inch (4 inch) sphere passes. The minimum height of the rail shall not be less than 3'-6" at any location as measured from the highest point of the adjacent walking surface (or conform to current code requirements).

All metal components shall have surface preparation using specified solvents and mechanical means. Solvent manufacturer's recommended procedures shall be followed for surface preparation.

Shim all bolt connections as required and secure bolts. Exposed bolts shall be fastened with an accepted semi-permanent adhesive to protect against vandalism.
Contractor shall handle, pack, and ship items to avoid damage to the finish. Upon arrival at job site the Contractor shall take precautions while storing and moving to avoid damage to the finish. If damage occurs, suitable touch-up material shall be readily available to repair the damage immediately.

Individual steel pieces to be welded shall be saw cut and carefully fitted together. All connections shall be fully welded and ground flush and smooth. All fabricated steel items shall be fine sanded throughout prior to finishing to produce a high standard of surface smoothness. All surfaces and connections shall be without visible grinding marks, surface differentiation or variation.

Brace work rigid and secure to surrounding construction. Provide temporary bracing or anchors as required.

Field verify and adjust sections of the work prior to anchoring to ensure matching alignments and stability of members at abutting joints. Report to and submit field revision sketches to the Engineer for approval before installing any assemblies and field fittings that do not match expected conditions that will require field cutting, drilling, and/or alignments that do not match the Plans and design criteria specified.

Clean surrounding concrete surfaces and roughen if required to improve bonding. Clean bottom surface of leveling plates immediately prior to installation. Take tightening bolts to maintain pavement Integrity without cracking or breaking. All paving damaged during fence installation will be required to be repaired to acceptable condition at as required and approved by the Engineer.

Panels (Fixed): Install concrete caps or retaining walls as indicated on the Plans with anchorage plate and bolts in proposed locations, align post plates, set panels plumb and level, brace as required, secure anchor bolts using metal shims if required.

Touch-up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Touch-Up prime and paint following shop priming and painting requirements specified to required preparation, minimum dry film thicknesses of specified coatings, number of coats, environmental conditions, and drying time between coats.

All rails shall be cleaned after erection with a method approved by the Engineer.

METHOD OF MEASUREMENT

Ornamental Fence shall be measured by the foot.

BASIS OF PAYMENT

Ornamental Fence will be paid at the contract unit price per linear foot complete in place and all costs in connection therewith shall be included. Payment shall include all labor and materials required to fabricate, finish, deliver, and install the respective items complete in place and accepted, including but not limited to gates, fasteners, accessories, cleaning, priming and two finish coats of paint.

ITEM 686. RESET MEMORIAL PLAQUE EACH

ITEM 686.2 CAMBRIDGE BOAT CLUB SIGN REMOVED AND RESET EACH

DESCRIPTION

General

The Work of these items consist of providing fully installed Memorial Plaque and Cambridge Boat Club Sign as indicated on the Contract Drawings and/or as specified herein and includes, but is not limited to, the following:

1. Removing, salvaging, stockpiling and resetting existing Memorial Plaque; Removal and legal disposal of any existing Memorial Plaque footings or base materials.

2. Removing, salvaging, stockpiling and resetting existing Cambridge Boat Club Sign; Removal and legal disposal of footings under items to be removed and stored for reuse

Related Work

Examine all other Items of the Special Provisions and all Drawings for the relationship of the Work under this Item and the Work of other trades. Cooperate with all trades and coordinate all Work under this Item herewith.

Samples and Submittals

The Contractor shall submit proposed procedures, methods, materials and location(s) of storing, protecting and securing the Memorial Plaque and Cambridge Boat Club Sign for review by DCR the Engineer and the Landscape Architect before construction. The Contractor shall photo document after light cleaning each and every item to be salvaged, stored and reset from every angle in minimum 8” x 10” photos (2 digital copies, one for the Engineer and one for themselves) with notes on conditions of the (1) Memorial Plaque and (1) Cambridge Boat Club Sign before removing, salvaging, protecting, and storing in secure location.

At least 15 days prior to installation, the Contractor shall notify the Landscape Architect of when the work will occur. Contractor to stake proposed locations for Reset Memorial Plaque and Cambridge Boat Club Sign for review and approval by Landscape Architect prior to final installation.

References

Where references are made in these Specifications to standard specifications, codes, etc., of the U.S. Government, State or local authorities, or professional and industrial societies and associations, the applicable portions thereof shall govern as fully as if they were recited at length herein, and shall include all revisions thereto issued as of the date of the Notice to Contractors pertaining hereto.

AASHTO: American Association of State Highway and Transportation Officials

MassDOT: "Standard Specifications for Highway and Bridges," Massachusetts Highway Department (formerly Massachusetts Department of Public Works), Commonwealth of Massachusetts, latest edition and all supplements.

MATERIALS

Memorial Plaque and Cambridge Boat Club Sign

Memorial Plaque and Cambridge Boat Club Sign shall be furnished from on-site existing material and be placed where indicated on Contract Drawings to be removed, stockpiled and reset.

Plaques and Signs shall be protected from damage during construction and shall be clean and unblemished as a condition of acceptance.

Gravel Borrow Base

Gravel Borrow for Base shall conform to MassDOT Standard Specifications, M Gravel Borrow Type b.

CONSTRUCTION METHODS

Inspections

Obtain inspection and approval of Landscape Architect for all subgrade preparation for Memorial Plaque and Cambridge Boat Club Sign prior to installing work and again, after layout and then upon installation.

Removal, Handling and Storage

Take all necessary precautions to protect all items from chipping, cracking, or other damage, during the removal and storage of these materials on the site. Damaged units will not be allowed to be installed.

Any damage that occurs to these items during the Contract period either in removal, salvaging, storing and/or resetting is the responsibility of the Contractor and will require replacement in kind at no cost to the Owner.

Installation

Remove Memorial Plaque and Cambridge Boat Club Sign and place each item on a heavy-duty hardwood pallet capable of supporting the weight of the item without deflecting. Memorial Plaque and Cambridge Boat Club Sign shall then be cleaned with a Tack Cloth, covered with Breathable Dust Cloth and placed on a pallet as specified.

Removed Memorial Plaque and Cambridge Boat Club Sign shall be protected and stored at a location approved by DCR and reviewed by the Engineer or Landscape Architect before construction and a protective locked secure fence for Stacked Items shall be installed around the pieces until they are reinstalled and accepted.

Memorial Plaque and Cambridge Boat Club Sign items shall be reset plumb and level in gravel base course as shown on the Contract Documents.

METHOD OF MEASUREMENT

ITEM 686. RESET MEMORIAL PLAQUE will be measured per EACH, complete in place as indicated on the Drawings, including all materials, excavation, backfilling, and miscellaneous items necessary to complete the Work as specified and as shown on the Drawings.

ITEM 686.2 CAMBRIDGE BOAT CLUB SIGN REMOVED AND RESET will be measured per EACH, complete in place as indicated on the Drawings, including all materials, excavation, backfilling, and miscellaneous items necessary to complete the Work as specified and as shown on the Drawings.

BASIS OF PAYMENT

Payment for Reset Memorial Plaque will be made at the Contract unit price per each, which price shall include removal, stockpiling, protection, excavation and backfilling, legal disposal, materials, fine grading, grading and compaction, all labor, equipment and transportation required to complete the re-installation to the satisfaction of the Engineer and to conform to the Drawings and Specifications.

Payment for Cambridge Boat Club Sign Removed and Reset will be made at the Contract unit price per each, which price shall include removal, stockpiling, protection, excavation and backfilling, legal disposal, materials, fine grading and compaction, all labor, equipment and transportation required to complete the re-installation to the satisfaction of the Engineer and to conform to the Drawings and Specifications.

ITEM 697.1 SILT SACK EACH

GENERAL

Work under this item shall conform to the relevant provisions of Sections 227 and 670 of the Standard Specifications and the following:

The work under this item includes the furnishing, installation, maintenance and removal of a reusable fabric sack to be installed in drainage structures for the protection of wetlands and other resource areas and the prevention of silt and sediment from the construction site from entering the storm water collection system. Devices shall be ACF Environmental (800)-448-3636; Reed & Graham, Inc. Geosynthetics (888)-381-0800; The BMP Store (800)-644-9223; or approved equal.

CONSTRUCTION METHODS

Silt sacks shall be installed in retained existing and proposed catch basins and drop inlets within the project limits and as required by the Engineer.

The silt sack shall be as manufactured to fit the opening of the drainage structure under regular flow conditions, and shall be mounted under the grate. The insert shall be secured from the surface such that the grate can be removed without the insert discharging into the structure. The filter material shall be installed and maintained in accordance with the manufacturer's written literature and as required by the Engineer.

Silt sacks shall remain in place until the graded areas have become permanently stabilized by vegetative growth. All materials used for the filter fabric will become the property of the Contractor and shall be removed from the site.

The Contractor shall inspect the condition of silt sacks after each rainstorm and during major rain events. Silt sacks shall be cleaned periodically to remove and disposed of accumulated debris as required. Silt sacks, which become damaged during construction operations, shall be repaired or replaced immediately at no additional cost to the Department.

When emptying the silt sack, the Contractor shall take all due care to prevent sediment from entering the structure. Any silt or other debris found in the drainage system at the end of construction shall be removed at the Contractor's expense. The silt and sediment from the silt sack shall be legally disposed of offsite. Under no condition shall silt and sediment from the insert be deposited on site and used in construction.

All curb openings shall be blocked to prevent stormwater from bypassing the device. All debris accumulated in silt sacks shall be handled and disposed of as described in Section 227 of the Standard Specifications.

METHOD OF MEASUREMENT

Item 697.1, Silt Sack, will be measured for payment per each, complete in place.

BASIS OF PAYMENT

Item 697.1, Silt Sack, will be paid for at the Contract unit price per each, complete in place, which price shall include all labor, materials, equipment and incidental costs required to complete the work. No separate payment will be made for removal and disposal of the sediment from the insert, but all costs in connection therewith shall be included in the Contract unit price bid.

ITEM 698.3 GEOTEXTILE FABRIC FOR SEPARATION SQUARE YARD

DESCRIPTION

Work under this Item shall include furnishing and installing geotextile fabric for subbase separation at modified rockfill areas, as shown on the Plans. Work under this Item shall conform to the provisions of Division III, Section M9.50.0 Type III of the Standard Specifications.

MATERIALS

The geotextile fabric used is required to be listed on the Quality Control Materials Ledger (QCML), which is approved for the prescribed application.

METHOD OF MEASUREMENT

Geotextile Fabric for Separation will be measured by the SQUARE YARD, without measurement of overlap, complete in place.

BASIS OF PAYMENT

The quantity, determined as provided above, will be paid for at the contract price per SQUARE YARD. Such price and payment shall be full compensation for all the work and materials required and specified under this Item to complete the work.

ITEM 698.5 NON-WOVEN GOETEXTILE FABRIC (GI) SQUARE YARD

DESCRIPTION

General

Non-woven geotextile shall have the following properties at a minimum. Non-woven Geotextile shall be Mirafi 180N, US Fabrics US205NW, Propex Geotex 801, Thrace-LINQ 180EX, or approved equal.

1. Minimum flow rate 90 gal/min/ft² (ASTM D4491)
2. Minimum grab tensile strength 200 lbs (ASTM D4632)
3. Minimum CBR puncture strength 300 psi (ASTM D6241)
4. Minimum tear resistance 80 lbs (ASTM D4533)
5. Minimum UV resistance 70% retained strength (ASTM D4355)

METHOD OF MEASUREMENT

Geotextile Fabric for Separation will be measured by the SQUARE YARD, without measurement of overlap, complete in place.

BASIS OF PAYMENT

The quantity, determined as provided above, will be paid for at the contract price per SQUARE YARD. Such price and payment shall be full compensation for all the work and materials required and specified under this Item to complete the work.

ITEM 701.3 CONCRETE LANDSCAPE PAVING SQUARE YARD

DESCRIPTION

General

Examine all other Items of the Standard Specifications, Standard Special Provisions and Special Provisions for requirements that may affect the Work of these Items whether or not such work is specifically mentioned.
The Work under these Items shall conform to the relevant provisions of the Standard Specifications, except as amended and supplemented as indicated on the Contract Drawings, specified herein and as directed by the Engineer. Item for Cement Concrete Landscape Pavement shall conform to the relevant portions of Section 476 – CEMENT CONCRETE PAVEMENT of the Standard Specifications.

Referenced Standards

Contractor shall comply with applicable requirements of the following codes and industry standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. The following references are used herein and shall mean:

ASTM - American Society for Testing and Materials,

AASHTO - American Association of State Highway and Transportation Officials,

ACI – American Concrete Institute,

Standard Specifications – "Standard Specifications for Highway and Bridges", MassDOT/Highway (formerly Massachusetts Highway Department, and Department of Public Works), Commonwealth of Massachusetts, latest edition and all Supplements.

Related Work

Examine all other Items of the Special Provisions and all Drawings for the relationship of the Work under this Item and the Work of other trades. Cooperate with all trades and coordinate all Work under this Item herewith.
Refer to the following related items which may include but are not limited to:

A. Item 513.2 – Granite Edging at Bench Pad,

B. Item 707.1 – Park Bench,

C. Item 707.175 – Park Bench Removed, Refinished and Reset,

D. Item 707.910 - Bicycle Ring.

Quality Assurance

Contractor shall comply with all regulations, laws, and ordinances required by all authorities having jurisdiction. All labor, materials, equipment, and services necessary to make the work comply with such requirements and the work shown on the Contract Drawings, as specified herein and as directed by the Engineer shall be provided without additional cost to the Owner.

Qualifications

Contractor for all landscape improvement work shall be well versed in procedures used in these items, and shall demonstrate that work of the same type, scale and complexity has been performed within the New England area. Refer to Submittals, herein.

Submittals

For each type of item, submit to the Engineer a list of five projects in which this type of item has been constructed. Indicate Sub-contractor responsible, personnel overseeing work, Owner of Project, location, and scale (in dollars) of work.

At least 30 days prior to intended use, Contractor shall provide the following samples and submittals for approval. Do not order materials until Engineer's approval of samples, certifications and/or test results has been obtained. Delivered materials shall closely match the approved samples. Samples and approvals that 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.

Shop Drawings: Submit 5 black line copies of detailed Shop Drawings for each item required to be fabricated or installed under these items. Include plans, sections and details as required to show all materials, layout, dimensions, jointing, for all items required. Take all necessary field dimensions and verify dimensions as required. Shop drawings required are as follows:

Cement Concrete Landscape Pavement showing typical sections, reinforcing, dimensions, finish, jointing M and scoring pattern.

Manufacturers' Literature or test results: Submit six (6) copies of each of manufacturer's material descriptions and/or installation instructions for the following:

Concrete aggregate mix analysis for all cast in place concrete items.

Sieve analysis of aggregate for sub-base and surface layer for Permeable Pavement materials.

Mock-ups and Samples:

General:

Schedule mock-up construction so that mock-up can be accepted a minimum of 30 days prior to the application of pavement surfaces represented by the mock-up.

Locate mock-up panels in areas as directed by Engineer.

Continue to construct mock-ups until acceptable mock-ups are produced (at no cost to Owner). Acceptable mock-ups shall become the standard for texture, color and workmanship of all subsequent work.

Use same setting bed and joint mixes used in accepted mock-ups in final work unless otherwise directed by Engineer.

Protect accepted mock-ups from damage until completion and acceptance of the work represented by the mock-ups.

Mock-up may become part of finished work. If located otherwise, remove mock-up panels from the site at completion of the project, unless otherwise instructed by Engineer.

Mock-ups:

Construct mock-up panels or areas for each different type of pavement system as specified herein to demonstrate ability to achieve types of setting bed, joints, pattern, color, texture and edging, as required.

Replace sample installations as many times as necessary until Engineer's approval of the installation has been obtained. Upon Engineer's approval, construct all subsequent work to conform to approval of sample installation. Review location of sample with Engineer before construction.

Construct a 5' x 5' (minimum) mock-up of the Cement Concrete Landscape Pavement. Construct sample in location that can become part of the pavement, if accepted by Engineer.

MATERIALS

Delivery

Materials shall be delivered in original packages with Manufacturers' or shipping labels. Engineer will have the right to reject materials delivered in damaged packages or materials without labels.

Storage

Materials shall be stored in a dry condition above ground on raised platforms, covered by opaque, waterproof tarpaulins or roofs, and shall be protected from damage and theft. Products delivered and stored for use shall match products submitted and approved by Engineer, or shall be rejected.

Cement Concrete Landscape Pavement

For dimensions and finishes of pavement and joints, refer to the Drawings. Concrete shall be 4000 PSI Portland Cement Concrete according to the Standard Specifications.
Welded Wire Fabric (WWF): Concrete shall be reinforced with 4" x 4" welded wire mesh where shown on the Drawings. Fabric shall conform to AASHTO M55, with fusion-bonded epoxy coating conforming to ASTM A775.

Base for Cement Concrete Landscape Pavement

Base for Cement Concrete Landscape Pavement shall be M1.03.0 Gravel Borrow Type b according to the Standard Specifications.

Penetrating Protective Sealant for Cement Concrete Landscape Pavement

Sealant for concrete shall be a clear, penetrating saline compound containing not less than 90% alkyl alkoxysaline, with oil repellency additives that eliminate the penetration of salt, water, deicing chemicals, acids, and oils into treated concrete. Sealant shall not produce any visible color changes to concrete following application.

CONSTRUCTION METHODS

General

All items located on the Drawings shall be fabricated and installed by Contractor as detailed on the Drawings, as per manufacturers' written installation procedures and as directed by the Engineer. All fabrication and installation work shall be accomplished using the highest standards of workmanship and shall include all excavation, compaction and fine grading of sub-base and gravel base materials, labor, transportation and incidentals to make the work complete.

Contractor shall schedule delivery of items and all necessary equipment and hardware so as to arrive at the site in a timely manner to comply with construction schedule and minimize on-site storage time. Contractor shall be ready to discuss the purchasing of site improvements with long lead times at the beginning of the Contract so suitable arrangements can be made to meet the date of completion. Items delivered to the site prior to scheduled installation time shall be stored in a secured staging area with all small components retained separately by Contractor. Protect all items from weather, careless handling, construction in the vicinity, and vandals or pilferers.
Stake locations of all items in the field for approval by Engineer before commencing any excavations.

Excavation

After approval of all shop drawings, execute all excavations according to Section 120 - EXCAVATION, proceeding within work area so as to avoid disruption of existing materials to remain or newly installed items. Any items to remain or items that are newly installed that are damaged shall be replaced or repaired to existing conditions by Contractor at no cost to the Owner. Backfilling of footings shall be as specified for those items.

Sub-bases

Sub-bases shall be furnished and placed under requirements of Section 151 - EMBANKMENT, and to the sections and elevations shown on the Drawings.

Protection during Construction

Protect adjacent plantings and site improvements from construction of concrete pavement.

Cement Concrete Landscape Pavement

Concrete pavement placement, curing testing, reinforcing and protection and formwork shall be as specified in the Standard Specifications Section 476 - CEMENT CONCRETE PAVEMENT, except as modified herein.
Contractor shall install all formwork for items level and with plumb vertical alignment, according to Section 476 – CEMENT CONCRETE PAVEMENT or as indicated otherwise on the Drawings.
All Cement Concrete Landscape Pavement shall have a minimum cross slope of 1% and a maximum of 2% or as indicated on the Drawings. All joints shall be flush to adjoining pavement the tops of curbs.
Coordinate complete installation of Granite Landscape Edge and other site improvements prior to installing pavement.

Welded Wire Fabric (WWF) shall be installed and supported with suitable fixture in accordance with ACI Standards to the locations and vertical placement indicated on the Drawings. Fabric shall be flat and held firmly in place. Where mesh is spliced, it shall be lapped a minimum of 12 inches, secured firmly in place by approved means.

Concrete shall be planned to be installed so as to complete finishing of surfaces within scheduled work times. All forms shall be joined neatly and tightly, shall be set true to the lines and grades indicated on the Drawings. Forms shall be of full concrete depth, of sufficient thickness to withstand the pressure of placed concrete, have uniform bearing throughout their length, and shall be well staked and braced.

No concrete shall be deposited into forms until the Engineer has inspected the placing of reinforcement and given permission to place concrete.

Surfaces shall be evenly screed to slope per requirements of the Drawings without any depressions to impede complete drainage. Finish tolerance for surface slopes shall be ¼” in 10 foot maximum deviation. Any surface troweling shall be minimal to complete the work, and only when the concrete has hardened sufficiently, but not to excess which will result in causing fine particles and water to surface. When concrete is sufficiently set, apply a medium broom finish in the direction of the slope or as indicated on the Drawings before tooling edges of panels and expansion joint edges. Concrete wheelchair ramps shall have a heavy broom finish with the striations parallel to the slopes. Concrete pavement shall be edge tooled and scored according to the Drawings only after the broom finishing has been completed.

Contraction (or Control) Joints (CJ) shall be formed in appropriately broomed concrete using a grooving tool having a depth equal to at least one-quarter the concrete thickness and a width of one-quarter inch maximum. Joints in exposed slabs shall be in uniform intervals according to the Drawings, not exceeding five feet in any direction, or as directed by the Engineer. All edges of exposed slabs shall have a tooled radius of 1/8” maximum.

Forms shall not be moved for 72 hours after the concrete has been placed. Extreme care shall be taken in removing forms in order that no damage will be done to the concrete. Under no condition shall any bar, pick or other tool be used which depends upon leverage on the concrete for removal of the forms.

Curing of the finished concrete surface shall be started as soon as it is possible to do so without damaging the surface. The surface shall be wetted otherwise kept moist throughout a minimum 6-day curing period through the use of wetted burlap, or an acrylic-based spray applied curing compound. Curing compound shall not be used on concrete designated to receive surface sealer on Drawings. The concrete surface shall be protected from all traffic and other disturbance during the curing period.

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. Unauthorized marking or graffiti on the finished surfaces shall be cause for rejection, and replacement by the Contractor at no additional cost to the Owner.

Thermal and Desiccation Protection

Adequate protection shall be provided where temperatures of 40 degrees F or lower occur during placing of concrete, and during the early curing period. The minimum temperature of fresh concrete after placing, and for the first 3 days, shall be maintained above 55 degrees F. In addition to the above requirements, an additional 3 days of protection from freezing shall be maintained.

Concrete shall not be installed during, prior to or immediately following rainfall or when the temperature is 40 degrees Fahrenheit and falling. Weather forecast printout shall be given to the Engineer prior to commencing this work. Forecasts shall be based upon National Weather Service (NOAA website www.noaa.gov, then enter "Boston or Cambridge, MA").

Protection of Completed Concrete Landscape Pavement

Protect completed concrete pavements from damage or defacement. Allow no pedestrian traffic on pavement for a minimum of 72 hours and no vehicular traffic for a minimum of 2 weeks. All damaged concrete pavement, other than that damaged by natural causes, shall be removed and re-poured by the Contractor at no additional cost to the Department. The Engineer shall determine if pavement replacement is warranted. Contractor shall review with the Engineer all intended procedures including protection of completed surfaces from vandalism and graffiti until surfaces have sufficiently set.

Any incidence of damage to any item during installation shall be reported immediately to the Engineer, remedial action shall be decided, and repairs made to the satisfaction of the Engineer.

Sealing Concrete

Seal concrete pavement after curing with specified material according to Manufacturer's instructions. Apply clear penetrating silane sealant to concrete pavement and wheelchair ramps per manufacturer's recommendations and as follows. Clean all surfaces to be treated prior to application so that they are dry and free of dust, surface dirt, efflorescence, and contaminants. Follow manufacturer's safety precautions. Apply sealant as packaged, do not dilute. Apply sealant with low-pressure (20 PSI) airless spray equipment. Apply sufficient material to thoroughly saturate the surface making sure to brush out excess material that does not penetrate. Surface residues, pools, and puddles shall be broomed out thoroughly until they penetrate into the surface. Remove excess sealant that has not penetrated the surface three minutes after application. Sealed paved surfaces shall display no color difference from the unsealed surface and no surface sheen. Protect exposed masonry pavements from damage or defacement. Allow no pedestrian traffic on pavement for a minimum of 72 hours and no vehicular traffic for a minimum of 2 weeks.

COMPENSATION

METHOD OF MEASUREMENT

Item 701.3 - CEMENT CONCRETE LANDSCAPE PAVEMENT will be measured per SQUARE YARD, installed complete and compacted in place including excavation, fine grading and compaction, gravel borrow, reinforcing, joint materials, sealer, all labor, materials, equipment and transportation.
No separate measurement shall be made for shop drawings, submittals, staking, or for approvals with the Engineer.

BASIS OF PAYMENT

Payment for Item 701.3 - Cement Concrete Landscape Pavement will be made at Contract unit price per SQUARE YARD which price shall include excavation, fine grading and compaction, gravel borrow, reinforcing, joint materials, sealer, all labor, materials, equipment and transportation required to complete the installation to conform to the Contract Drawings and Specifications to the satisfaction of the Engineer.

No separate payments for these items shall be made for shop drawings, submittals, staking, or for approvals with the Engineer.

ITEM 702.1 FLEXIBLE POROUS PAVEMENT SIDEWALK SQUARE FOOT

The work under this Item shall conform to the relevant provisions of Section 701 of the Standard Specifications and the following:

GENERAL

Flexible porous pavement shall be installed as shown on the contract drawings and at selected locations as required by the Engineer. Application areas will encompass the length and width of the proposed porous pavement sidewalks; however, widths may vary according to existing site configurations and limitations when installed adjacent to fences, walls, steps, walks, etc.

The work of this Item includes subgrade preparation and installation of flexible porous paving,

Flexible porous paving shall be:

- HD2000 "Flexi-Pave" as manufactured by K.B. Industries, Inc., 28100 US Hwy 19N, Suite 410, Clearwater, FL 33761, 877-KBI-FLEX, www.kbius.com

MATERIALS

The sub-base material for "Flexi-pave" system shall be Crushed Stone. Crushed Stone shall satisfy the requirements specified in MassDOT specification Section M2.01.7 for Dense Graded Crushed Stone for Sub-Base.

The Contractor shall reference Flexi-Pave manufacturer's information. The certified installer is responsible for supplying and installing a warranted material that meets the following manufacturer's specifications:

- The material must consist of and utilize recycle tires, aggregate, and binder.
- Color: Granite

SUBMITTALS

The Contractor shall submit a list of materials proposed for work under this Item, including the name and address of the materials producer and the location from which the materials are to be obtained. The Contractor shall submit certificates, signed by the materials producer and the paving subcontractor, stating that materials meet or exceed the specified requirements. Submit name and contact information of company responsible for performing paving operations (certified installer) as soon as this information becomes available.

Material samples for the following:

- Flexible porous paving, color: Granite

Constructed Samples - Submit the following:

- Sample Panel: Construct a 5' x 5' sample of the Flexible Porous Paving material for approval. The sample shall show all aspects of finish appearance. The sample, upon approval, shall be maintained as the standard of minimal quality for approval of all proposed surfacing and paving work required for the project.

CONSTRUCTION METHODS

Quality Assurance

The Contractor shall use an adequate number of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work under this Item.

Flexi-pave shall be installed by a certified installer. Contractor must either become a Certified Installer or use a Certified Installer for mixing and placement of Flexi-Pave

All materials, methods of construction and workmanship shall conform to applicable requirements of ASTM Standards unless otherwise specified.

Weather Limitations

"Flexi-Pave" shall not be placed when the ambient air temperature at the paving site in the shade away from artificial heat is below 45° F or above 95° F. The Contractor shall not pave on days when rain is forecast for the day unless a change in the weather results in favorable paving conditions as determined by the Engineer.

Flexible Porous Paving (Flexi-Pave)

The Contractor shall reference the manufacturer's recommendations. The material must be applied in a minimum 2"-thickness (nom.) in such manner that it is completely free of joints or seams, provides impact absorption, is flexible to substrate movement and root growth and is noncracking during freeze-thaw conditions. The material shall have an available 5-year warranty for pedestrian or non-traffic applications.

The material is to be porous to precipitation with an 18% - 22% dynamic flexible void capacity. The material must withstand continual daily foot, bicycle, and pedestrian curb use with vehicular crossings. Application of the material will occur in locations identified by the DPW Superintendent, or the Engineer, over various substrate materials with the majority of application occurring over natural earth and existing tree roots. The product must retain durability over the various substrates.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Measurement for Item 702.1 Flexible Porous Pavement Sidewalk shall be based on the actual number of SQUARE FEET of Flexible Porous Pavement Sidewalk installed, complete in place, within the limits as shown on the contract drawings and as required by the Engineer. Placement of Flexible Porous Pavement Sidewalk to excess thicknesses and outside the limits defined shall be at no additional cost to the DCR.

The unit bid price for Item 702.1 Flexible Porous Pavement Sidewalk, shall include the furnishing of all labor, materials, tools, equipment, and incidentals, including the time required to determine the exact limits of flexi-pave based on field observations of tree root locations, excavation of existing sidewalk, any temporary asphalt and crushed stone subbase required to install Flexible Porous Pavement Sidewalk to the depth and width indicated, complete in place, as shown on the contract plans and as required by the Engineer.

The unit bid price shall also include the cost of an available 5-year warranty for the material for pedestrian or non-traffic applications.

ITEM 704.02 DRAINAGE AGGREGATE CUBIC YARD

Drainage aggregate for dry swales shall conform to the relevant provisions of Section 150 and the following:

DESCRIPTION

This work shall consist of constructing a drainage aggregate course within the proposed dry swale within the project limits in accordance with the details shown on the Contract Drawings, as specified in these Specifications and as required by the Engineer.

MATERIALS AND CONSTRUCTION METHODS

Stone dust materials shall consist of crushed stone or gravel fines conforming to the following gradation:

U.S. Standard Sieve Size	Percent Passing
1 ½" (37.5 mm)	100
1" (25 mm)	95-100
½ "(12.5 mm)	25-60
No. 4 (4.75 mm)	0-10
No. 8 (2.36 mm)	0-5

Choker course gradation shall be submitted to the Engineer for approval.

METHOD OF MEASUREMENT

Drainage Aggregate shall be measured for payment by volume in Cubic Yards (CY) complete in place.

BASIS OF PAYEMENT

Drainage Aggregate shall be paid for at the Contract unit price bid per Cubic Yard (CY), which shall include all labor, materials, equipment, and incidental costs required to complete the work.

ITEM 704.2 STABILIZED STONE DUST PAVING SQUARE FOOT

DESCRIPTION

General

The Work of these items consist of providing a fully installed stabilized stone dust paving as indicated on the Contract Drawings and/or as specified herein and includes, but is not limited to, the following:

1. Purchasing and installing stabilized stone dust paving

Examine all Contract Drawings and all items of the Specifications for requirements and provisions affecting the Work of these items. Provide all equipment and materials, and do all work necessary to construct the stabilized stone dust paving (decomposed granite) with stabilizer material, including aggregate base as indicated on the Drawings and as specified herein.

Coordinate Work with that of all other trades affecting, or affected by Work of these items. Cooperate with such trades to assure the steady progress of all Work under the Contract.

Reference Standards

Contractor shall comply with applicable requirements of the following codes and industry standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. The following references are used herein and shall mean:

ASTM - American Society for Testing and Materials,

ASTM C136 / C136M – 14, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates, ASTM International, West Conshohocken, PA, 2014, www.astm.org

ASTM D2419 – 14, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregates, ASTM International, West Conshohocken, PA, 2014, www.astm.org

ASTM F1951 – 14, Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment, ASTM International, West Conshohocken, PA, 2014, www.astm.org

MassDOT Standard Specifications: Commonwealth of Massachusetts, Massachusetts Department of Transportation/Highway (formerly Massachusetts Highway Department and Department of Public Works), "Standard Specifications for Highways and Bridges," latest edition and including all applicable Supplemental Specifications, Standard Special Provisions and Special Provisions.

Related Work

Examine all other Items of the Special Provisions and all Drawings for the relationship of the Work under this Item and the Work of other trades. Cooperate with all trades and coordinate all Work under this Item herewith.

Quality Assurance

Installer to provide evidence of five (5) projects installed in the past three years to indicate successful experience in installation of stabilized aggregate surfacing. Contractor shall comply with all regulations, laws, and ordinances required by all authorities having jurisdiction. All labor, materials, equipment, and services necessary to make the work comply with such requirements and the work specified in Drawings and herein shall be provided without additional cost to the Owner.

Qualifications

Contractor for stabilized stone dust paving work shall be well versed in procedures used in these paving materials.

Contractor shall engage an experienced product representative from the aggregate binder manufacturer prior to and during installation of the stabilized aggregate surfacing.

Warranty

Contractor shall provide a written warranty agreeing to repair or replace components of stabilized surfacing that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:

1. Premature wear and tear, including cracking, spauling or loss of more than ¼ inch of aggregate surface material, provided the material is maintained in accordance with manufacturer's written maintenance instructions.

2. Failure of system to meet performance requirements.

Warranty Period: Contractor shall provide warranty for performance of product. Contractor shall warranty installation of product for the time of one year from completion.

Contractor shall provide, for a period of 60 days, unconditional maintenance to include complete repairs to any area of the stabilized aggregate surface that fails. Repairs shall be as specified herein.

Submittals

1. Manufacturer's product data sheet.
2. 1 quart sample of base course.
3. Base Course gradation indicating that the product meets specifications
4. 1 quart sample of stabilized crushed aggregate paving.
5. Stabilized crushed aggregate gradation indicating that the product meets specifications.
6. Manufacturer's Material Safety Data Sheet.

Construction Samples:

1. Install 5 ft. wide x 5 ft. long mock-up of stabilized stone dust paving in location directed by the Engineer and Landscape Architect

Schedule mock-up construction so that mock-up can be accepted a minimum of 10 days prior to the application of paving surfaces represented by the mock-up.

Locate mock-up panel in area as directed by Landscape Architect and/or Owner.

Continue to construct mock-up until acceptable mock-up is produced (at no cost to the Owner). Acceptable mock-up shall be standard for texture, color, and workmanship.

Protect accepted mock-up from damage until completion and acceptance of the work represented by the mock-up.

Rejected mock-ups must be completely removed and disposed of legally after a final mock-up is approved.
Project Site Conditions

Environmental Limitations: Do not install aggregate paving during rainy conditions or below 40 degrees Fahrenheit and falling. Rainfall within 3 days of installation will extend the curing time.

Manufacturer's representative shall approve site conditions prior to commencing installing accessible crushed stone paving.

MATERIALS

Delivery: Materials shall be delivered in original packages with Manufacturers' labels. Engineer will have the right to reject materials delivered in damaged packages without labels. Stabilized crushed stone aggregate shall be delivered to the jobsite fully blended, hydrated, and ready for installation.

Storage: Packaged materials shall be stored in a dry condition above ground on raised platforms, covered by opaque, waterproof tarpaulins or roofs, and shall be protected from damage, theft, and moisture. Cover the stockpile with a tarp if there is any chance of rain or if the ore-blended material is drying out. Mist with water, if necessary but be careful not to add too much water when maintaining the moisture level.

Products delivered and stored for use shall match products submitted and approved by Engineer, or shall be rejected.

Stabilized Stone Dust Paving

Basis of design is Stabilized Stone Dust, as manufactured by: Read Custom Soils; 158 Tihonet Road, Wareham, MA 02571. Phone: toll free 800-924-5335; 781-828-6300. email: sales@readcustomsoils.com, or approved equal as reviewed by the Landscape Architect.

Granular Base Course:

Material for granular base course shall be a graded, granular, non-frost susceptible, free-draining material, consisting of either durable stone or coarse sand, practically free from loam and clay, and which can be readily compacted to form a stable foundation.

Gravel Borrow for Base shall conform to MassDOT Standard Specifications, M1.03.0 Gravel Borrow Type b.

Crushed Aggregate Material:

Crushed Aggregate Material shall consist of locally sourced, sound, angular, durable particles, with gradation in accordance with ASTM C165:

Sieve Size	Percent Passing by Weight
#3/8"	100
No. 4	80-100
No. 8	65-90
No. 16	40-60
No. 30	25-55
No. 50	15-35
No. 100	10-20
No. 200	5-15

Color shall be "Natural" grey.

Aggregate Binder:

Aggregate binder shall be a 100% natural material, non-toxic, non-staining, odorless, low-impact, permeable, environmentally safe powder Organic-Lock as manufactured by:

Envirobond Products Corporation
6191-2100 Bloor Street West
Toronto, Ontario, Canada
M6S 5A5
1-866-636-8476
info@envirobond.com
www.envirobond.com
www.organic-lock.com

or approved equal as reviewed by Landscape Architect.

Stabilized Crushed Stone Aggregate shall be precision blended at the source, delivered to the jobsite fully blended, hydrated, and ready for installation.

CONSTRUCTION

All items located on the Drawings shall be fabricated and installed by Contractor as detailed on the Drawings, as per manufacturers' written installation procedures and as directed by the Engineer. All fabrication and installation work shall be accomplished using the highest standards of workmanship and shall include all

excavation, compaction and fine grading of subbase and gravel base materials, labor, transportation and incidentals to make the work complete.

Contractor shall schedule delivery of items and all necessary equipment and hardware so as to arrive at the site in a timely manner to comply with construction schedule and minimize on-site storage time. Contractor shall be ready to discuss the purchasing of site improvements with long lead times at the beginning of the Contract so suitable arrangements can be made to meet the date of completion. Items delivered to the site prior to scheduled installation time shall be stored in a secured staging area with all small components retained separately by Contractor. Protect all items from weather, careless handling, construction in the vicinity, and vandals or pilferers.

Stake locations of all items in the field for approval by Engineer before commencing any excavation.

Grading:

Areas to be paved will be compacted and brought approximately to subgrade elevation 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 done under this Section.

Existing subgrade material which 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 conforming to this Section.

Subgrade of areas to be paved shall be re-compacted as required to bring top 8 in. of material immediately below gravel base course to a compaction of at least 90% of maximum density, as determined by ASTM D 1557, Method D. Subgrade compaction shall extend for a distance of at least 1 ft. beyond pavement edge.

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 MassDOT Standard Specifications. Completed subgrade after filling such areas shall be uniformly and properly graded.

Areas being graded or compacted shall be kept shaped and drained during construction. Ruts greater than or equal to 2 in. deep in subgrade, shall be graded out, reshaped as required, and re-compacted before placing pavement.

Materials shall not be stored or stockpiled on subgrade.

Disposal of debris and other material excavated and/or stripped under this section, and material unsuitable for or in excess of requirements for completing work of this Section shall be disposed of according to the methods outlined in the specifications of this project and as shown on the Contract Drawings.

Prepared subgrade will be inspected by the Engineer. Subgrade shall be approved by the Engineer before installation of paving base course. Disturbance to subgrade caused by inspection procedures shall be repaired under this Section of the specification.

Aggregate Base Course:

Aggregate base course 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:

MassDOT Standard Specifications for Highways and Bridges, Section 401, "Gravel Sub-base".

Compaction of aggregate base course shall be to 95% of maximum density as determined by ASTM D 1557, Method D. Stone greater than 2-1/2 in. shall be excluded from course.

Width of base course shall be greater than or equal to the width of pavement surface, if continuous lateral support is provided during rolling, and shall extend at least 2 x base thickness beyond edge of the course above, if not so supported.

Aggregate material shall be applied in lifts less than or equal to 6 in. thick, compacted measure. Each lift shall be separately compacted to specified density, using a 6 ton steel wheel roller or vibratory roller equivalent to a 6 ton static roller, or an approved equivalent.

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 in. measured by means of a 10 ft. long straightedge shall be replaced and properly compacted.

Subgrade and base course shall be kept clean and uncontaminated. Less select materials shall not be permitted to become mixed with gravel. Materials spilled outside pavement lines shall be removed and area repaired.

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.

Stone Dust Paving:

Stabilized stone aggregate surfacing shall be placed only after excavation and construction work that might injure the surfacing have been completed. Damage to stabilized aggregate surfacing, adjacent grades or materials occurring during construction shall be repaired by the Contractor before acceptance at no additional cost to the Owner.

Stabilized aggregate surfacing shall be installed on the compacted base course. Spray water over the compacted base before installing stone dust to improve the bond.

Blending Stabilizer:

Stabilizer shall be mixed with water off-site by approved manufacturer in accordance with manufacturer's

recommendations, and delivered to site for placement. It is critical that Stabilizer be thoroughly and uniformly mixed throughout the crushed aggregate screenings. Blending material on-site is not acceptable.

Placement:

Allow for about 17% compaction; i.e.: install 3.6" loose depth for 3" compacted depth.

A minimum depth of 4" of crushed stone material after compaction shall be installed in all areas as shown on the Drawings.

Place material when base is dry and environmental conditions are above 40 degrees and no rain is expected for within three (3) days of installation.

Place pre-blending material with a paving machine or manually (in sections).

Product representative shall be on-site during placement for approval of material.

Compaction:

Upon thorough moisture penetration, compact aggregate screenings to 85% relative compaction by equipment such as; a 2 to 4-ton double drum roller or a 1,000-lb. single drum roller. The roller size will depend on the depth of the pathway. DO NOT use a vibratory plate compactor or vibration function on roller as vibration separates large aggregate particles. Do not begin compaction until 24 hours after placement and up to 48 hours, depending on time required for moisture penetration. Coordinate with product representative to determine appropriate time allowance.

If surface aggregate dries significantly quicker than subsurface material, lightly mist surface before compaction.

Take care in compacting crushed 3/8" minus aggregate screenings when adjacent to planting. Hand tamping with 8" or 10" hand tamp is recommended.

Inspection:

Finished surface of pathway shall be smooth, uniform and solid. There shall be no evidence of chipping or cracking. Cured and compacted pathway shall be firm throughout profile with no spongy areas. Loose material will not be present on the surface after installation, but may appear after use and according to environmental conditions. Pathway should remain stable underneath the loose granite on top. It should be a "natural" looking pathway, yet stable through full depth of materials.

Repairs:

All damaged areas identified prior to substantial completion or identified as applicable under the one year general workmanship warrantee period shall be repaired by excavating extent of damage to the depth of the stabilized aggregate surface and removing the damaged material from the site and disposing of the material in a legal manner.

After removing the damaged stabilized aggregate surface saw cut the edge of the damaged area to produce a straight vertical edge.

Moisten the exposed base course with a light spray.

Pre-blend the replacement crushed stone aggregate material with Organic-Lock at 28-34 lbs/ imperial ton. Apply the material to the excavated area and compact. Thoroughly water the material to achieve a 8-10% moisture content. Use the "snowball test" to determine moisture content - refer to *Light Vehicular Traffic Application Installation Guidelines Brochure* as provided by manufacturer for details.

Allow the newly installed Organic-Lock Pathway Aggregate to cure, but not completely dry out.

Re-compact the material, ensuring that the final grade and crown are maintained.

Compact the placed mixture with 10-inch hand tamp or 250 to 300 pound roller. Keep traffic off areas for 48 hours after repair has been completed.

COMPENSATION

METHOD OF MEASUREMENT

Item 704.2 STABILIZED STONE DUST PAVING will be based on the actual number of square feet of Stabilized Aggregate Surfacing placed, complete per SQUARE FOOT within the limits shown on the Drawings adjusted, if needed, for field conditions. Placement of Stabilized Stone Dust Paving to excess thicknesses and outside the limits defined in the Drawings without approval by Owner shall be at no additional cost to the Owner.

BASIS OF PAYMENT

STABILIZED STONE DUST PAVING: The Contractor shall furnish all labor, materials, excavation, compaction, tools, equipment, and incidentals including gravel borrow subbase, aggregate, and stabilizer required to install STABILIZED STONE DUST PAVING to the depth and width indicated complete, as shown in the Drawings and adjusted to field conditions installed complete in place, including topping new areas of paving plus repair prior to substantial completion.

ITEM 707.101	**DRINKING FOUNTAIN**	**EACH**
ITEM 707.18	**SHURCLIFF PARK BENCH**	**EACH**
ITEM 707.9	**BICYCLE RACK**	**EACH**

DESCRIPTION

General

Examine all other Items of the Standard Specifications, Standard Special Provisions and Special Provisions for requirements that may affect the Work of these Items whether or not such work is specifically mentioned.

Work of these Items consists of all labor, materials, equipment and incidentals required to furnish and install the following, as shown on the Drawings and specified herein:

Drinking Fountain
Shurcliff Park Bench
Bicycle Rack

Referenced Standards

Contractor shall comply with applicable requirements of the following codes and industry standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. The following references are used herein and shall mean:

ASTM - American Society for Testing and Materials,
AASHTO - American Association of State Highway and Transportation Officials,
AISI – American Iron and Steel Institute,
AWS - American Welding Society,
SSPC - Steel Structures Painting Council,
Standard Specifications: "Standard Specifications for Highway and Bridges", MassDOT/Highway (formerly Massachusetts Highway Department, or Department of Public Works) Commonwealth of Massachusetts, latest edition and all supplements.

Related Work

Examine all other Items of the Special Provisions and all Drawings for the relationship of the Work under this Item and the Work of other trades. Cooperate with all trades and coordinate all Work under this Item herewith.

Refer to the following related items which may include but are not limited to:

Item 001-040, Study and Analysis of Masonry Material and Procedures
Item 701.3, Cement Concrete Landscape Paving.

Submittals

At least 30 days prior to intended use, Contractor shall provide the following samples and submittals for approval. Do not order materials until Engineer's 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.

Shop Drawings: Submit 6 black line copies of each of detailed Shop Drawings for each item required to be fabricated or installed under these Items. Include plans, sections and details as required to show all materials, layout, dimensions, jointing, method of connection and assembly, fabrication and tolerances for types of materials, types and details of connections and openings, cuts, holes, bolts and painting for all items required. Take all necessary field dimensions and verify dimensions as required. Shop drawings required are as follows:

Drinking Fountain
Shurcliff Park Bench
Bicycle Rack

Manufacturer's Literature: Submit four (4) copies of each of manufacturer's material descriptions and/or installation instructions for the following:

Drinking Fountain
Shurcliff Park Bench
Bicycle Rack
Primer, paint, color and application process for all painted items

Galvanizing Certification

Furnish to the Engineer notarized certificates of compliance with ASTM and AASHTO requirements specified under these Items.

Each certificate shall be signed by the galvanizer and list a detailed description of all material and methods used.

Certification shall state that the galvanizing is in conformance with respective galvanized items.

Mock-ups

Replace sample installation as many times as necessary until Engineer's and Landscape Architect's approval of the installation has been obtained. Upon their approval, construct all subsequent metal fabrication work to conform to approved sample installation.

MATERIALS

General

Provide all materials from new stock unless herein indicated as salvaged, free from defects impairing

strength durability and appearance, and of best commercial quality for the purpose specified.

Supply all equipment hardware and necessary accessories required for complete, operating and installed site improvement item specified herein.

All hardware and materials indicated as stainless steel shall be AISI Type 304 conforming to the requirements of ASTM A193.

Steel components shall be fabricated from steel conforming to ASTM A36 and shall be galvanized by the hot-dip process conforming to ASTM A153-73 for Zinc Coating (Hot-Dip). Provide all exposed fasteners of the same material, color and finish as the fastened material unless otherwise indicated.

Provide all exposed fasteners vandal-proof (spanner-head type), unless otherwise noted.

Concrete for footings of all site improvements and reset items, as indicated on the Drawings, shall be 4,000 PSI Portland Cement Concrete.

Drinking Fountain

Drinking Fountain shall be Elkay Commercial Drinking Fountain with Bottle Filler, Manufacturer Model: LK4420BF1UEVG, as manufactured by:

W.W. Grainger, Inc.
1-800-472-4643
www.grainger.com
or equal approved by the Landscape Architect.

Drinking Fountain shall be stainless steel, color: Green, and include an ADA compliant Basin and Bottle Filling Dispenser.

Park Bench

All new park benches shall be Model 71” long Shurcliff Bench with 2 supports per bench and back as manufactured by:

Custom Fabrication Inc.
Harpursville, NY
607-693-3223
www.customfabricationinc.com.
or equal approved by the Engineer and Landscape Architect.

Slats: 2” x 6” (nominal) vertical grain Douglas Fir with 1/8” radius at all edges. Five (5) per bench. Primed and finished with tnemec enamel, color “Federal Green 14062”.

Frame shall be 1-1/2” x 6” steel bar support

The supports shall be embedded in a six-inch thick reinforced concrete pad as shown on the drawings. All steel members are to be coated with zinc rich epoxy then finished with polyester powder coating (Standard

Federal Color #14062).

Benches are to be delivered to the project site assembled.

Bicycle Rack

Bicycle Rack shall be Swerve Rack as manufactured by:

Dero
5522 Lakeland Ave. N.
Minneapolis, MN 55429
888-337-6729
www.dero.com

Posts shall be made from standard 1.9" OD Schedule 40 steel pipe with height of 34" and high polished shine stainless steel finish.

Attachment hardware as described herein and in the Drawings shall be provided by the Contractor.

CONSTRUCTION METHODS

General

All items located on the Drawings shall be fabricated and installed by Contractor as detailed on the Drawings, as per manufacturers' written installation procedures and as directed by the Landscape Architect. All fabrication and installation work shall be accomplished using the highest standards of workmanship and shall include all excavation, concrete for footings, labor, transportation and incidentals to make the work complete.

Contractor shall schedule delivery of items and all necessary equipment and hardware so as to arrive at the site in a timely manner to comply with construction schedule and minimize on-site storage time. Contractor shall be ready to discuss the purchasing of site improvements with long lead times at the beginning of the contract so suitable arrangements can be made to meet the date of completion. Items delivered to the site prior to scheduled installation time shall be stored in a secured staging area with all small components retained separately by Contractor. Protect all items from weather, careless handling, construction in the vicinity, vandals or pilferers. All stored materials and items must be protected from weather, careless handling and vandalism.

Stake locations of all items in the field for approval by the Engineer and Landscape Architect before commencing any excavation.

Contractor shall install all items level and with plumb vertical alignment, or as indicated otherwise on the Drawings.

All damaged portions of installed items shall be reported to the Engineer and Landscape Architect immediately and appropriate means for repairing shall be determined and approved to the satisfaction of the Engineer and Landscape Architect.

Excavation

After approval of all shop drawings, execute all excavations in accordance with requirements of Section 140 – Excavation for Structures of the Standard Specifications proceeding within work areas using methods to avoid disruption of existing materials to remain or newly installed items. Any items which are to remain or have been newly installed that are damaged by excavation shall be replaced or repaired to existing conditions by Contractor at no cost to the Owner.

Footings

Placement of dense graded crushed stone or gravel borrow, when indicated on the Drawings, shall be as specified in Standard Specifications Section 402, except that compaction may be done with vibrating tamper instead of rollers.

Installation of all concrete footings and bases, form work, reinforcing, curing, testing and protection shall be as specified, grades and imbedded hardware shall be as indicated on the Drawings. Secure and brace all imbedded hardware and objects in concrete in a true and vertical position until cured.

Contractor shall finish all concrete surfaces which will remain at finished grade by troweling all surfaces smoothly to drain away from installed item, tooling all edges neatly with rolled edges and corners and protecting surfaces from sun, wind and vandalism until cured. Wrap and protect all imbedded anchor bolts. Backfilling of footings shall be as specified.

All steel shall be fabricated, shop welded connections before galvanizing. All welds shall be continuous fillets, ground flush and smooth, conforming to latest requirements of specifications of AWS.

Galvanized members requiring shop fabrication shall be welded, drilled, and assembled, as applicable, prior to galvanizing.

Galvanized members that are to be field welded or that are to be shop welded to un-galvanized members shall be masked to a distance of one inch from the weld line prior to galvanizing.

All members to be galvanized shall be abrasively cleaned, in accordance with SSPC SP6, Commercial Blast Cleaning.

Verify that all members have been abrasively cleaned as specified above.

Pickle all steel surfaces before hot-dip galvanizing in accordance with SSPC-SP8 - Pickling.

Apply galvanizing in the weights and thicknesses specified in the applicable standards listed in Standard Specifications, Section M7.10.0.

The indicated minimum thickness shall be the minimum measured at any point.

Inspect galvanizing for full coverage and adhesion to steel. Grind rough areas to produce a uniform surface. Repair minor defects, and coat masked areas, in accordance with ASTM A 7780, Repair of Hot Dipped Galvanizing.

Galvanized and finished manufactured items shall be handled and shipped in such a manner as to minimize damage to the finish. Upon arrival at job site it is Contractor's responsibility to take equal precautions. Since some surface damage is inevitable, suitable touch-up material shall be readily available from the galvanizer or manufacturer for Contractor's use.

Upon acceptance of construction and installation of each unit of site furniture, the galvanizer or manufacturer shall supply to the Owner the equivalent of one-half pint of touch-up material for each unit installed.

Steel fabrication shall be accomplished using the highest standards of workmanship. Individual steel pieces making up the site item frames shall be saw cut and carefully fitted together. All connections shall be full welded and ground flush and smooth. All fabricated steel items shall be fine sanded throughout to produce a high standard of surface smoothness. All surfaces and connections shall be without grinding marks, surface differentiation or variation.

Shim all bolt connections as necessary and secure bolts. Bolts exposed shall be tack welded to prevent against vandalism.

Field Welding: Comply with AWS D1.1, AWS D1.2, AWS D1.3 and AWS D1.4 as applicable for procedures of manual metal-arc welding, appearance and quality of welds and correction methods for defective welds.

Drinking Fountain

Fabricate and install Drinking Fountain as shown on the Drawings and in accordance with approved Shop Drawings and manufacturer’s written installation instructions.

Coordinate all work, including water connection, with work of other trades. Test and verify the water supply and pressure meet manufacturers requirements following installation and report confirmation to the Engineer and Landscape Architect.

Shurcliff Park Bench

Fabricate and install Shurcliff Park Benches as shown on the Drawings and in accordance with approved Shop Drawings.

Concrete foundation placement, curing, testing, reinforcing and protection and form work shall be specified. Concrete shall have a medium broom finish parallel to the bench length.

All steel shall be fabricated before galvanizing. All joints shall be full welded and ground flush and smooth.

Bench metal supports shall be primed and painted in accordance with the material specifications in this Item.

Benches shall be set plumb and horizontal.

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.

Bicycle Rack

Fabricate and install Bicycle Rack as shown on the Drawings and in accordance with approved Shop Drawings.

Bicycle rack shall be installed plumb and true. Installation of bicycle rack and concrete footing shall be as shown on the Drawings. Brace post plumb until concrete footing has set.

Install Bicycle Rack per manufacturer's written installation procedures for surface mounting and as directed by the Landscape Architect.

Adjust and Clean All Items

Touch Up Painting: Immediately, after erection, clean field welds, bolted connections, abraded areas and surfaces to which paint was omitted for field welding and paint exposed areas with same material as used for shop painting to comply with SSPC PA1 requirements for touch up of field painted surfaces.

Apply by brush or spray to provide the required minimum dry film thickness.

COMPENSATION

METHOD OF MEASUREMENT

ITEM 707.101 Drinking Fountain, ITEM 707.18 Shurcliff Park Bench, and ITEM 707.9 Bicycle Rack shall be measured complete in place per EACH including legal disposal of old footings or stacking of materials and reinstallation of these landscape items as shown on the Drawings and as specified herein. Resetting and/or legal disposal of materials will not be measured separately, but shall be included in this item.

No separate measurement shall be made for shop drawings, submittals, staking, or for approvals with the Engineer and Landscape Architect. Measurements will be included under respective items for Drinking Fountain, Shurcliff Park Bench, and Bicycle Rack.

Concrete Landscape Pavement pads and surrounding granite edging, where shown on the Drawings for Drinking Fountain, Shurcliff Park Bench, and Bicycle Rack shall be measured under Item 701.3 –Concrete Landscape Paving.

BASIS OF PAYMENT

Payment for Item 707.101 Drinking Fountain will be at the Contract unit price per EACH unit complete in place. These prices and payments shall constitute full compensation for complete compliance with requirements of these Items, including all labor, equipment, materials, footings, excavation, transportation, tools and incidental work to conform to the Contract Drawings and Specifications to the satisfaction of the Engineer and Landscape Architect.

Payment for Item 707.18 Shurcliff Park Bench will be at the Contract unit price per EACH unit complete in place. This price and payment shall constitute full compensation for complete compliance with requirements of this item including granite edging pieces and their concrete setting bed, all labor, equipment, materials, tools, incidental work, removal and disposal of old concrete pads to conform to the Contract Drawings and Specifications to the satisfaction of the Engineer and Landscape Architect.

Payments for Item 707.9 Bicycle Rack will be at the Contract unit price per EACH unit complete in place. This price and payment shall constitute full compensation for complete compliance with requirements of this item including granite edging pieces and their concrete setting bed, all labor, equipment, materials, tools, incidental work, removal and disposal of old concrete pads to conform to the Contract Drawings and Specifications to the satisfaction of the Engineer and Landscape Architect.

No separate payments for these items shall be made for shop drawings, submittals, staking, or for approvals with the Engineer and Landscape Architect. Payments will be included under respective pay items for Drinking Fountain, Shurcliff Park Bench, and Bicycle Rack.

Concrete Landscape Pavement for pads for Drinking Fountain, Shurcliff Park Bench, and Bicycle Rack shall be paid for under Item 701.3 –Concrete Landscape Paving.

ITEM 707.17 PARK BENCH REMOVED AND STACKED EACH

DESCRIPTION

The work to be done under this Item consists of removing, transporting, and stacking existing park benches, including their supports and all mounting hardware, in a location approved by the DCR.

METHOD OF MEASUREMENT

Each park bench removed, transported, and stacked, including labor, material and equipment will be measured as one unit per each bench.

BASIS OF PAYMENT

The contract unit price paid for each park bench removed and stacked shall include full compensation for furnishing all labor, tools, materials, equipment and incidentals, and for doing all the work, involved in removing, transporting and stacking of park benches.

ITEM 707.19 SHURCLIFF PARK BENCH REFURBISHED AND RESET EACH

DESCRIPTION

The work to be done under this item consists of assessing existing Shurcliff park bench components for reuse at the approval of the Engineer and DCR. Components determined to be suitable for reuse will be restored per DCR requirements and as specified under Item 707.18 – Shurcliff Park Bench. Once restored, all benches and supports suitable for reuse shall be reset on new concrete slabs at locations shown on the plans.

MATERIALS

Contractor shall assess the condition of benches removed and stacked under Item 707.17 – Park Bench Removed and Stacked and determine their suitability for reuse. All materials selected by the Contractor for reuse shall be reviewed and approved by DCR prior to commencement of restoration by the Contractor.

Materials not selected for refurbishment and reuse shall be legally disposed of by the Contractor.

Refurbished benches shall meet the specified requirements of Item 707.18 – Shurcliff Park Bench

CONSTRUCTION METHOD

Contractor shall coordinate with DCR for transporting refurbished benches and install on new concrete slabs at the locations shown on the Plans.

METHOD OF MEASUREMENT

Shurcliff Park Bench Refurbished and Reset will be measured per each park bench actually reset complete in place.

BASIS OF PAYMENT

Shurcliff Park Bench Refurbished and Reset will be paid for at the contract unit price per each, which price shall be full compensation for all required labor, tools, equipment, and materials for coordination with DCR, transportation, and installation of the park bench complete in place, including the anchor bolts.

The installation of concrete slabs at bench locations will be paid for separately under Item 701.3, Concrete Landscape Paving.

ITEM 710.401 GRANITE BENCH EACH

DESCRIPTION

General

The Work under these items shall consist of furnishing, constructing, and installing the following components, complete in place, as shown on the Contract Drawings:

A. Granite Bench

Examine all Contract Drawings and all items of the Specifications for requirements and provisions affecting the Work of these items. Provide all equipment and materials, and do all work necessary to construct the granite benches, including aggregate base as indicated on the Drawings and as specified herein.

Coordinate Work with that of all other trades affecting, or affected by Work of these items. Cooperate with such trades to assure the steady progress of all Work under the Contract.

Related Work

Examine all other Items of the Special Provisions and all Drawings for the relationship of the Work under this Item and the Work of other trades. Cooperate with all trades and coordinate all Work under this Item herewith.

Reference Standards

Contractor shall comply with applicable requirements of the following codes and industry standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. The following references are used herein and shall mean:

ASTM: American Society for Testing and Materials.
NBGQA: National Building Granite Quarries Association, Inc., "Specifications for Architectural Granite".

Related Work

Examine all other Items of the Special Provisions and all Drawings for the relationship of the Work under this Item and the Work of other trades. Cooperate with all trades and coordinate all Work under this Item herewith.

Quality Assurance

Contractor shall comply with all regulations, laws, and ordinances required by all authorities having jurisdiction. All labor, materials, equipment, and services necessary to make the work comply with such requirements and the work specified in Drawings and herein shall be provided without additional cost to the Owner.

Materials used in connection with this Work shall conform in all respects to that as required by the requirements of designated references, with modifications as specified herein.

Submittals

Contractor shall submit shop drawings of every item listed. Shop drawings shall include plans, sections and details as required to show all materials, layout, dimensions, openings, cuts, holes, sandblasting for lettering and logo with infill material for all items required. Coordinate trades as required.

Submit shop drawings for the following:

Granite Bench

Shop drawings will be returned to the Contractor for resubmission if required information is incomplete. Verify all dimensions in the field before shop drawings are submitted.

Manufacturers' Literature: Submit product data, including details of construction, materials, dimensions, hardware preparation, color charts and specific finishes, and label compliance.

Test Results: Submit the following test results for new granite items specified in this Section:

ASTM C-97-83: Absorption and Bulk Specific Gravity
ASTM C-99-85: Modulus of Rupture
ASTM C-170-85: Compressive Strength

Granite Samples: Submit samples of the following items for review and approval before ordering materials and construction:

Two (2) 6-inch x 6-inch x ¾-inch samples of specified granite type in each specified exposed finish.

Qualifications

Masonry Work shall be performed under the direction of a supervisor having not less than five years of successful experience in comparable granite masonry projects and utilizing personnel skilled in the processes and operations indicated and required.

Mock-ups

Provide the following mock- ups to be constructed on site for review by Landscape Architect:

One Granite Bench

If location of mock-up is remote, review mock-up location with Landscape Architect before proceeding.

Revise or replace sample installation as many times as necessary until obtaining Landscape Architect's approval.

Construct all subsequent work to match approved sample. Approved sample may become part of the finished work if properly located and constructed.

Delivery, Handling and Storage

Deliver materials in secured, protective containers marked with name of fabricator and identification of contents according to designated items. After delivery, store materials under waterproof covers on planking clear of ground and protect from construction activities, handling damage, dirt, stain, water and wind. Storage piles or stacks shall be located to avoid or be protected from heavy or unnecessary traffic. Materials shall be stored under an approved roof or covered with waterproof tarpaulins, at all times, except when materials are being installed.

Stored materials shall be adequately protected against moisture by (1) stacking in such a manner as to allow a complete circulation of air under each stack, and (2) covering each stack, top and sides with a waterproof paper or membrane. Coverings shall remain in place at all times, when not working from the particular stack.

Take all necessary precautions to protect all items from moisture, chipping, cracking, or other damage, during the transportation of these materials to the project, unloading and storage on the site. After delivery take all necessary precautions to prevent all items from chipping, cracking, construction dust and debris, or damage of any kind. Damaged units will not be allowed to be installed and should any damage units be found in constructed work, such units shall be removed immediately and replaced with new units, and the Contractor shall assume all expenses incurred.

MATERIALS

Granite

Granite for all Benches shall meet NBGQA Granite Building Stone Standard: ASTM C 615, unless otherwise accepted by the Landscape Architect.

Granite shall conform to the grain size, pattern and color range of "Chester" granite, as provided by:

Williams Stone
1158 Lee-Westfield Road, P.O. Box 278
East Otis, MA 01029
Phone: 1-413-269-4544 or 1-800-832-2052
Fax: 1-413-269-6148
Email: granite@williamsstone.com
Website: http://williamsstone.com

or approved comparable, color and performance matched equal. Other granites of same shade and grain size and patterning may be submitted by the Contractor for use only after review and acceptance of the color, grain pattern, and ASTM testing results by the Landscape Architect. Any submitted granite shall meet the overall requirements for new granite specified herein and be acceptable to the Landscape Architect.

Granite Bench shall be fabricated to all dimensions shown on the Contract Drawings and finished with the following finishes:

Rocked all exposed sides
Honed exposed top
Sawn unexposed bottom

New granite color and grain shall be medium to fine grain and free from damage, visible blemishes not typical for approved samples (natural to the stone or caused during delivery, storage, or construction), errant color and iron stains, deposits or seams, and shall match samples approved by the Landscape Architect, or will be rejected. Rust stains from natural cleft deposits or seams that appear after installation and before Final Acceptance may be cause for rejection and replacement of stone at Contractor's expense. Granite appearance, as specified on the Contract Drawings, specified herein, and exhibited in approved sample submittals shall be consistent throughout the Project.

Gravel Borrow Base

Gravel Borrow for Setting Base shall conform to MassDOT Standard Specifications, M Gravel Borrow Type b.

CONSTRUCTION METHODS

General

Obtain inspection and approval of Landscape Architect for all granite benches upon delivery to the project site, after layout and then after installation and cleaning.

Granite Bench shall be located where shown on the Contract Drawings. If any location that is discovered to be impossible due to utilities or other obstruction then the Landscape Architect shall be notified immediately to discuss alternate locations.

Excavate according to MassDOT Standard Specifications Sections 120 – Excavation, and Section 140 – Excavation for Structures, as applicable. If unsuitable bearing material is encountered for the sub-grade, Contractor shall obtain instructions from the Landscape Architect and Engineer before proceeding.

Comply with each of the applicable technical Specifications. All granite items located on the Contract Drawings shall be fabricated and installed by the Contractor as detailed on the approved shop drawings, as per suppliers' and fabricators' written installation procedures, as approved by the Landscape Architect. All fabrication and installation work shall be accomplished using the highest standards of workmanship and shall include all excavation, labor, transportation and incidentals to make the work complete.

Project Conditions: Installation of items shall follow manufacturer's guidelines for project conditions during installation.

Granite must be protected during transport, delivery, storage, and installation. Any damage or failure such as chipping, scratches, or cracking of any kind in granite before acceptance may be cause for rejection of stone and replacement at Contractor's expense.

Contractor shall schedule delivery of items and all necessary equipment and hardware so as to arrive at the site in a timely manner to comply with construction schedule and minimize on-site storage time. The Contractor shall be ready to discuss the purchasing of stonework items with long lead times for procurement and/or fabrication at the

beginning of the Contract so suitable arrangements can be made to meet the date of completion. Items delivered to the site prior to scheduled installation time shall be stored in a secured staging area with all small components retained separately by the Contractor. Protect all items from weather, careless handling, ongoing construction in the vicinity, vandals or pilferers.

Stake locations of all items in the field and construct mock-up for review and approval of the Landscape Architect before commencing final construction.

Contractor shall install all granite benches items level and with plumb vertical alignment, and install all paving or concrete pads at slope of proposed grades, or with a minimal 1% cross pitch to drain, or as indicated otherwise on the Contract Drawings.

Any incidence of damage, vandalism, or theft of any item during installation shall be reported immediately to the Landscape Architect, remedial action shall be decided, and repairs made to the satisfaction of the Landscape Architect. The Contractor is required to secure all items of the Work from access by the Public until Final Acceptance, unless otherwise permitted by the Landscape Architect.

Construction of Base Materials

Placement of gravel borrow and dense graded stone pack shall be as specified in MassDOT Standard Specifications Section 405, Gravel Base Course.

Installing Granite

Stonework shall be fabricated, shipped, handled, and installed only by skilled stone masons and stone fitters.

All new stone items shall be shop cut, pre-drilled and pre-assembled to verify dimensions in the Shop before delivery to the site. All dimensions shall be verified by the stone supplier in the field, and shop drawings and samples approved by the Landscape Architect before stone fabrication. Coordinate stone fabrication and installation with all trades that may affect stone installation.

Supplier shall clearly label and number stone pieces in the shop, with accompanying key drawings and locations, for installation in the field.

Construction tolerances for stone items shall be the following:

All vertical surfaces shall be plumb, unless otherwise shown on the Contract Drawings. Maximum variation from vertical shall be 1/4 in 10 feet vertical, excepting required cross pitches indicated on the Contract Drawings.

Granite Bench to be laid as shown on Contract Drawings, horizontal surfaces shall be level, unless otherwise shown on drawings.

METHOD OF MEASUREMENT

Item 710.401 GRANITE BENCH shall be measured per EACH item, installed complete in place including all labor, materials, granular base, delivery costs and equipment required or incidental for the satisfactory completion of the work.

Gravel borrow and joint materials shall not be paid for separately, but shall be included under Item 710.401 Granite Bench.

BASIS OF PAYMENT

Granite Bench will be paid for at the Contract Unit Price per EACH item, installed complete in place, and shall include all labor and materials required until Final Acceptance.

Gravel borrow and joint materials shall not be paid for separately, but shall be included under Item 710.401 Granite Bench.

ITEM 740. ENGINEERS FIELD OFFICE AND EQUIPMENT (TYPE A) MONTH

The work under this Item shall conform to the relevant provisions of Subsection 740 of the Standard Specifications and the following:

A computer system and printer system meeting minimum requirements set forth below including installation, maintenance, power, paper, disks, and other supplies shall be provided at the Resident Engineer's Office:

All equipment shall be UL approved and Energy Star compliant.

The Computer System shall meet the following minimum criteria or better:

Processor:	Intel, 3.5 GHz
System Memory (RAM):	12 GB
Hard Drive:	500 GB
Optical Drive:	DVD-RW/DVD+RW/CD-RW/CD+RW
Graphics Card:	8 GB
Network Adapter:	10/100 Mbit/s
USB Ports:	6 USB 3.0 ports
Keyboard:	Generic
Mouse:	Optical mouse with scroll, MS-Mouse compliant

The Video/Audio computer system shall be capable of allowing video calling and recording:
Video camera shall be High Definition 1080p widescreen capable video calling and recording with built in microphone. The microphone system shall capture natural audio while filtering out background noise.

Audio shall be stereo multimedia speaker system delivering premium sound.

OS:	Latest Windows Professional with all security updates
Web Browser:	Latest Internet Explorer with all security updates
Applications:	Latest MS Office Professional with all security updates Latest Adobe Acrobat Professional with all security updates Latest Autodesk AutoCAD LT Antivirus software with all current security updates maintained through the life of the contract.
Monitors:	Two 27" LED with Full HD resolution. Max. resolution 1920 x 1080
Flash drives:	2 (two) - 128GB USB 3.0
Internet access:	High Speed (min. 24 mbps) internet access with wireless router.

ITEM 740. (Continued)

The Multifunction Printer System shall meet the following minimum criteria or better:

Color laser printer, fax, scanner, email and copier all in one with the following minimum capabilities:
- Estimated volume 8,000 pages per month - 600 x 600 dpi capability
- LCD touch panel display - 30 pages per minute print speed (color),
- 50 page reversing automatic document feeder - 4 Paper Trays Standard
(RADF) (not including the bypass tray)
- Reduction/enlargement capability - Automatic duplexing
- Ability to copy and print 11" x 17" paper size - Finisher with staple functions
- email and network pc connectivity - Standard Ethernet. Print Controller
- Microsoft and Apple compatibility - Scan documents to PDF, PC and USB
- ability to overwrite latent images on hard drive - ability to print with authenticated access protection

The Contractor shall supply a maintenance contract for next day service, and all supplies (toner, staples, paper) necessary to meet estimated monthly usage.

The Engineer's Field Office and the equipment included herein including the computer system, and printer shall remain the property of the Contractor at the completion of the project. Disks, flash drives, and card readers with cards shall become the property of the Department.

BASIS OF PAYMENT

Compensation for this work will be made at the contract unit price per month which price includes full compensation for all services and equipment, and incidentals necessary to provide equipment, maintenance, insurance as specified and as required by the Engineer.

ITEM 751.1 LOAM FOR LAWNS CUBIC YARD

DESCRIPTION

General

The work of this section includes placing, compacting, and fine grading installed tested and approved loam borrow in all seeded areas to required depths, and providing loam borrow in seeded areas in quantities sufficient to meet the requirements of the drawings.

Examine all other Sections of the specifications for requirements which affect Work of this Section whether or not such work is specifically mentioned in this Section.

Coordinate work with that of all other trades affecting, or affected by Work of this Section. Cooperate with such trades to assure the steady progress of all Work under the Contract.

All related items shall be installed as indicated on the Drawings and specified herein and includes, but is not limited to, the following:

Loam for Lawns
Soil amendments
Fine grading

Related Work

Examine all other Items of the Special Provisions and all Drawings for the relationship of the Work under this Item and the Work of other trades. Cooperate with all trades and coordinate all Work under this Item herewith.

Refer to the following related items which may include but are not limited to:

Item 765-100, Seeded Lawn.
Item 765.71 Meadow Seeding

Samples and Submittals

At least 30 days prior to ordering, the Contractor shall submit to the Engineer representative samples, certifications, and certified test results for materials as specified below. No materials shall be delivered until the required submittals have been reviewed and approved by the Engineer. Delivered materials shall closely match the approved samples. Approval of test results does not constitute final acceptance. The Engineer reserves the right to reject on or after delivery any material which does not meet the Specifications.

Prior to ordering the below listed materials, submit certified testing results and representative samples to Engineer for selection. No materials shall be ordered or delivered until required samples, certifications, manufacturers' literature and test results have been reviewed by Landscape Architect. Delivered materials shall closely match the samples.

Loam for Lawns: Contractor shall provide a one cubic foot representative sample from each proposed source for testing and analysis at Contractor's own expense.

If more than one loam is used, Contractor shall provide samples from each source. The Engineer will examine each loam delivery and may request further loam testing.

Contractor shall collect and deliver samples to an approved testing laboratory according to their specific instructions and shall have the testing report sent directly to the Engineer for review. No loam shall be delivered until the review of samples and test results by the Engineer, but such review shall not constitute final acceptance. The Engineer reserves the right to reject on or after delivery any material which does not meet these specifications.

Tests for gradation and organic matter shall be performed by a private testing laboratory acceptable to the Engineer. Tests for soil chemistry and pH may be performed by the Soil Testing Lab, West Experimental Station, University of Massachusetts, Amherst, MA, 01003-8021, ph: 423-545-2311, email: soiltest@umext.umass.edu, or another private or public agricultural experimental station approved by the Engineer, but fees, if any, shall be paid for by Contractor. Collection of samples for testing shall be done by the Contractor under the supervision of the Landscape Architect. Samples shall be collected, processed, and mailed according to test lab requirements. The manufacturer or supplier will be required to submit acceptable certification, properly notarized, that the material meets the specifications. Testing reports shall include the following tests and recommendations:

1. Mechanical gradation (sieve analysis) and soil classification.

2. Percent organic matter shall be determined by the loss on ignition of oven-dried samples. Test Samples shall be oven-dried to a constant weight at a temperature of 230 degrees Fahrenheit, plus or minus nine degrees.

3. Chemical analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Magnesium, Calcium, Aluminum, Soluble Salts, and acidity (soil and buffer pH).

4. Soil tests shall show recommendations for soil additives such as limestone, sand, humus, and fertilizer to correct soils deficiencies as necessary, and for additives necessary to accomplish particular planting objectives noted.

5. All tests shall be performed in accordance with the current standards of the AOAC.

Composted Humus: Submit one cubic foot sample and source.

Examination of Conditions

Contractor shall request inspection by the Engineer for approval of finished grade and loam before installing seeding.

MATERIALS

Loam for Lawns

Loam shall be fertile, friable soil obtained from naturally well-drained areas or shall be the product of a commercial sand and gravel processing facility. It shall be uncontaminated by salt water, foreign matter, or substances harmful to plant growth. Loam shall be free of debris rocks, clods, and any other extraneous matter. Loam for Lawns shall have no material greater than ½ in. in diameter. Loam shall have the following mechanical analysis:

U.S. Sieve No.	Percent Passing By Weight (Maximum/Minimum)
10	85-100
40	35-85
200	10-35
0.002 mm	<5

Testing shall be on material that has passed the No. 10 sieve. Loam shall contain 4% to 10% organic matter as determined by the loss on ignition of oven-dried samples. Lawn areas shall have an organic content of at least 4%. Salinity (electrical conductivity) shall be less than 0.1 S/m as determined by a 1:2 (by volume) soil-to-water mix. Salt test samples shall not be oven-dried. The acidity range of the Loam shall be pH 5.5 to 7.0.

Soil Additives For Loam

Additives shall be used to counteract soil deficiencies as recommended by the soil analysis. Organic matter used as an amendment to soil shall be manufactured compost. Lime or sulfur shall be used to bring soil to acceptable pH levels, per soil test reports. For soils with more than 20% passing the No. 200 sieve, gypsum shall be added at a rate of 3.2 pcf. Soil amendments shall be incorporated thoroughly into loam to meet the specified requirements for loam prior to delivering the material on site.

Composted humus, sand, lime, fertilizer or other amendments shall be used to counteract soil deficiencies as determined by soil analysis. Additives shall be spread and thoroughly integrated into loam layers by disc harrowing or roto-tilling at an off-site location prior to delivery to Project site.

Raw organic matter and peat moss shall not be accepted as humus. Organic matter shall be natural, composted humus, acceptable to the Engineer. Organic matter shall be low in wood content, free from hard lumps, in a shredded or granular form and safe for plants, humans and soil organisms. The acidity range shall be approximately 5.5 pH to 7.6 pH. The minimum water absorbing ability by weight on an oven-dry basis, the percent organic matter as determined by loss on ignition, and the carbon to nitrogen ratio for organic material shall be submitted to the Engineer for review and approval before purchasing and construction.

Organic Leaf Compost, which contains no toxic substances harmful to plant growth and which is acceptable to the Engineer, may be used as an organic amendment for loam and for planting mix.

Sulphur for adjustment of loam pH shall be commercial or flour sulphur, unadulterated and shall be delivered in containers with the name of the manufacturer, material analysis and net weight appearing on each container.

Ground limestone for adjustment of loam pH shall be in accordance with the requirements of MHD Standard Specification Section M6.01.0.

Water

Contractor shall be responsible to furnish a supply of water to the site at no extra cost to the Owner. If metered municipal water is available at the site, Contractor may request to use this source but shall accept the cost of water, materials, equipment, and labor for using that water. All work injured or damaged due to the lack of water, or due to the use of too much water, shall be Contractor's responsibility to correct. Water used shall be potable quality, free from impurities injurious to vegetation. Water shall not be drawn from the Charles River or its canals for use in loam placement, planting or seeding operations.

CONSTRUCTION METHODS

Filling And Compaction for Soil Materials In Seeded Areas

Placing and Compacting Ordinary Borrow and Gravel Borrow: Ordinary Borrow (Item 150-000) and Gravel Borrow (Item 151-000) shall be placed in compliance with the construction methods of the indicated Items except that compaction requirements shall be as indicated herein.

Preparation of Areas on which Loam is to be Placed

All areas to receive loam shall be free of construction debris, refuse, compressible or decayable materials and standing water. The area upon which the above materials are to be placed shall be raked, harrowed or dragged to form a smooth surface. All stones, undesirable growth and debris larger than 2 in. in diameter shall be removed from the area and disposed of by the Contractor outside the location.

When directed by the Engineer, additional suitable material available from excavation or furnished under Item 150, Ordinary Borrow, shall be spread as required to repair gullies or depressions.

Placing Loam for Lawns

The Contractor shall notify the Engineer when areas to receive loam are ready for inspection and approval. Placement of loam fill material shall not begin until the Engineer has approved the grading of the material that the loam is placed upon.

Loam shall not be handled or placed when the ground or the loam is frozen or saturated, i.e., when squeezed sample shows any sign of free moisture.

The Engineer shall approve the use of the Contractor's equipment. Any equipment or procedures that are likely to damage or over-compact underlying structure or materials shall be rejected.

All loam is to be placed "in-the-dry," to which end dewatering may be required. Spreading and drying of each layer may also be required.

Conversely, if the testing laboratory determines that the loam is too dry for proper compaction, water shall be added to provide the specified optimum moisture content, as necessary for proper compaction.

Loam shall be placed in lifts not to exceed 4 in. After each lift, the soil shall be thoroughly mixed into the soil layer beneath it. Compaction of each lift shall be minimal, sufficient only to achieve the required grades. Over-compaction of existing soils or fills that would be detrimental to planting objectives shall be corrected by tilling or other means at no additional cost.

Maximum dry density shall be determined in accordance with ASTM-D1557, Method D. The following percentages of maximum dry densities shall be achieved for all fill materials in lawn or planting areas.

All seeded area fills, 88-90%

Grade stakes shall be set to check finished grades. Deviation from lines and grades that are greater than 1 in. shall not be permitted.

The Contractor shall supply additional loam as necessary so that following finish the grading and compaction operations, the placed loam shall conform to the depth required.

After loam has been spread, it shall be carefully prepared by hand raking.

Cleanup

Absolutely no debris may be left on the site. Excavated material shall be removed. Repair damage to site or structures to restore them to their original condition at no additional cost to the Owner. All debris and excavated material removed from site shall be disposed of legally.

METHOD OF MEASUREMENT

The quantity of Item 751.1 Loam for Lawns shall be determined by measurement in place after compaction to the depth specified on the plans or as directed, and there shall be no additional compensation to account for such loss as may be due to settlement, shrinkage and penetration into the underlying material.

BASIS OF PAYMENT

Item 751.1 LOAM FOR LAWNS will be paid for at the contract unit price per CUBIC YARD, complete in place, which prices shall include all testing, analysis, materials, amendments, excavation, grading, fine grading, compaction, labor, and equipment required or incidental for the satisfactory completion of the work.

ITEM 751.2 PLANTING SOIL CUBIC YARD

DESCRIPTION

General

The work of this section includes placing, compacting, and fine grading installed tested and approved planting soil in all seeded and planted areas to required depths, and providing specified planting soil in landscape areas in quantities sufficient to meet the requirements of the drawings. The work related to this section and related items shall be in accordance with these specifications and in close conformity with the lines and grades shown on the plans or established by the Landscape Architect and Engineer.

Examine all other Sections of the specifications for requirements which affect Work of this Section whether or not such work is specifically mentioned in this Section.

Coordinate work with that of all other trades affecting, or affected by Work of this Section. Cooperate with such trades to assure the steady progress of all Work under the Contract.

Related Work

Examine all other Items of the Special Provisions and all Drawings for the relationship of the Work under this Item and the Work of other trades. Cooperate with all trades and coordinate all Work under this Item herewith.

Samples and Submittals

At least 30 days prior to ordering, the Contractor shall submit to the Landscape Architect representative samples, certifications, and certified test results for materials as specified below. No materials shall be delivered until the required submittals have been reviewed and approved by the Landscape Architect and Engineer. Delivered materials shall closely match the approved samples. Approval of test results does not constitute final acceptance. The Landscape Architect Engineer reserves the right to reject on or after delivery any material which does not meet the Specifications.

Do not order or deliver materials until required samples, certifications, manufacturers' literature and test results have been reviewed by the Landscape Architect. Delivered materials shall closely match the samples, as judged by the Landscape Architect. If any deviations from specified materials are proposed, submit written request explaining differences and reasons for request. Submit three (3) copies of each document required, or as directed by the Landscape Architect.

Soil Additives and amendments: Product or testing certificates signed by manufacturers certifying that their products comply with specified requirements:

Manufacturers' certified analysis for all products specified.

Analysis for other amendments, such as organic compost, by the University of Massachusetts Agricultural Extension Service or other approved testing laboratory, made according to methods established by the AOAC, where applicable, and as required in this Specification.

Sieve and salt analysis of sand proposed as a planting soil amendment or component.

Chemicals and Pesticides (if approved): Manufacturers' literature.

Soil tests: Reports indicating and interpreting test results for complete planting soil and soil components. Final planting soil for testing may be composed of tested, stockpiled topsoil for reuse, approved organic compost and/or sand amendments, and/or off-site loam borrow mixed in order to meet Specifications for planting soil. Submit reports at least one (1) month before any delivery of materials. All tests shall be performed by the University of Massachusetts Cooperative Extension Service in accordance with current standards of Association of Official Agricultural Chemists or other testing laboratory as approved by the Landscape Architect. Contractor shall deliver test samples to laboratory, and have test results sent directly to the Landscape Architect. All costs shall be paid by Contractor. Testing reports shall include the following for the stockpiled topsoil and finished planting soil that may or may not be amended in order to meet the specifications:

Mechanical gradation (sieve analysis) and USDA soil classification

Percent organic matter, determined by loss on ignition of samples oven-dried to constant weight at 230 degrees F, plus or minus nine (9) degrees

Chemical analysis for elements specified herein.

Chemical analysis for soluble salts

Chemical analysis for carbon: nitrogen ratio

Chemical analysis for acidity (pH)

Recommendations for soil additives to correct soils deficiencies as necessary to accomplish particular planting operations of Project

Chemical analysis for toxic elements in planting soil as specified herein.

Testing for heavy metals as required by the USEPA

Refer to Planting Soil and Planting Soil Testing Program this Section, for additional requirements.

Organic Material: organic matter from biosolids will not be allowed.

Samples:

Planting Soil complete with any necessary amendments and additives: Following initial testing and certification by the Contractor of planting soil, and/or soil amendments proposed for use to meet specifications, provide two (2) ten-pound representative samples of amended planting soil for testing. Provide a two-pound sample for the Landscape Architect's inspection, to be retained by the Landscape Architect for comparison with delivered soil. The Landscape Architect may examine each planting soil delivery to the site, and may request further testing be performed at the Contractor's expense.

No planting soil shall be delivered until the review of samples and test results by the Landscape Architect, but such review shall not constitute final acceptance. The Landscape Architect reserves the right to reject on or after delivery any material that does not meet specifications or match approved samples. Use of unapproved planting soil will result in rejection by the Landscape Architect and removal by the Contractor at no additional cost to the college.

Organic Material: Two-pound sample and source for review.

Chemicals (lawn and tree herbicides, fungicides, pesticides, fertilizers): Manufacturer's literature and analysis.

Maintenance: Provide watering and fertilizing schedule to DCR for approval.

Maintenance Instructions: Submit recommended procedures for routine year-round maintenance of plantings. Instructions shall be submitted as a condition of Substantial Completion of the Project.

References

Where references are made in these Specifications to standard specifications, codes, etc., of the U.S. Government, State or local authorities, or professional and industrial societies and associations, the applicable portions thereof shall govern as fully as if they were printed in their entirety, herein, and shall include all revisions thereto issued as of the date of the Notice to Contractors pertaining hereto. Comply with the requirements of the following codes and industry standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. The following references are used herein and shall mean:

MassDOT Standard Specifications: Commonwealth of Massachusetts, Massachusetts Department of Transportation/Highway (formerly Massachusetts Highway Department and Department of Public Works), "Standard Specifications for Highways and Bridges," latest edition and including all applicable Supplemental Specifications, Standard Special Provisions and Special Provisions.

The following references are also used herein and shall mean:

ANLA: American Nursery and Landscape Association (formerly American Association of Nurserymen) "American Standard for Nursery Stock," ANSI Z60.1, latest edition.

AJCHN: American Joint Committee on Horticultural Nomenclature. "Standardized Plant Names," latest edition.

AOAC: Association of Official Agricultural Chemists.

USDA: United States Department of Agriculture, Agricultural Research Service, "USDA Plant Hardiness Zone Map," Miscellaneous Publication No. 1475, latest edition.

ASTM International: American Society of Testing Materials International.

AASHTO: American Association of State Highway and Transportation Officials.

ANSI/NFPA: American National Standards Institute, National Fire Protection Act.
UMTC: University of Massachusetts Transportation Center, "Manufactured Loam using Compost Material - Phase 1: Feasibility", October 1966 or latest update.

MassDEP: Department of Environmental Protection, Commonwealth of Massachusetts.

USEPA: United States Environmental Protection Agency.

Quality Assurance

Contractor shall have at least five (5) years of experience in Landscape Work similar in materials, design, and extent to that indicated for this project and with a record of successful landscape establishment. Installer shall maintain an experienced supervisor on the project site during all times that landscape construction is in progress.

Contractor shall conduct pre-landscape construction conference at Project site as directed by the Landscape Architect, to review landscape construction procedures, site conditions, and submittal requirements required in the Work of this Section, especially the requirements for Planting Soil, before any products are submitted for review and approval, or landscape construction commences.

No herbicides, pre-emergents, chemical fertilizers, fungicides, and pesticides shall be used unless reviewed and approved in writing by DCR and project Landscape Architect and permitted for use, and applied by appropriately licensed personnel according to manufacturer's recommendations.

Select compatible products where options are provided, provide each material from a single source and only with review and approval of Cambridge Conservation Commission and Landscape Architect.

Examination of Existing Conditions

Inspect all areas to be planted before starting Work and report any defect, such as incorrect grading, incorrect subgrade elevations, or drainage problems, etc., to the Landscape Architect and DCR prior to beginning Work. Commencement of Work shall indicate acceptance of filled subgrade areas to be planted, and Contractor shall assume responsibility for Work. Inspect areas to be fine graded and planted before starting work.

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 re-handling plants prior to final installation.

Determine location of above-grade and underground utilities and perform Work in a manner, which will avoid damage. Review the locations of utilities with the Landscape Architect before proceeding. Contact all relevant utility companies, public or private, prior to beginning work; contact DIG SAFE 1-888-344-7233 (serves five N. E. states). Report any conflicts to the Landscape Architect and the City or Town in writing before excavating. Hand-excavate as required. Maintain grade stakes until removal is approved by the Landscape Architect or Engineer.

MATERIALS

General

Material shall meet the requirements specified herein:

Planting Soil
Aluminum Sulphate
Ground Limestone
Organic Compost
Sand
Fertilizer

Planting Soil Source

Contractor shall be responsible for providing, screening, and mixing planting soil and loam amendments to create suitable planting soil that meets specifications in quantities and locations shown in the Drawings. Contractor shall provide alternative sources of planting soil components and amendments as required and requested by the Landscape Architect, based on soil tests performed on an on-going basis throughout the construction period in order to meet specifications. Final planting soil approved for use shall be screened with a 1-inch screen prior to spreading.

Planting soil mix, delivered, and/or installed shall be consistent throughout the project, and shall be obtained from approved sources, matching approved samples and mixture proportions reviewed before construction. If source or component changes at any time during construction, Contractor shall obtain new mechanical sieve, heavy metals, chemical, and nutrient tests of new source samples, remix components and resubmit test results of new planting soil mixture to the Landscape Architect for review and approval.

Planting Soil

Planting soil shall be a natural, amended natural, or manufactured soil, produced by a commercial processing facility specializing in production of loam, sands, gravels, and stone. Planting soil may have its topsoil component stripped from sites scheduled for construction, but not from USDA-classified prime farmland. Stripped topsoil shall be free from subsoil. Natural topsoil shall be from well-drained sites where topsoil occurs at least 6" deep. Topsoil or organic matter obtained from bogs or marshes shall not be used. It shall conform to the following:

Organic additives for Planting Soil shall be derived from natural organic sources such as mature leaf compost or sphagnum peat moss if acceptable to the Engineer, and **not** from composted biosolids or waste.

Planting soil shall be a "sandy loam" as determined by mechanical analysis (ASTM D-422) and based on the USDA Classification system, conforming to the following grain size distribution:

U.S. Sieve No.	Percent Passing By Weight	
	Maximum	Minimum
4	100	97
10	95	90
40	85	60
100	60	38
200	35	22
0.002 mm	5	0

Maximum grain size of any soil material shall be 1" in the largest dimension and shall be screened to meet those criteria. Test shall be by combined hydrometer and wet sieving in compliance with ASTM D422 after destruction of organic matter by ignition.

Organic Matter Percentage Requirements:

Planting soil as amended and proposed for use for seeded and planted areas, shall contain between 5% min. and 8% max. organic matter by weight as determined by the loss on ignition of samples that have been oven-dried to a constant weight at a temperature of 105 degrees C. (Test minus sieve #4 material). Minimum organic content in acceptable test sample (and delivered loam) shall be 5 percent and maximum organic content shall be 8 percent. Refer to requirements for acceptable organic matter added as an amendment to loam borrow.

Organic Matter shall be derived from natural organic sources such as mature leaf compost**.**

Organic matter from biosolids will not be allowed.

The acidity range of planting soil shall be 5.5 to 6.5 ph.

Planting soil shall be screened and free of plants and roots, clay lumps, stones or debris one (1) inch or larger in any dimension.

Soluble salt content shall be less than 75 PPM, if a naturally stripped topsoil. Loam borrow manufactured from organic composted sludge may have a higher soluble salt content, but shall not exceed levels recommended for the specific plantings (75 PPM). Salt content will lower the longer the soil is spread on site, with rain and aging of the organic component. If salt content of the planting soil is too high, as determined by the Landscape Architect, the salt content must be within approved ranges by the time the soil is spread on site and plants installed, or planting will be delayed or soil rejected and will require replacement with an approved planting soil.

Carbon: nitrogen ratio shall be between ten (10) and fourteen (14) to one (1) if applicable.

Nutrient content of prepared planting soil and levels of toxic elements and compounds in complete planting soil shall be within the following ranges, measured in PPM:

Substance	Acceptable Range PPM (=mg/kg)	Unacceptable Level PPM (=mg/kg)
Aluminum		75+
Ammonium	6 - 24	>24
Arsenic	<1	10+
Boron	.1-.5	.5+
Cadmium	<0.2	5.0+
Calcium	1000 - 1500	>1500
Chromium		250+
Cobalt		50+
Copper	0.3-.6	>.6
Iron	2.7 – 9.4	>10
Lead	0-10	>22
Magnesium	50 - 120	>120
Manganese	1.1 – 6.3	>7
Mercury		2+
Molybdenum	0 - 15	40+
Nickel		100+
Nitrate	30 - 235	235+
Phosphorus	4 - 14	18+
Potassium	100 - 160	200+
Selenium		36+
Zinc	1.0 – 7.6	15+
PCBs	0	1+

Planting Soil Testing Program

Contractor shall be responsible for mixing and obtaining planting soil samples and submitting samples for testing to ensure that proposed and installed planting soil materials conform to the specifications as stated herein and as required in Article 1.5. All costs for testing will be paid for by the Contractor. Submit prototype planting soil mixes to Laboratory at least 60 days before intended use on site, to allow for reformulation and retesting if test results are rejected.

All planting soil and planting soil products brought to or bulk mixed on site, even if previously approved by test results, shall be submitted for testing conformance and as required in the on-site planting soil sampling program. Tests shall be combined hydrometer and wet sieving in compliance with ASTM C422 after destruction of organic matter by ignition and according to additional requirements of this Section. Samples for tests shall be taken from stockpiles and source within one (1) day of delivery to the site in the presence of the Landscape Architect.

Prior to delivery or spreading, Contractor shall submit a minimum of two (2) approved sample test results of planting soil from each proposed location or source.

Contractor shall deliver samples to Landscape Architect and testing laboratory, shall have testing report sent directly to the Landscape Architect, and shall pay all costs. Contractor shall furnish additional amendments of fertilizer, lime and organic matter at his/her own expense that may be required by test results and required by specifications.

Sieve, heavy metals, and chemical analysis shall be performed by the University of Massachusetts Agricultural Station in Amherst, MA or approved testing laboratory, in accordance with the current standards of the Association of Official Agricultural Chemists and as required meeting requirements for chemical compositions as specified. Incomplete testing or test results will result in rejection and require re-testing by the Contractor at his/her expense.

Soil samples of mixed and fully amended planting soil shall be tested for Nitrate, Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium Aluminum, Soluble Salts and show the acidity of the soil and other values for compounds as indicated in Article 2.1 paragraph B. All sands and organic matter proposed for use as soil amendments shall also be tested for the requirements specified for those items and submitted for review and approval.

Manufactured loam submitted for use as planting soil that tests at unacceptable levels (non-agronomic) for nutrient content and toxic compounds will be rejected by the Engineer and will require reformulation, alternate sources, and retesting to meet specifications for acceptance.

Based on the initial planting soil test results, the planting soil shall be identified as acceptable, acceptable with certain fertilizer, limestone, and other amendments, or unacceptable and requiring resubmission and retesting. If sand, gypsum, or other major planting soil components are required to be added to meet specifications, additional samples with new formulations shall be required to be submitted for testing, review, and approval. If the planting soil is found unacceptable, the Contractor shall be responsible for identifying another source of planting soil and soil ingredients, and/or remix and re-blend as many planting soil component mixtures required producing a planting soil approved by the Landscape Architect that meets specifications. Contractor shall incur all expenses associated with testing and mixing additional samples required for approval.

All planting soil and sand-based planting medium installed shall match the samples approved by the Landscape Architect. The Landscape Architect may require Contractor to furnish additional testing of planting soil or planting medium delivered to the site if it does not appear to be consistent with previously tested samples.

Soil Additives for Planting Soil

Aluminum sulphate for adjustment of planting soil pH shall be commercial sulfur, unadulterated, delivered in containers with the name of the manufacturer, material analysis and net weight appearing on each container.

Ground limestone for adjustment of planting soil pH shall be agricultural grade ground dolomite limestone containing at least 85% calcium carbonate equivalent, with 50% passing the 100 mesh and 95% passing the 20 mesh sieve.

Organic Compost:

Organic compost shall be natural or manufactured mature, composted organic material such as mature leaf compost, etc. (not biosolids). Organic material shall be as specified by UMTC 'Article 5.4 - Standard Compost Specifications for Massachusetts'. Only compost meeting Class A (USEPA) or Type I (MassDEP) compost products shall be acceptable.

Organic compost shall be produced by a MassDEP-approved composting vendor of material originating from mature leaf compost, other aged composted vegetable materials such as brewer's waste, composted with wood products, safe for plants, humans and soil organisms (Class A or Type I). Raw (uncomposted or unprocessed) or incompletely composted organic matter shall be rejected. Biosolid composted matter or waste shall not acceptable for use as organic compost additive for Planting Soil.

Organic compost shall contain no uncomposted bulking agents, such as uncomposted wood chips, and shall be free from hard lumps and free water when handled (at least 60% dry solids). It may be shredded or granular in form. No plastic shall be present. It shall be free from excessive amounts of zinc or unpleasant odor. 100% of material shall pass a 1/2" sieve.

Peat moss shall not be acceptable for use as humus in the planted and seeded areas.

Each and every source of organic material proposed for use as a soil amendment or component of planting soil must be tested on the criteria specified in this Article and results submitted for review and approval by the Landscape Architect before construction. Each delivery of organic material must match samples tested by Contractor and approved by the Landscape Architect or delivered material will be rejected. Each delivery of compost shall require testing and approval, per specifications, to insure compliance with previously approved test submittals. Contractor shall provide sufficient quantities of composted organic material to meet requirements of the planting soil specified and detailed in the Drawings after mixing, spreading, and compaction, and may obtain this material from various sources, if material and test results have been reviewed and approved by the Landscape Architect.

<u>Other Requirements and Test Results for Specific Characteristics of the Organic Matter and Results Issued for the Following Criteria Shall Be:</u>

According to the methods of testing of AOAC, latest edition, the acidity range shall be approximately 5.5 pH minimum to 8.0 pH maximum.

The organic matter shall not be less than 40% as determined by loss on ignition for biosolid compost and may be higher for other compost types. The density shall be 1150 kilos/cubic meter (850 lbs/cy).

The water absorbing ability shall be 200% minimum by weight on an oven dry basis for organic compost other than peat moss.

The Carbon/nitrogen ratio shall be between 10/1 to maximum 20/1 without the addition of nitrogen.

The degree of maturity should be between Grades IV and V, 'curing compost' and 'very stable compost' as measured in a colorimetric-based maturity test. The stability shall be, on the 02 evolution test, < 7 mg C02 - C/g BVS day or deWar self-heating test < 15 degrees C above room temperature.

There should be no unpleasant or detectable odor of ammonia or hydrogen sulfide, which would indicate immature compost.

Total salinity should be less than 4.0 mm hos/cm (Ds/m) or less than 2560 PPM salt (NACL)

The material shall contain some nitrogen, phosphorus, copper, boron, manganese, and molybdenum in horticulturally and agriculturally appropriate proportions to prevent ion antagonisms.

Concentrations of arsenic, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, and selenium must be below EPA (EPA CFR Part 503 Regulations, Table 3, p. 93392, Vol. 58 No.32, 1993) and Commonwealth standards for application to soils with human activity. No pesticide residues or chlorinated hydrocarbons of any kind should be present.

Maturity and age of composted organic material intended for use on this project shall be verified in writing by supplier as part of test results.

Sand for Use as Planting Soil Additive or Component:

Sand for use as ingredient or amendment in planting soil shall be medium sand with angular (not round) sand particles (beach sand not acceptable). Sand that meets M4.101.0 type a Sand Borrow per MassDOT Standard Specifications may be used if material is not self-compacting or overly gravelly, according to the Landscape Architect.

Sand sources and requirements of sand as a planting soil component or amendment may require adjustment at the request of the Landscape Architect, depending on the characteristics and proportions of the other planting soil components (stripped topsoil, borrow, organic component) used to mix the approved planting soil. The intent of the installed planting soil is to provide a consistent, stable, well-draining, aerated, nutrient rich, and friable planting soil that will support mature trees and lawns in an irrigated environment.

Fertilizer shall consist of only composted organic material.

Superphosphate shall not be used.

CONSTRUCTION METHODS

Planting Soil Preparation, Placement, and Fine Grading

Planting Soil Placement and Finished Grading:

Subgrade, Proposed Grades, and Finished Grade Inspections: Contractor shall request inspections by the Landscape Architect of the finished subgrade, proposed finished grades as indicated by grade stakes, and finished grade planting soil for approval. Subgrade shall be roughly scarified with a claw before installing planting soil for plantings and seeded areas.

Tolerances: Compacted, finished grades in planting and seeded areas shall deviate no more than 1 inch from indicated finish grade. Slopes shall be evenly graded with smooth lines and grades.

Placement:

Planting soil shall be screened with 1-inch screen before spreading. After planting soil has been spread in 6-inch lifts maximum, it shall be carefully prepared by scarifying or harrowing to mix interface of subsoil and planting soil, soil shall be hand raked, and lightly rolled. The whole surface shall then be raked to a smooth, uniform surface to lines and grade as shown on the Plans.

Finished grading work shall not be done during wet, inclement, or freezing weather.

All depressions caused by settlement shall be filled with additional planting soil that matches approved planting soil and the surface shall be regraded and raked until a smooth and even finished grade is created.

Unless otherwise approved by the Landscape Architect, approved planting soil shall be placed to minimum depths after compaction and to rates as specified herein and as shown in the Drawings. Contractor shall be responsible to locate and protect utilities during all operations.

Planting soil structure shall not be destroyed through excessive and unnecessary handling or compaction or deterioration of soil structure will result in rejection of planting soil for use. Compaction of planting soil shall be between 80 - 85% maximum dry densities as verified by soil compaction tests as required by the Landscape Architect. Compaction shall be obtained by light rolling, dragging or other method approved by the Landscape Architect to maximum 85% dry density. Do not over-compact, or loosening and re-rolling of the soils will be required. The compaction of the soil shall be adjusted by soil type within the required maximums, with less compaction preferred in finer soils.

Soil additive incorporation for planted areas:

Soil additives shall be spread and thoroughly incorporated into the planting soil by harrowing or other methods approved by the Landscape Architect. The following soil additives shall be incorporated:

Ground limestone is required by soil analysis to achieve a pH of 6.0 to 6.5, but the maximum amount applied shall be 1 pound per square yard. Limestone may not be mixed with fertilizer for application and shall be applied a minimum of two (2) weeks prior to fertilizer application.

Lime and fertilizer shall be spread mechanically rather than in one operation with hydroseeding:

After the planting soil is placed and before it is raked to true lines and rolled, limestone shall be spread evenly over planting soil surface and thoroughly incorporated with planting soil by heavy raking to a least on-half depth of planting soil.

Fertilizer shall be uniformly spread and immediately mixed with the upper 2-in of topsoil.

Organic material and other bulk amendments (such as sand) mixed to make manufactured planting soil shall be thoroughly mixed in soil stockpile locations as specified in Article 3.1 or in a commercial facility, according to proportions determined by soil testing and approved mixing and test results, and not on grade after spreading.

The Contractor shall notify the Landscape Architect and Engineer when areas to receive loam are ready for inspection and approval. Placement of loam fill material shall not begin until the Landscape Architect and Engineer has approved the subgrade.

The Engineer shall approve the use of the Contractor's equipment. Any equipment or procedures that are likely to damage or over-compact underlying structure or materials shall be rejected.

COMPENSATION

METHOD OF MEASUREMENT

ITEM 751.2 PLANTING SOIL shall be measured by the CUBIC YARD, determined by measurement in place after compaction to the depth specified on the plans or as directed, and to the volume so ascertained there shall be added 10% to compensate for such loss as may be due to settlement, shrinkage and penetration into the underlying material.

BASIS OF PAYMENT

Item 751.2 Planting Soil will be paid for at the contract unit price per CUBIC YARD, installed complete in place, which prices shall include all testing, analysis, placement, excavation, grading fine grading, amendments, labor, materials, and equipment required or incidental for the satisfactory completion of the work.

ITEM 751.3 DRY SWALE PLANTING SOIL (GI) CUBIC YARD

DESCRIPTION

General

The work under this item shall conform to the relevant provisions of Section 751 of the Standard Specifications for Highways and Bridges and the following:

The work shall include loam and related items as indicated on the Drawings or specified herein, but is not limited to, testing, placing, spreading and grading seeding & planting media and related items.

Related Work

The following items of work are specified and included in other Sections of the Specifications:

1. Item 101. Clearing and Grubbing
2. Item 120.1 Unclassified Excavation
3. Item 170. Fine Grading and Compacting - Subgrade Area
4. Item 765.76 Dry Swale Seeding Mix

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References and Standards

The following related terms are used herein and shall mean:

AOAC: Association of Official Agricultural Chemists.

Samples and Submittals

At least 30 days prior to ordering the below listed materials, submit certified testing results and representative samples to Engineer for selection. No materials shall be ordered or delivered until required samples, certifications, manufacturer's literature and test results have been reviewed by Engineer. Delivered materials shall closely match the approved samples. The Engineer reserves the right to reject, on or after delivery, any material that does not meet these Specifications.

The Contractor shall perform testing in two stages.

In the first stage, the Contractor shall sample and test Base Loam and Sand for mechanical gradation, percent organics and chemical analysis as follows:

The Contractor shall provide one cubic foot representative samples from each proposed source of Base Loam and Sand for testing and analysis at the Contractor's own expense. Contractor shall deliver samples to testing laboratories and shall have the testing report sent directly to the Engineer. Tests for gradation and organics shall be performed by a private testing laboratory approved by the Engineer. Tests for soil chemistry and pH may be performed by a public agricultural extension service agency. All tests shall be performed in accordance with the current standards of the Association of Official Agricultural Chemists. See Soil Testing requirements in this Section for required tests and recommendations.

In addition to soil testing of Base Loam and Sand, submit the following:

Compost: Submit a one quart-size sample.

Contractor shall provide a written certification from the supplier that compost contents shall meet all requirement of the specification.

Limestone: Submit supplier's certification that the limestone being supplied conforms to these Specifications

Acidulant: Submit supplier's certification that the acidulant being supplied conforms to these Specifications

In the second stage, the Contractor shall sample and test the Dry Swale Planting Soil mix. Testing shall be for mechanical gradation, percent organics and chemical analysis as stipulated above for Base Loam and Sand.

The Contractor shall furnish representative samples of the Dry Swale Planting Soil proposed for use for testing and analysis at the Contractor's own expense. Contractor shall deliver samples to testing laboratories and shall have the testing report sent directly to the Engineer. Tests for gradation and organics shall be performed by a private testing laboratory approved by the Engineer. Tests for soil chemistry and pH may be performed by a public agricultural extension service agency. All tests shall be performed in accordance with the current standards of the Association of Official Agricultural Chemists. See Soil Testing requirements in this Section for required tests and recommendations.

No Dry Swale Planting Soil shall be delivered to the site until the approval of test reports by the Engineer has been given, but such approval shall not constitute final acceptance. The Engineer reserves the right to reject on or after delivery any material which does not meet these specifications.

Soil Testing

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.

Percent of organic matter shall be determined by the loss on ignition of oven-dried samples. Test Samples shall be oven-dried to a constant weight at a temperature of 230 degrees Fahrenheit, plus or minus 9 degrees F.
Chemical analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium, Iron, Manganese, Copper, Zinc, extractable Aluminum, Soluble Salts, and acidity (pH) and buffer (pH). Nutrient levels shall be measured in parts per million (PPM). Cation Exchange Capacity shall be measured.

Soil analysis tests shall show recommendations for fertilizers to nutrient deficiencies as required for (species of plants) (and) (lawn planting) on the construction site. Recommendations for fertilization shall indicate NPK proportions, secondary and micro-nutrients and rates of application in either gallons or pounds per 1,000 square feet.

MATERIALS

General

The Dry Swale Planting Soil shall be manufactured from three base components: Base Loam, Sand and Compost, in proportions to meet the requirements specified herein.

Base Loam

Base Loam shall be existing topsoil stripped and stockpiled at the site or shall be imported. Stripped topsoil shall be sampled and tested for grain size distribution and organic content according to tests as specified. Test results shall be reported to the Engineer, who may recommend minor adjustments to specified approximate mixing ratios and mix requirements for the mix type. Stripped topsoil which has been contaminated by incorporation of subsoil shall not be acceptable for use and shall be replaced with imported topsoil meeting specification requirements at no cost to be owner.

Base Loam as required for the work shall be free of subsoil, large stones, earth clods, sticks, stumps, clay lumps, roots or other objectionable, extraneous matter or debris. Base Loam shall also be free of quack-grass rhizomes, Agropyron Repens, and the nut-like tubers of nutgrass, Cyperus Esculentus, and all other primary noxious weeds. Base Loam shall not be delivered or used for planting while in a frozen or muddy condition. Base Loam for mixing shall conform to the following grain size distribution for material passing the #10 sieve:

U.S. Sieve Size Number	Percent Passing Minimum	Maximum
10	---	100
18	85	100
35	70	95
60	50	85
140	36	53
270	32	42
0.002mm	3	6

The ratio of the particle size for 80% passing (D80) to the particle size for 30% passing (D30) shall be 8 or less. (D80/D30 < 8)

Maximum size shall be one-inch largest dimension. The maximum retained on the #10 sieve shall be 20% by weight of the total sample.

The organic content shall be between 4.0 and 8.0 percent

Sand

Sand: for mixing with base loam to meet specification requirements shall be uniformly graded coarse sand consisting of clean, inert, rounded grains of quartz or other durable rock and free from loam or clay, surface coatings, mica, other deleterious materials with the following gradation.

U.S. Sieve Size Number	Percent Passing Minimum	Maximum
10	100	---
18	65	90
35	35	60
60	15	30
140	0	8
270	0	3
0.002mm	0	0.5

Maximum size shall be one inch largest dimension. The maximum retained on the #10 sieve shall be 20% by weight of the total sample.

The ratio of the particle size for 70% passing (D70) to the particle size for 20% passing (D20) shall be 3.0 or less. (D70/D20 <3.0).

Compost

Compost for amending seeding and planting media: stable, humus-like material produced from the aerobic decomposition of organic residues consisting of Leaf or Yard Waste Compost which shall be composted for a minimum of one year (12 months). Compost shall be free of debris such as plastics, metal, concrete or other debris and stones larger than 1/2", larger branches and roots and wood chips over 1/2" in length or diameter. Compost shall be a dark brown to black color and be capable of supporting plant growth with appropriate management practices in conjunction with addition of fertilizer and other amendments as applicable, with no visible free water or dust, with no unpleasant odor, and meeting the following criteria as reported by laboratory tests.

1. The ratio of carbon to nitrogen shall be in the range of 12:1 to 25:1

2. Stability shall be assessed by the Solvita procedure. Protocols are specified by the Solvita manual (version 4.0). The compost shall achieve a maturity index of 6 or more as measured by the Solvita scale.

3. Pathogens/Metals/Vector Attraction reduction shall meet 40 CFR Part 503 rule, Table 3, page 9392, Vol. 58 No. 32, and Commonwealth of Massachusetts 310 CMR 32.00 (for applications to soils with human activity).

4. Organic Content: at least 20 percent (dry weight). One hundred percent of the material shall pass a 3/8-inch (or smaller) screen. Debris such as metal, glass, plastic, wood (other than residual chips), asphalt or masonry shall not be visible and shall not exceed one percent dry weight. Organic content shall be determined by weight loss on ignition or H2O2 for particles passing a Number 10 sieve according to procedures performed by the West Experiment Station at the University of Massachusetts, Amherst or equivalent. For loss by ignition, a 50-cc sub-sample of the screened and mixed compost is ground to pass the number 60 sieve. Two to three grams (+ 0.001g) of ground sample, dried to a constant weight at 105 degrees C is placed into a muffle furnace. The temperature is slowly raised (5C/minute) to 450C and maintained for three hours. The sample is removed to an oven to equilibrate at 105C and the weight is taken. Organic matter is calculated as loss on ignition.

5. pH: shall be 6.5 to 7.2, as determined from a 1:1 soil-distilled water suspension using a glass electrode pH meter - American Society of Agronomy Methods of Soil Analysis, Part 2, 1986.

6. Salinity: Electrical conductivity of a one to five soil to water ratio extract shall not exceed 2.0 mOhms/cm (dS/m).

7. Compost shall be screened to 1/2 inch maximum particle size and shall contain not more that 3 percent material finer that 0.002mm as determined by hydrometer test on ashed material.

8. Nutrient content shall be determined by the University of Massachusetts Soil Testing Laboratory or equivalent laboratory and utilized to evaluate soil required amendments for the mixed soils. Chemical analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium, Aluminum, Magnesium, Chromium, Iron, Manganese, Lead, Soluble Salts, Cation Exchange Capacity, soil reaction (pH), buffer pH, and micronutrients.

Dry Swale Planting Soil

Planting soil mixes shall be free of plants and their roots, debris and other extraneous matter. They shall be uncontaminated by salt water, foreign matter and substances harmful to plant growth. The electrical conductivity (EC2) of a 1:2 soil-water suspension shall be equal to or less than 1.0 millimhos/cm. (Test minus sieve #4 material).

Dry Swale Planting Soil shall be a blended mix of base loam, sand and compost to create a planting soil medium for use in dry swales as specified herein.

Base Loam, Sand and Compost, each as specified above, shall be combined in an approximate mix ratio of two parts by volume Sand to one and one half parts by volume Base Loam to one part by volume Compost (2S:1.5L:1C) to create a uniform blend which meets the following requirements.

Gradation for Material Passing the Number 10 Sieve:

U.S. Sieve Size Number	Percent Passing Minimum	Maximum
10	0	---
18	70	90
35	48	74
60	26	52
140	18	32
270	14	20
0.002mm	2	6

Maximum size shall be one inch largest dimension. The maximum retained on the #10 sieve shall be 20% by weight of the total sample

Ratio of the particle size for 80% passing (D80) to the particle size for 30% passing (D30) shall be 6.5 or less. (D80/D30 <6.5)

Saturated hydraulic conductivity of the mix: not less than 2 inches per hour according to ASTM D5856-95 (2000) when compacted to a minimum of 86% Standard Proctor, ASTM 698

Organic content: between 4.5 and 7.0 percent by weight.

CONSTRUCTION METHODS

All areas to receive Dry Swale Planting Soil shall be inspected by the Contractor before starting work and any defect such as incorrect grading shall be reported to the Engineer prior to beginning this work.

Amendments

Incorporate amendments to modify pH, per recommendations of test reports, to meet the requirements of this Specification. Soil amendments shall be spread and thoroughly incorporated into the layer of planting soil media by harrowing or other methods reviewed by the Engineer.

Filling and Compacting Dry Swale Planting Soil

Perform percolation tests on existing, in place subsoils or placed fill prior to placing and spreading planting soil media. Testing shall be conducted after the requirements of Item 120.1 Unclassified Excavation and Item 150. Ordinary Borrow have been met.

1. Perform percolation testing of subsoil or placed fills to determine whether or not the subgrade, subsoils, and placed fills drain properly. Perform percolation tests for each lift as specified in herein.

2. In the event that percolation testing indicates that the subgrade, subsoil, placed fills have been over compacted and do not drain, the contractor shall loosen up the top sixteen (16") inches of the compacted layers by ripping or other mechanical means. Re-compact the borrow by driving a small, tracked bulldozer over the area at low speeds so that the tracks of the bulldozer pass over the affected area and the soil is compacted to a density that shall percolate as specified under the work herein. Under no circumstances shall wheeled vehicles be driven over subsoil, placed fills or ordinary borrow that have been shown to percolate or subsoil, placed fills or ordinary borrow that has been loosened and shown to percolate. The work of loosening the top sixteen (16") inches of soil and re-compacting the soil shall be as specified, performed and paid for under Item 120.1 Unclassified Excavation or Item 150. Ordinary Borrow.

3. Perform sufficient percolation tests in areas of poorly draining or compacted subsoil or compacted placed fills as required by the Engineer to ensure that these underlying soils drain. Likewise, perform sufficient percolation tests after ripping and loosening to ensure that the soils are no longer too compact to drain.

All areas to be spread with the planting soil media shall be free of construction debris, refuse, compressible or decayable materials and standing water. Do not place planting soil media when soil materials are frozen. No soil material containing ice or frozen lumps shall be used.

Protect existing trees in areas to be spread with planting soil media. Avoid compacting any existing soil, subsoil, subgrade or planting soil media in the vicinity of existing tree roots and do not use heavy equipment within the drip line of existing trees. Placement of lifts of the planting soil media shall not exceed 6 inches in

depth over existing tree roots and no fill shall come in contact with existing tree trunks. Filled areas around existing trees shall be graded to drain away from existing trees at a minimum slope of 2 percent.

The Contractor shall notify the Engineer when areas to be filled are ready for formal inspection. Placement of fill material shall not begin until Engineer has approved subgrade.

The Engineer shall reject the use of the Contractor's compaction equipment if, in the opinion of the Engineer, the equipment is unsuited to or inadequate for compacting materials to the specified densities within a reasonable length of time, or if equipment or procedures are likely to damage underlying materials.

All fill material is to be placed "in-the-dry" to which dewatering may be required. Spreading and drying of each layer may also be required.

Conversely, if the testing laboratory determines that the fill material is too dry for proper compaction, water shall be added to provide the specified optimum moisture content, as required for proper compaction.

Compaction of each lift shall be done with hand-operated equipment, as specified herein and as determined by ASTM Test, D1556. Fill shall be placed in successive horizontal lifts no thicker 6 inches and compacted to required density as specified herein. Maximum dry density shall be determined in accordance with ASTM D1557, Method D. Maximum dry densities for planting soil media shall be between 86 and 88 percent.

In planting areas, compaction requirements for planting soil media shall be considered minimums and maximums within the density percentages called for, and any over-compaction of existing soils or fills which would be detrimental to planting objectives shall be corrected by tilling or other means and re-compacting to specified compaction limits at no additional cost.

Fine Grading

Planting soil media shall be spread in accordance with these specifications over approved areas to a depth sufficiently greater than shown on the drawings so that after required compaction, the planting soil media depth shall equal that which is required by the Drawings.

Select equipment and otherwise phase the installation of the planting soil media to ensure that wheeled equipment does not travel over subsoil, placed fills or ordinary borrow or already installed planting soil media. Movement of tracked equipment over said soils shall be reviewed and considered for approval by the Engineer. If it is determined by the Engineer that wheeled equipment shall travel over already installed soil, provide a written description of sequencing of work that ensures that compacted soil is loosened and recompacted as the work progresses. Alternatively, place one-inch thick steel plate ballast (or equivalent ballast approved by the Engineer) over the length and width of any travel way to protect planting soils from compaction.

After initial filling, Contractor shall request approval of rough grading by Engineer.

Following approval of rough grading, Contractor shall supply additional planting soil media as required so that following finish grading and compaction, the depth of the planting soil media fill shall conform to the depth required.

No soil shall be placed in a wet or frozen condition.

Sufficient grade stakes shall be set for checking the finished grades. Deviation from elevations shown on Drawings 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.

After seeding and planting media has been spread, it shall be carefully prepared by hand raking.

Contractor shall obtain Engineer's written approval of fine grading and bed preparation before doing any planting.

METHOD OF MEASUREMENT

Item 751.3 Dry Swale Planting Soil (GI) will be measured for payment by the cubic yard, complete in place.

No separate payment will be made for earth excavation or filling operations to establish subgrade or subsoil elevations, but all costs in connection therewith shall be included in the Contract unit price bid.

BASIS OF PAYMENT

Item 751.3 Dry Swale Planting Soil (GI) will be paid for at the Contract unit price per cubic yard, which price shall include all labor, materials, equipment and incidental costs including but not limited to testing, required to complete the work.

ITEM 751.5 FIBER REINFORCED SOIL CUBIC YARD

DESCRIPTION

General

Work under this Item shall conform to the requirements and applicable provisions of Section 751 of the MassDOT Standard Specifications and the following:

Scope of Work

This Section specifies administrative and procedural requirements for manufactured Fiber Reinforced Soil including, but not limited, to the following:

Fiber Reinforced Soil material acquisition.
Testing and analysis for specification conformance.
Preparation of mixes and testing for conformance. Mock Up.
Final in-place testing of soil as delivered by manufacturer.
Coordination with other contractors. Clean-up.

Quality Assurance

Contractor is solely responsible for quality control of the Work.

The installer shall be a firm having at least 5 years of successful experience of a scope similar to that required for the Work, including the preparation, mixing and installation of custom Planting Soil and planting mixes in urban locations.

Installer Field Supervision: Installer to maintain an experienced full-time supervisor on Project site when any Fiber Reinforced Soil preparation work is in progress.

The installer's crew shall be experienced in the installation of soil, grading and interpretation of grading plans in urban areas.

Provide submittals of qualifications of installers and installer field supervisors to demonstrate experience.

Fiber Reinforced Soil work shall be performed by a firm that has sufficient earthwork machinery at the job site simultaneously to amply provide for the vigorous execution of the site work without interruption or delay, except for unforeseen circumstances, such as weather. Machinery operators shall be well experienced in this type of work.

Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State and municipal authorities having jurisdiction. Obtain necessary approvals from all such authorities.

Comply with all requirements for control of silt and sediment during soil installation work as indicated in the contract documents. Provide additional silt and sediment control to maintain silt and sediments within the working area as required by the progress of the work or as directed by the Landscape Architect and Engineer.

Pre-installation Conference: Conduct conference at project site prior to the start of any work-related Fiber Reinforced Soil preparation and shall meet the requirements of this Section.

Layout and Grading

Permanent benchmarks shall be established by a registered land surveyor or professional civil engineer. The Contractor shall maintain established bounds and benchmarks and replace them, if any are destroyed or disturbed.

The Contractor shall maintain at the site, sufficient surveying equipment to accurately excavate to the required subgrade and install soil to the required finish grade. The Contractor shall be responsible to install soil profiles at the elevations and thickness shown on the Plans.

Testing and Submittals

Product Data and Manufacturer's Literature for Reinforced Fibers

Certificates: Within 2 weeks of placement, contractor shall submit certification that all soil blend components and all soil blends meet all environmental standards of the State of Massachusetts for use in residential zones.

Testing for Fiber Reinforced Soil is required at the following intervals:

Testing of individual components for all soil mixes. Tests are as described in this Section.
After test results for base soil components have been accepted, create sample mixes of the Fiber Reinforced soil mix and perform tests described in this Section.

Test Reports: Submit certified reports for tests as described in this Section.

Mechanical gradation (sieve analysis) shall be submitted for both the Base Loam and Sand Base Layer and shall be compared to the USDA Soil Classification System. Percent clay (0.002 mm) shall be reported separately in addition to silt (ASTM D-422-63, hydrometer method).

The silt and clay content shall be determined by a Hydrometer Test of soil passing the #270 sieve.

Chemical analysis shall be undertaken for Phosphorus, Potassium, Calcium Magnesium, Aluminum, Iron, Manganese, Lead, Cation Exchange Capacity, Soluble Salts, acidity (pH) and buffer pH. Recommendations for pH adjustments and fertilizer soil amendments shall be included with all test reports.

Tests shall be conducted in accordance with Recommended Soil Testing Procedures for the Northeastern United States, 2nd Edition, Northeastern Regional Publication No. 493; Agricultural Experiment Stations of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont and West Virginia. Tests include the following:

Test for soil Organic Matter by loss of weight on ignition, as described in Northeastern Regional Publication No. 493.

Test for soil CEC by exchangeable acidity method as described in Northeastern Regional Publication No. 493.

Test for soil Soluble Salts shall be by the 1:2 (v:v) soil:water Extract Method as described in Northeastern Regional Publication No. 493.

Test for Buffer pH by the SMP method as described in Northeastern Regional Publication No. 493.

Certified reports on analyses from producers of composted organic materials and Biochar are required, particularly when sources are changed. Analyses will include all tests for criteria specified in 2.01F.

Density Tests: In-place density testing is required in all areas. Fiber Reinforced Soil must be tested for in place density by ASTM D6938-10 Nuclear Methods and reported as percent of Standard Proctor Maximum Dry Density values.

Allow sufficient time to obtain horticultural soil test approval and obtain the maximum dry density and optimum moisture content by ASTM 698 Standard Proctor Test.

Testing Agencies: The following firms are acceptable testing agencies for the soil and compost.

Leaf Yard Waste Compost Stability Test Comprehensive Testing: Woods End Research Laboratory, P.O. Box 297, Mt. Vernon, ME, 04352, tel: 201.293.2457, www,woodsend.org, or alternate approved STA compost testing laboratory listed by the US Composting Council, www.compostingcouncil.org.

Mechanical Gradation and Chemical Analysis, All Components and Soil Mixes: University of Massachusetts, West Experiment Station, Amherst, MA 01003, tel: 413.545.2311, fax: 413.545.1931. Approved Equal.

Biochar shall be tested using International BioChar Initiative (IBI) Laboratory Testing procedures. Submit test results to Landscape Architect for approval, prior to ordering.

Samples: Prior to ordering the below listed materials, submit required testing and representative samples to the Landscape Architect and Engineer for approval. Do not order materials until Landscape Architect and Engineer's approvals has been obtained. Delivered materials shall closely match the approved samples.

Compost: duplicate samples of 1 gallon.
Base Loam: duplicate samples of 1 gallon.
Coarse Sand: duplicate samples of 1 gallon
Mixed Fiber Reinforced Soil, after approval of individual components: duplicate samples of 1 gallon.

Imported Manufactured Soils may be obtained by one or more of the following sources:

Read Custom Soils, 125 Turnpike St., Canton, Massachusetts, 888-475-5526,
Contact Tony Will
D & H Loam, 2352 Main Street, Concord, Massachusetts, 978-897-4901,
Contact: Tom Dexter
New England Specialty Soils (N.E.S.S.), 435 Lancaster Street, Leominster, Mass, 978-230-2300, Contact: Ed Downing

AgResource Inc. 100 Main St. Amesbury, Massachusetts, 978-388-5110,
Contact: Dave Harding

Landscape Architect and Engineer shall have the right to reject any soil blender. Soil components must be approved in writing prior to delivery to site.

Mock-up and Inspections

At the beginning of site work, the contractor shall demonstrate, in the presence of the Engineer, subgrade preparations, including de-compaction and re-compaction methods that achieve the requirements of this Section. All subsequent subgrade preparations shall be in accordance with approved methods.

The Contractor shall not place Fiber Reinforced Soil on prepared subgrade prior to inspection and approval of Engineer for compliance with depth, compaction and percolation rate. The Contractor shall request inspection before proceeding at least ten working days prior to placement of soils.

The Contractor shall construct a Mock Up of the initial installation Fiber Reinforced Soil in the presence of the Engineer. The Mock Up may be part of the permanent installation if the Engineer approves it. The Mock Up shall be conducted with the same equipment that will be used for the duration of the Fiber Reinforced Soil installation. Mock Up must be conducted with material compliant with the soil moisture requirements. A geotechnical testing agency shall be on site to conduct soil moisture and compaction/density tests for each lift installed during the Mock Up.

Delivery, Storage and Handling

No mixing of Fiber Reinforced Soil components shall occur on site. Fiber reinforced soil shall be mixed at the approved manufacturer's location and delivered to site complete and ready for installation including appropriate moisture content. Coordinate with manufacturer to ensure that appropriate quantity of material is delivered to site to ensure no excess material is stockpiled on site at the end of each working day. Fiber reinforced soil shall not be stockpiled on site over night at any time.

Material shall not be handled or hauled, placed or compacted when it is wet as after a heavy rainfall, early spring or if frozen. Soil shall be handled only when the moisture content is compliant with this Section. The Landscape Architect and Engineer shall be consulted to determine if the soil is too wet to handle.

Store and handle packaged materials in strict compliance with manufacturer's instructions and recommendations. Protect all materials from weather, damage, injury and theft.

Fibers shall be delivered directly to the manufacturer's yard and shall be packaged in Sealed, Waterproof Polypropylene 50 lb Bales (Palletized), 1,000 lb Bulk Bags (Palletized), or other Approved Packaging. Each Bale /Bag to be properly identified with a legible label as to its Contents with the following information:

FRS Product Brand Name / Style Number.
Name / Address of Fiber Manufacturer / Supplier.
Proper Notification of Patents / Trademarks.
Net Weight of contents of each Bale / Bag.
Outside storage of Specified Bales / Bags is Acceptable with Limited UV Exposure.

Sequence deliveries to avoid delay.

Prohibit vehicular and pedestrian traffic on or around stockpiled soil during daily construction activities.

Soil Moisture Content

Contractor shall not move, blend or grade soil when moisture content is so great that free moisture is apparent, nor when it is so dry that dust will form in the air or that clods will not break readily, nor when it is frozen. Apply water, if necessary, or allow to dry to bring soil moisture between 60% of optimum moisture content and optimum moisture content as determined by ASTM D698 prior to compaction, grading or planting.

Fiber Reinforced Soil must be tested and be compliant for soil moisture content immediately prior to delivery or placement at the site. For best results, the recommended moisture content for Fiber Reinforced Soil is between optimum and two percent below optimum moisture content.

Field Soil Moisture Test procedure is applicable for general soil moving and placement only and shall not be considered appropriate for compaction of soils, nor is a replacement for the above testing procedure.

Form soil in palm of hand, if soil retains shape and crumbles upon touching, the soil may be worked.

If the soil will not retain shape it is too dry and should not be worked.

If the soil retains shape and will not crumble, it is too wet and should not be worked.

If the soil glistens or free water is observed when the sample is patted in the palm

MATERIALS

Soil Materials - General

All soil material shall be imported and fulfill the requirements as specified and be tested to confirm the specified characteristics.

Samples of individual components of soil mixes in addition to blended soil mixes including mulch materials shall be submitted by the Contractor for testing and analysis to the approved testing laboratory. Comply with specific materials requirements specified.

No base component material or soil components for soil mixes shall be used until certified test reports by an approved agricultural testing laboratory have been received and approved by the Landscape Architect and Engineer.
As necessary, make any and all soil mix amendments and resubmit test reports indicating amendments until approved.

The Landscape Architect and Engineer may request additional testing by Contractor for confirmation of mix quality and/or soil mix amendments at any time until completion. Changes in mix ratios may be required.

Soil Testing and Soils Testing Report Submittal

All testing of the soil mix components shall be carried out by the Soils Testing Laboratory. Recommendations for amending and/or correcting the soil mix will be provided to the Contractor by the Engineer after approval by the Landscape Architect and Engineer.

Failure of any material by testing and/or amendment procedure to meet Specification requirements shall require the Contractor to seek another source for the failed material and the initiation of all testing procedures for the new replacement material shall immediately take place.

The Contractor shall be responsible for recognizing that these critical project materials warrant timely and serious attention, that the testing process to achieve Approved materials should be considered a lead time item, and that under no circumstance shall failure to comply with all specification requirements be an excuse for "staying on project construction schedule."

Soil Samples: Contractor is responsible for paying costs for testing. Submit 1 gallon soil sample in two phases. Submit samples concurrent with soil test reports in both phases. Submit as phase one, Fiber Reinforced soil base components for approval. Only after approval of phase one components, submit as phase two, soil blend mix / medium for approval. All reports must be from recent analyses, less than 90 days old, and represent materials that are available for delivery to the site.

Phase One Submittals of Fiber Reinforced Soil Components:

Base Loam
Compost
Coarse Sand for Amending Soil
Biochar IBI Test Report
Sand Base Layer Sieve Analysis

Phase Two Submittals of Soil Medium: mixing and batching of soil medium to be submitted in the same manner as bulk soils and will be prepared prior to delivery to site.

Fiber Reinforced Soil

Phase Three Submittals shall be identical to Phase Two Submittals and be conducted for each 200 cubic yards of soil material prepared for the project site.

Submit reports for each of the above samples: Submit sample from each proposed source for testing and approval. Deliver samples to the testing laboratory and pay costs. Send report directly to Landscape Architect and Engineer.

Soil Sample Submittals: Sampling shall be done by the Contractor. The size of the samples and method of sampling shall be as follows: Samples shall be representative of the material to be brought to the site. Each sample shall be a Composite Sample, which consists of 5 separate sub samples taken from a minimum of (5) different locations at each source and mixed together to make the test sample.

The Contractor shall schedule this testing in order to permit reasonable time for testing, evaluation, and approvals prior to scheduled installation. Allow for a minimum of 4 weeks to perform testing and obtain approvals for Phase 1 Submittals.

Base Loam

Base Loam, as required for blending with sand and compost, shall be a naturally occurring A- Horizon soil formed from geologic soil forming processes without admixtures of sand or organic matter sources (composts). Base Loam, which has been contaminated by incorporation of subsoil, shall not be acceptable for use. Base Loam as required for the work shall be free of subsoil, large stones, earth clods, sticks, stumps, clay lumps, roots or other objectionable, extraneous matter or debris. Base Loam shall also be free of quack-grass rhizomes, Agropyron Repens, and the nut- like tubers of nutgrass, Cyperus Esculentus, and all other primary noxious weeds. Base Loam shall not be delivered or used for planting while in a frozen or muddy condition. Base Loam for mixing shall conform to the following grain size distribution for material passing the #10 sieve:

	Percent Passing	
U.S. Sieve Size Number	Minimum	Maximum
10	---	100
18	85	100
35	70	95
60	50	85
140	36	53
270	32	42
0.002mm	3	6

The ratio of the particle size for 80% passing (D80) to the particle size for 30% passing (D30) shall be 8 or less ($D80/D30 < 8$).

Maximum size shall be one-inch largest dimension. The maximum retained on the #10 sieve shall be 20% by weight of the total sample. Tests shall be by combined hydrometer and wet sieving in compliance with ASTM D422 after destruction of organic matter by ignition.

The organic content shall be between 4.0 and 8.0 percent by weight.

pH shall be between 5.8 and 7.0.

Chemical analysis shall be undertaken for Phosphorus, Potassium, Calcium Magnesium, Aluminum, Iron, Manganese, Lead, Cation Exchange Capacity, Soluble Salts, acidity (pH) and buffer pH.

Coarse Sand

Sand for Reinforced Fiber Soil Blends and Sand Base Layer shall be uniformly graded medium to coarse sand consisting of clean, inert, rounded to sub-angular grains of quartz or other durable rock free from loam or clay, mica, surface coatings and deleterious materials with the following grain size distribution for material passing the #10 sieve:

	Percent Passing	
U.S. Sieve Size Number	Minimum	Maximum
10	100	--
18	60	80
35	25	45
60	8	20
140	0	8
270	0	3
0.002mm	0	0.6

Maximum size shall be one-inch largest dimension. The maximum retained on the #10 sieve shall be 20% by weight of the total sample.

The ratio of the particle size for 70% passing (D70) to the particle size for 20% passing (D20) shall be 3.0 or less (D70/D20 <3.0). Tests shall be by combined hydrometer and wet sieving in compliance with ASTM D422.

pH shall be less than 7.5.

Sand for Sand Base Layer shall contain less than 1% Silt and less than 1% Clay as determined by the particle sieve analysis report.

Compost

Organic Matter for amending planting soils shall be a stable, humus-like material produced from the aerobic decomposition and curing of Leaf Yard Waste Compost, composted for a minimum of one year (12 months). The leaf yard waste compost shall be free of debris such as plastics, metal, concrete or other debris. The leaf yard waste compost shall be free of stones larger than 1/2", larger branches and roots. Wood chips over 1" in length or diameter shall be removed by screening. The compost shall be a dark brown to black color and be capable of supporting plant growth with appropriate management practices in conjunction with addition of fertilizer and other amendments as applicable, with no visible free water or dust, with no unpleasant odor, and meeting the following criteria as reported by laboratory tests.

The ratio of carbon to nitrogen shall be in the range of 12:1 to 25:1.

Stability shall be assessed by the Solvita procedure. Protocols are specified by the Solvita manual (version 4.0). The compost must achieve a maturity index of 6 or more as measured by the Solvita scale. Stability tests shall be conducted by Woods End Research Laboratory, Mt. Vernon, Maine.

Organic Content shall be at least 20 percent (dry weight). One hundred percent of the material shall pass a 1/2-inch (or smaller) screen. Debris such as metal, glass, plastic, wood (other than residual chips), asphalt or masonry shall not be visible and shall not exceed one percent dry weight. Organic content shall be determined by weight loss on ignition for particles passing a number 10 sieve

pH: The pH shall be between 6.5 to 7.4 as determined from a 1:1 soil-distilled water suspension using a glass electrode pH meter American Society of Agronomy Methods of Soil Analysis.

Salinity: Electrical conductivity of a one to five soil to water ratio extract shall not exceed 2.5 mmhos/cm (dS/m).

The compost shall be screened to 1/2-inch maximum particle size and shall contain not more that 3 percent material finer that 0.002mm as determined by hydrometer test on ashed material.

Nutrient content shall be determined by the University of Massachusetts Soil Testing Laboratory or equivalent laboratory and utilized to evaluate soil-required amendments for the mixed soils. Chemical analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium, Aluminum, Magnesium, Iron, Manganese, Lead, Soluble Salts, Cation Exchange Capacity, soil reaction (pH), and buffer pH.

Biochar

Biochar for Reinforced Fiber Soil amendment shall be produced by Standard Biocarbon Corp; 542 Hammett Rd, Enfield ME 04493; info@standardbiocarbon.com; 207-200-1887, or approved equal and meet the following requirements:

Percentage of organic carbon – Greater than 80% (> 80%)
Percentage of total ash – Less than 5% (< 5%)
The ratio of Hydrogen to Carbon – Less than 0.7 (H:C <0.7)

Biochar shall be tested using International BioChar Initiative (IBI) Laboratory Testing procedures.

Fibers

Fibers for Reinforced Fiber Soil shall be TURFGRIDS 3610GF discrete, fibrillated fibers for soil and turf reinforcement as manufactured by Fiber Reinforced Soils, LLC: 225-757-9136 (O); 225-752-7975 (F); www.fibersoils.com, or approved equal.

Materials: 100% Polypropylene Fibers shall be inert and shall conform to the following properties:

Property	Test Method	Requirement
Polypropylene	ASTM D4101 Group 1/Class 1/ Grade 2	99% Minimum
Moisture Absorption	-----	Nil
Fiber Length	Measured	1.0 inch, minimum
Color	-----	Green
Specific Gravity	ASTM D792	0.91 gm/cm^3
Carbon Black Content	ASTM D1603	-----
Tensile Strength	ASTM D2256	40,000 psi, minimum
Tensile Elongation	ASTM D2256	15%, maximum
Young's Modulus	ASTM D3822	600,000 psi, minimum

Fiber Reinforced Soil

Base Loam, Sand and Compost, each as specified above, shall be combined in an approximate mix ratio of four parts by volume Sand to one part by volume Base Loam to one and one half part by volume Compost (4S:1L:1.5C) to create a uniform blend which meets the following requirements.

Biochar should be inoculated by blending it with 20% (by volume) mature leaf compost and stockpiling for at least One (1) Month prior to use in a soil blend.

Incorporate 10% inoculated Biochar in blended soil.

Gradation for Material Passing the Number 10 Sieve:

	% Passing by Weight	
U.S. Sieve Size Number	Minimum	Maximum
10	100	--
18	68	90
35	38	63
60	18	39
140	9	18
270	8	10
0.002mm	1	2

Maximum size shall be one-inch largest dimension. The maximum retained on the #10 sieve shall be 15% by weight of the total sample.

Ratio of the particle size for 70% passing (D70) to the particle size for 20% passing (D20) shall be 3.2 or less. (D70/D20 <3.2)

Saturated hydraulic conductivity of the mix: not less than 6 inches per hour, according to ASTM D5856-95 (2000) when compacted to a minimum of 92% Standard Proctor, ASTM 698.

Organic content: between 2.5 and 3.5 percent by weight.

The pH shall be between 6.0 and 6.5.

After approval of the above horticultural testing, conduct Standard Proctor Test ASTM 698 to obtain maximum dry density and optimum moisture content values.

CONSTRUCTION METHODS

Pre-installation Examantion and Preparation

Coordinate activities with other project contractors so that there is no planting soil disturbance from traffic or other construction activities subsequent to placement.

Pre-Installation Examination Required: The Contractor shall examine previous work, related work, and conditions under which this work is to be performed and shall notify Engineer in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means Contractor accepts substrates, previous work, and conditions. The Contractor shall not place any planting soil until all work in adjacent areas is complete and approved by the Landscape Architect and Engineer.

Kickoff Meeting: At least 10 working days prior to the start of work, the contractor shall request a landscape construction kickoff meeting with the Engineer, landscape architect, and any other parties involved with landscape construction. The contractor must demonstrate familiarity with this Section, and other relevant sections of the construction documents. The contractor shall articulate the means and methods of soil blending, subgrade preparation, soil placement and other steps outlined in this Section.

Examination of Subgrade: The subgrade shall be examined by the Contractor prior to the start of subgrade preparation, soil placement and planting. Any deficiencies shall be noted and related to the Landscape Architect and Engineer in writing prior to acceptance of the subgrade by the Landscape Contractor. Deficiencies include, but shall not be limited to the following:

Construction debris present within the planting areas.

The subgrade is at incorrect depths for installing the designed soil profile.

Incomplete lighting and exterior electrical installation.

Conflict with underground utilities.

Subgrade contaminated with oils, compressible material, silt or clay

Subgrade must infiltrate water at the rate of at least one inch per hour or be evaluated for amendment of subgrade soils to improve infiltration or installation of subsurface drainage.

Confirm that the subgrade is at the proper elevation and compacted as required. Subgrade elevations shall slope parallel to the finished grade and/or toward the subsurface drain lines as shown on the drawings.

Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace slopes where required and maintain sides of slopes of excavations in safe condition until completion of backfilling. Provide protection measures as required for public safety.

All subgrade areas to be filled with Fiber Reinforced Soil shall be free of construction debris, refuse, vegetation, compressible or decayable materials, all stones greater than 2 inches, concrete washout or soil crusting films of silt or clay that reduces or stops drainage from the Fiber Reinforced Soil into the subsoil; and/or standing water. Such material shall be removed from the site.

Do not proceed with the installation of Fiber Reinforced Soil, until all utility work in the area has been installed.

The Contractor shall identify the locations of underground utilities prior to proceeding with soil work and shall protect all utilities from damage.

Mixing of Fiber Reinforced Soil at Manufacturer's Yard

The Reinforced Fiber Soil blend shall be delivered to site pre-blended with the proper type and amount of FiberSoils fibers as specified in this section and ready for installation. No mixing of Reinforced Fiber Soil will be allowed on site.

Soil blend shall be produced with equipment that blends together each component in a thorough and uniform manner by an approved manufacturer meeting the qualifications of this specification.

Spread soil amendments into base loam at the specified addition rate over the soil profile.

Mix soil amendments with initial pass with reverse tine rotary mixer rotary tiller (RotaDairon, Blecavator, STEC, GKB, or Redexim or equivalent).

Spread fibers at an application rate of one (1) lb / 6 SF for mixing depth of 6". Turfgrids shall be spread in specified grid pattern using drop spreader, top dresser, modified straw blower, or hand spreading application. Some hand raking may be required to obtain uniform coverage at specified addition rate.

Mix fibers to 6" depth with rotary mixer until uniform fiber / sand composite is obtained. Mixing requires two (2) passes at right angles with recommended rotary mixer. Equipment recommendations are Rotodairon, Blecavator, or equivalent.

Working around Utilities

Carefully examine the civil, record, and survey drawings to become familiar with the existing underground conditions before digging.

Known underground and surface utility lines are indicated on the utility drawings – See Highway and Utility plans. Contact the local Dig Safe organization and give them their required time to respond and mark the property. Determine location of underground utilities and perform work in a manner that will avoid possible damage. Hand excavate as required. Maintain grade stakes set by others until parties concerned mutually agree upon removal.

Perform work in a manner that will protect utilities from damage. Hand excavate as required and provide adequate means of support and protection of utilities during soil installation operations. Maintain grade stakes set by others until parties concerned mutually agree upon removal. The Contractor shall repair all utilities damaged by soil operations.

Subgrade Preparation, Inspection and Percolation Testing

After subgrade levels have been reached, the Engineer shall observe de-compaction and preparation of the subgrade according to this Section and inspect soil conditions to evaluate subsurface drainage conditions.

Coordinate the following scarification work to eliminate subgrade compaction resultant when located in planted areas. Maintain 12" clearance from any underground utilities during subgrade de-compaction.

Heavy Site Subgrade Compaction Mitigation

Heavily compacted subgrade areas such as, but not limited to, temporary parking areas, material stockpile areas, temporary roadways, construction areas and areas around structures and other similar areas.

Prior to establishing the final subgrade, these areas shall be dug up or ripped to a depth of (18) inches to break up the soil hard pan, then re-compacted with two passes of the tracks of a wide track bulldozer size D-6 or smaller, or other approved equipment. Additional passes of the equipment may be required by the Engineer. Vibratory compaction of subgrade in planted areas is prohibited.

Utilize perforated canisters or buckets seven to ten inches in diameter and a minimum of six inches high. Perforations should be 1/8-1/4" in diameter and shall be spaced no greater than 1 inch apart

General Site Subgrade Compaction Mitigation

For all planting areas that are not heavily compacted and would be mitigated as specified above:

> Immediately prior to placing Fiber Reinforced Soil, the entire subgrade shall be loosened to a minimum depth of 8-inches using the teeth of a backhoe or other suitable equipment, then re-compacted with two passes of the tracks of a wide track bulldozer size D-6 or smaller, or other approved equipment. Vibratory compaction of subgrade in planted areas is prohibited.

After Subgrade has been scarified as described above, it shall be recompressed by using the tracks of a wide-tracked bulldozer, multiple passes of a skid steer loader, or the curled bucket of an excavator. Verify the subgrade passes water at or greater than the minimum requirement.

Remove all stones or debris greater than 6" in any dimension from the subgrade prior to placing Fiber Reinforced Soil.

Backfilling of Fiber Reinforced Soil

Soil Placement Preparation:

> Verify that the subgrade preparations have been reviewed and accepted, including de-compaction and removal of large stones.
>
> Notify the Engineer of soil placement operations at least seven calendar days prior to the beginning of work.
>
> Verify that the subgrade passes the minimum water infiltration requirement.

Do not proceed with the installation Fiber Reinforced Soil, until all utility work in the area has been installed.

The Contractor shall identify the locations of underground utilities prior to proceeding with soil work and shall protect all utilities from damage.

Do not begin Fiber Reinforced Soil installation until all utilities, subgrade preparations and irrigation risers shown on the drawings are viewed and approved by the Engineer.

Protect adjacent walls, walks and utilities from damage or staining by the soil. Use plywood and/or plastic sheeting as directed to cover existing asphalt, concrete, metal, and masonry work.

After the subgrade soils have been loosened, re-compressed and inspected, the Sand Base Layer shall be installed to the depths shown on the contract drawings. Place Fiber Reinforced Soil above the sand base layer to the limits shown on the plans. Fiber Reinforced Soil may be spread by using a wide track bulldozer size D-5 or smaller or may be dumped and spread with the bucket of a backhoe from the edge of the loosened area. No rubber- tired equipment or heavy equipment except for a small bulldozer shall pass over the subsoils (subgrade) after they have been loosened and recompressed. If the Contractor plans to utilize such areas for any use of heavy equipment, this work should be carried out prior to beginning the process of loosening soils or filling in that area.

Placement of Fiber Reinforced Soil

All soils shall be placed in lifts not to exceed 8 inches in thickness and compacted to meet minimum and maximum requirements as specified below.

Install a Sand Base Layer as described in this Section to the depths indicated on the contract drawings.

Compaction of Fiber Reinforced Soil

Soil shall be spread in lifts not greater than eight inches and compacted with a minimum of two passes of vibratory compaction equipment to a density between 92 and 96 percent Standard Proctor Maximum Dry Density.

Density testing for Soil must be by ASTM D6938-10 Nuclear Methods, after ASTM D698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort. Density testing shall be conducted at a minimum of one test for each plant bed for each lift. Geotechnical testing agency must be on-site to conduct soil moisture and density tests during installation of Soil.

Scarify the top of each lift by hand raking to break the skin effect resultant from vibratory compaction equipment prior to placing subsequent lifts.

In all cases, the soil being placed shall be in a dry to damp condition. No wet soils shall be placed. Soil moisture content must be compliant with this Section prior to compaction.

Fiber Reinforced Soil shall never be moved or worked when wet or frozen.

Protection

The Contractor shall protect soil work and materials from damage due to operations by other Contractors or trespassers. Maintain protection during installation until acceptance. Treat, repair or replace damaged Fiber Reinforced Soil installation work immediately.

Provide all means necessary, including fences, to protect all soil areas from contamination by trash, dust, debris, and any toxic material harmful to plants or humans after placement. Any uneven or settled areas shall be filled, re-graded and re-compacted to meet the requirements of this Specification. Soil that becomes contaminated shall be removed and replaced with specified soil material.

Phase the installation of the soil mix such that equipment does not have to travel over already installed soil.

Apply filter fabric covering and planking or other engineering controls over soil to minimize compaction and collect dust and debris in any area where the Contractor must work after the installation of Fiber Reinforced Soil.

Replace Fiber Reinforced Soil that has become contaminated as determined by the Landscape Architect or Engineer.

Clean-up

During installation, keep pavements clean and work area in an orderly condition.

Keep the site free of trash and debris at all times. Immediately dispose of wrappings or waste materials associated with products necessary for the completion of the work.

All trash and debris shall be kept in a central collection container. Do not bury trash and debris in back-fill.

Once installation is complete, remove any excess soil from pavements or embedded in fixtures.

Coordination and Excess Materials

Coordinate activities with other project contractors so that there is no soil disturbance from traffic or other construction activities subsequent to placement.

Excess Fiber Reinforced Soil Mixture and Materials: Remove the excess Fiber Reinforced soil mixture and materials at the end of each construction day from the site at no additional cost to the Owner unless otherwise requested.

Post-installation Testing

Placed Fiber Reinforced Soil must be capable of infiltrating water at the minimum rate provided in this Section.

METHOD OF MEASUREMENT

Item 751.5 FIBER REINFORCED SOIL shall be measured by the CUBIC YARD installed complete-in-place including all excavation, grading, fine grading, compaction, testing, sampling, labor, equipment, delivery, and materials required to complete the work specified. Sand Base Layer shall be considered incidental to the work of Reinforced Fiber Soil and shall not be measured separately.

BASIS OF PAYMENT

Payment for work under Item 751.5 Fiber Reinforced Soil shall be at the contract unit price per Cubic Yard, which price shall be full compensation for all labor, equipment, sampling, testing, delivery, materials and incidental costs required to complete the work. No separate or additional payment will be made for testing, re-testing, re-mixing, or other adjustments made to the mix as directed by the Engineer or Landscape Architect in order to complete the work as per the requirements of this section.

Sand Base Layer and BioChar shall be considered incidental to the work and shall not be paid for separately.

ITEM 751.7 COMPOST TOPSOIL SQUARE YARD

DESCRIPTION

General

Examine all other Items of the Standard Specifications, Standard Special Provisions and Special Provisions for requirements that may affect the Work of this Item whether or not such work is specifically mentioned.

The purpose of this item is to provide compost mulch for erosion control, adding organic content and better seed establishment. Hydraulic application equipment will be required for this item, unless otherwise directed.

Organic Compost Testing

The Contractor shall provide preliminary tests on material proposed and, after review and acceptance of preliminary test results, shall provide two 1-quart representative samples in clear, re-sealable plastic bags per each 200 cubic yard source for testing during construction and only on delivered materials or material that matches delivered material.

MATERIALS

Compost

Coarse compost shall be compost meeting the Standard Specifications except as amended herein. No kiln-dried wood or construction debris shall be allowed.

Organic matter content shall be between 20-100% (dry weight basis) as determined by ASTM D2974 (method A) Standard Test Methods for Moisture, Ash and Organic Matter of Peat and Other Organic Soils.

Moisture content shall be <150% by dry weight (<60% by wet weight) as measured by ASTM D2216 Standard Test Method for Laboratory Determination of Water Content of Soil and Rock and ASTM D2974 (cited above).

Organic compost shall be natural or manufactured mature, composted organic material and aged a minimum of one (1) year. Organic material shall be as specified by UMTC 'Article 5.4 - Standard Compost Specifications for Massachusetts'. Only compost meeting Class A (E.P.A.Federal) or Type I (Massachusetts) compost products shall be acceptable.

Organic compost shall be produced by a DEP-approved composting vendor of material originating from mature leaf compost, mature composted animal manure, other aged, composted vegetable materials such as brewer's waste, composted with wood products, safe for plants, humans and soil organisms (Class A or Type I). Raw (uncomposted or unprocessed) or incompletely composted organic matter shall be rejected. Organic matter manufactured from sludge and other biowaste materials shall not be allowed.

Organic compost shall contain no uncomposted bulking agents, such as uncomposted wood chips, and shall be free from hard lumps and free water when handled (at least 60% dry solids). It may be shredded or granular in form. No plastic shall be present. It shall be free from excessive amounts of zinc or unpleasant odor. 100% of material shall pass a 1/2" sieve.

Each and every source of organic material proposed for use as a soil amendment or component of planting soil must be tested on the criteria specified in this Article and results submitted for review and approval by the Landscape Architect before construction. Each delivery of organic material must match samples tested by Contractor and approved by the Landscape Architect or delivered material will be rejected. Each delivery of compost shall require testing and approval, per specifications, to insure compliance with previously approved test submittals. Contractor shall provide sufficient quantities of composted organic material to meet requirements of the planting soil specified and detailed in the Drawings after mixing, spreading, and compaction, and may obtain this material from various sources, if material and test results have been reviewed and approved by the Landscape Architect.

Other requirements and test results for specific characteristics of the organic matter and results issued for the following criteria shall be:

According to the methods of testing of AOAC, latest edition, the acidity range shall be approximately 5.5 pH minimum to 8.0 pH maximum.

The organic matter shall not be less than 40% as determined by loss on ignition for biosolid compost and may be higher for other compost types. The density shall be 1150 kilos/cubic meter (850 lbs/cy).

The water absorbing ability shall be 200% minimum by weight on an oven dry basis for organic compost other than peat moss.

The Carbon/nitrogen ratio shall be between 10/1 to maximum 20/1 without the addition of nitrogen.

The degree of maturity should be between Grades IV and V, 'curing compost' and 'very stable compost' as measured in a colorimetric-based maturity test. The stability shall be, on the 02 evolution test, < 7 mg C02 - C/g BVS day or deWar self-heating test < 15 degrees C above room temperature.

There should be no unpleasant or detectable odor of ammonia or hydrogen sulfide, which would indicate immature compost.

Total salinity should be less than 4.0 mm hos/cm (Ds/m) or less than 2560 PPM salt (NACL)

The material shall contain some nitrogen, phosphorus, copper, boron, manganese, and molybdenum in horticulturally and agriculturally appropriate proportions to prevent ion antagonisms.

Concentrations of arsenic, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, and selenium must be below EPA (EPA CFR Part 503 Regulations, Table 3, p. 93392, Vol. 58 No.32, 1993) and Commonwealth standards for application to soils with human activity. No pesticide residues or chlorinated hydrocarbons of any kind should be present.

Maturity and age of composted organic material intended for use on this project shall be verified in writing by supplier as part of test results.

CONSTRUCTION METHODS

Prior to placement of compost on areas for lawn and restoration seeding, soil surface shall be free of stones larger than 1-inch in diameter and shall be tilled or tracked to ensure an uneven surface for mixing of compost and soil. Surface preparation shall be incidental to this item.

Compost shall be hydraulically applied to areas for seeding unless otherwise directed. Seed may be added to the hydraulically applied compost, however seed course shall be within ½-inch of the compost depth.

COMPENSATION

METHOD OF MEASUREMENT

Measurement for Item 751.7 COMPOST TOPSOIL shall be by the SQUARE YARD of compost installed, approved, and maintained complete in place. Hydromulch shall not be measured separately but is included in respective seeded lawn items.

BASIS OF PAYMENT

Payment for Item 751.7 COMPOST TOPSOIL will be made at the Contract Unit Bid Price per SQUARE YARD and will be compensation for all labor, materials and equipment necessary to complete the Work specified above. Hydromulch shall not be paid for separately but is included in respective seeding items.

ITEM 756. NPDES STORMWATER POLLUTION PREVENTION PLAN LUMP SUM

GENERAL

This Item addresses the implementation of a Storm Water Pollution Prevention Plan required by the National Pollutant Discharge Elimination System (NPDES) and applicable Construction General Permit (CGP).

Pursuant to the Federal Clean Water Act, construction activities which disturb one acre or more are required to apply to the U.S. Environmental Protection Agency (EPA) for coverage under the NPDES General Permit for Storm Water Discharges from Construction Activities. On February 16, 2012 (77 FR 12286), EPA issued the final NPDES CGP for construction activity.

The NPDES CGP requires the submission of a Notice of Intent (NOI) to the U.S. EPA prior to the of construction (defined as any activity which disturbs land, including clearing and grubbing). There is a seven (7) day review period commencing from the date on which EPA enters the NOI into their database. The Contractor is advised that, based on the review of the NOI, EPA may require additional information, including but not limited to, the submission of the Storm Water Pollution Prevention Plan (SWPPP) for review. Work may not commence on the project until final authorization has been granted by EPA and the Massachusetts Department of Environmental Protection (if applicable, see below). Any additional time required by EPA or DEP for review of submittals will not constitute a basis for claim of delay.

In addition, if the project discharges to an Outstanding Resource Water, vernal pool, or is within a coastal ACEC as identified by the Massachusetts Department of Environmental Protection (DEP), a separate notification to DEP is required. DEP may also require submission of the SWPPP for review and approval. Filing fees associated with the notification to DEP and, if required, the SWPPP filing to DEP shall be paid by the Contractor.

Separate NOIs must be submitted by all required Permittees, including but not limited to, the Owner, and the Operator (the Contractor). In cases where the Municipality or other party would either be classified as an Owner, Operator, and/or have control over the plans and specifications or day-to-day site operations, said Municipality or party must also submit a NOI. The Contractor is responsible to ensure that all required Permittees have submitted an NOI and shall provide proof of same to the Engineer prior to the start of any work.

The General Permit also requires the preparation and implementation of a SWPPP in accordance with the aforementioned statutes and regulations. The SWPPP shall include the NPDES General Permit conditions and required information, MassDOT Performance Standards and detailed descriptions of erosion and sedimentation controls to be implemented during construction. It is the responsibility of the Contractor to prepare the SWPPP to meet the requirements of the most recently issued CGP and, if applicable, the DEP requirements. The Contractor shall submit three (3) copies of the draft SWPPP to the Engineer for review and approval at least two weeks prior to any site activities. It is the responsibility of the Contractor to be familiar with the NPDES General Permit conditions and the conditions of any Wetlands Protection Act Order of Conditions or Determination, DEP Water Quality Certification, Army Corps of Engineers Section 404 Permit and all other environmental permits and regulations applicable to this project. The Contractor shall include in the SWPPP the methods and means necessary to comply with applicable conditions of said permits and regulations.

It is the responsibility of the Contractor to complete the SWPPP in accordance with the NPDES General Permit and DEP requirements, provide all information required, and obtain all certifications as required by the NPDES General Permit. Any amendments to the SWPPP required by site conditions, schedule changes, revised or additional work, construction methodologies, regulations and the like are the responsibility of the Contractor. Amendments will require the approval of the Engineer prior to implementation.

Included in the General Permit conditions is the requirement for inspection of all erosion controls and site conditions on a weekly basis as well as after each incidence of rainfall exceeding 0.5 inches in twenty-four hours. The Contractor shall choose a qualified individual who shall be on-site during construction to perform these inspections. The Engineer must approve the Contractor's inspector. In addition, if the Engineer determines at any time that the inspector's performance is inadequate, the Contractor shall provide an alternate inspector. Written weekly inspection forms, storm event inspection forms, and Monthly Summary Reports must be completed and provided to the Engineer within two (2) business days of completion. Monthly Summary Reports must include a summary of construction activities undertaken during the reporting period, general site conditions, erosion control maintenance and corrective actions taken, the anticipated schedule of construction activities for the next reporting period, any SWPPP amendments, and representative photographs.

The Contractor is responsible for preparation of the SWPPP, all required certifications, inspections, forms, reports and any and all corrective actions necessary to comply with the provisions of the General Permit. Work associated with performance of inspections of all erosion controls and site conditions is considered incidental to this item. The Standard Specifications require adequate erosion control for the duration of the contract. Inspection of these controls is considered incidental to the applicable items. Additional erosion controls beyond those specified in bid items elsewhere in this contract which are selected by the Contractor to facilitate and/or address the Contractor's schedule, methods, and prosecution of the work shall be considered incidental to this item.

The CGP requires the submission of a Notice of Termination (NOT) from all Permittees (Operators, Owners, etc.) when final stabilization has been achieved. Approval of final stabilization by the Engineer and confirmation of submission of all NOTs by the Contractor will be required prior to submission of the Engineer's Final Estimate.

METHOD OF MEASURMENT AND BASIS OF PAYMENT

Item 756. NPDES Stormwater Pollution Prevention Plan will be measured and paid for at the unit bid price per Lump Sum, which price shall include all work detailed above, including, but not limited to, SWPPP preparation, required SWPPP amendments (including revisions/addenda pre, during and post- construction), NOI and NOT submissions, certifications, DEP filing fee (if required), inspections, preparation of weekly, monthly, and other required reports, distribution of copies, and all other requirements as described in this special provision. Upon final acceptance of the SWPPP, a payment equal to 50% of the contract lump sum price shall be paid. The remaining 50% of the lump sum shall be paid in 10% increments distributed equally throughout the remaining period of the contract, not including extensions of time.

ITEM 765.	**SEEDED LAWN**	**SQUARE YARD**
ITEM 765.1	**OVERSEEDING**	**SQUARE YARD**
ITEM 765.71	**SEEDED MEADOW**	**SQUARE YARD**

DESCRIPTION

General

Examine all other Items of the MassDOT Standard Specifications, Standard Special Provisions and Special Provisions for requirements that may affect the Work of this Item whether or not such work is specifically mentioned.

The intent of these items is to provide both a temporary cover crop for the prevention of erosion and to provide a permanent grassed surface. Unless otherwise shown on the plans or reviewed by the Engineer or Landscape Architect, all exposed soil areas will be provided with a grassed surface.

Work under these items shall include furnishing and installing grass seed mix as shown on the contract drawings, and in this special provision. Work under this item shall conform to the relevant provisions of MassDOT Standard Specifications, Standard Special Provisions and Special Provisions Division II, Section 765, Section 767, Division III, Section M6, and shall include the following:

Seeded Lawn Mix for Seeded Lawn and Overseeding as reviewed by the Landscape Architect

Seeded Meadow Mix as reviewed by the Landscape Architect

Maintenance (including watering), reseeding, guarantee, and protection of seeded and/or sodded lawns for one year following final acceptance of seeded areas.

Related Work

Examine all other Items of the Special Provisions and all Drawings for the relationship of the Work under this Item and the Work of other trades. Cooperate with all trades and coordinate all Work under this Item herewith.

Examination of Conditions

The Contractor must satisfy himself by his own investigation and research, regarding all conditions affecting the work and the amount of work to be done, the labor and equipment needed, and make his bid in sole reliance thereon.

Submittals

Thirty days prior to the time of seeding, the Contractor shall provide for the approval by the Engineer and Landscape Architect a written description for the seed mixes showing the percentage by weight of each of the kinds of seed. This description shall also include the following:

Seed Mixes: Manufacturers' Certificates of Compliance with the specifications for each type of seed and

name and location of the seed supplier. These certificates shall include the guaranteed percentage of purity, weed content and germination of the seed, and the net weight and date of shipment and pounds per acre sowing rate. No seed may be sown by the Contractor until the submitted certificates have been approved by the Landscape Architect.

Hydromulch, Tackifier, Erosion Control Blanket, Hay Blanket: Contractor shall submit manufacturer's product information a minimum of 30 days prior to the time of seeding for review and approval by Landscape Architect.

References

Where references are made in these Specifications to standard specifications, codes, etc., of the U.S. Government, State or local authorities, or professional and industrial societies and associations, the applicable portions thereof shall govern as fully as if they were printed in their entirety, herein, and shall include all revisions thereto issued as of the date of the Notice to Contractors pertaining hereto. Comply with the requirements of the following codes and industry standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. The following references are used herein and shall mean:

MassDOT Standard Specifications: Commonwealth of Massachusetts, Massachusetts Department of Transportation/Highway (formerly Massachusetts Highway Department and Department of Public Works), "Standard Specifications for Highways and Bridges," latest edition and including all applicable Supplemental Specifications, Standard Special Provisions and Special Provisions.

The following references are also used herein and shall mean:

ANLA: American Nursery and Landscape Association (formerly American Association of Nurserymen) "American Standard for Nursery Stock," ANSI Z60.1, latest edition.

AJCHN: American Joint Committee on Horticultural Nomenclature. "Standardized Plant Names," latest edition.

AOAC: Association of Official Agricultural Chemists.

USDA: United States Department of Agriculture, Agricultural Research Service, "USDA Plant Hardiness Zone Map," Miscellaneous Publication No. 1475, latest edition.

ASTM International: American Society of Testing Materials International.

AASHTO: American Association of State Highway and Transportation Officials.

ANSI/NFPA: American National Standards Institute, National Fire Protection Act.

UMTC: University of Massachusetts Transportation Center, "Manufactured Loam using Compost Material - Phase 1: Feasibility", October 1966 or latest update.

MassDEP: Department of Environmental Protection, Commonwealth of Massachusetts.
USEPA: United States Environmental Protection Agency.

MATERIALS

Seed:
Contractor shall furnish the Landscape Architect with the dealer's certificate of the mixture composition for review and approval before seeding operations begin.

SEEDING- MEADOWS: Seed for Meadow shall be sown at no less than 20 lbs PLS/acre on areas of less than 3:1 slope and 25 lbs PLS/acre on areas of greater than 3:1 slope formulated from the following native low grass growing, mowable, drought tolerant species:

Scientific Name	Common Name	% PLS by Weight
Elymus virginicus	Virginia Wild Rye	30.00%
Elymus canadensis	Canada Wild Rye	25.00%
Schizachyrium scoparium	Little Bluestem	22.00%
Dichanthelium clandestinum	Deertongue grass	8.00%
Agrostis perennans	Upland Bentgrass	6.00%
Carex vulpinoidea	Fox Sedge	2.00%
Juncus tenuis	Path Rush	2.00%
Juncus effusus	Soft Rush	0.10%
		95.10%

Meadow Seed Mix shall contain a total of 4.9% PLS of the following low growing wildflowers in the following rates:

Scientific Name	Common Name	% PLS by Weight
Penstemon digitalis	Beard-tongue	2.00%
Aster novae-angliae	New England Aster	1.00%
Solidago caesia	Woodland Goldenrod	0.50%
Aster cordifolius	Blue Wood Aster	0.50%
Eupatorium maculatum	Joe-pye Weed	0.30%
Geum canadense	White Avens	0.30%
Solidago rigida	Rigid Goldenrod	0.30%
		4.90%

Proportions of the species in the Meadow mix by weight may be formulated by New England Wetland Plants: phone: (413) 548-8000; Fax: (413) 549-4000; 820 West Street Amherst, MA 01002; www.newp.com) or approved equal, with approval by the Landscape Architect during construction for this specific site, use, and mowing requirements for maximum growth and cover that assumes, after establishment, mowing a minimum of three times per growing season to four inch height. Species shall not be substituted with other species (some species may be deleted) without prior review and approval.

Sow in early spring, April 1- May 15th. **or** 50 lbs/ acre if seeded September 15- October 1st. **Fall Seeding will require second seeding the following spring April 1-May 15th at rate of 20 lbs/ acre, pending review of germination and growth by Landscape Architect.**

Seed shall be fresh, clean, new crop seed. Grass and flowers shall be of the previous year's crop and the weed seed content shall not exceed 1% by weight. Where possible, seed stock shall come from a local source. The seed shall be furnished and delivered, in the proportion specified, 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 which has become wet, moldy or otherwise damaged shall not be acceptable. The Contractor shall take care to handle and store the seed according to grower's recommendations and shall not subject the seed to extremes of heat, cold or moist conditions.

Cover crop will be required if circumstances where delays in seeding could occur. At the direction of the Landscape Architect, Add 30 lbs/acre of a cover crop. Cover Crop shall be grain oats and shall be applied only from January 1 to July 31. Cover crops shall be properly cut and managed after plant establishment to prevent it from reseeding. Cover Crop, if required, will not be measured or paid for separately

SEEDING- LAWN AND OVERSEEDING: Sow at six (6) lbs per 1,000 square feet or three hundred (300) lbs per Acre of PT Lawn Seed's 769 R&R Eco-Turf containing the following seed varieties thoroughly mixed, or approved equal:

Common Name	Botanical Name	% PLS by Weight
Quatro Sheep Fescue	Festuca ovina 'Quatro'	35%
Eureka II Hard Fescue	Festuca trachyphylla 'Eureka II'	30%
Banfield Perennial Ryegrass	Lolium perenne 'Banfield'	30%
Microclover	Trifolium repens var Pipolina ssp Microclover	5%

Proportions of the species in the Seeded Lawn by weight may be formulated by PT Lawn Seed: phone: 800.345.3295 / 503.239.7518 info@protimelawnseed.com or approved equal, with approval by the Landscape Architect.

Note: If these specific named varieties and/or cultivars of lawn grass species listed above are not available at the time of construction, the Contractor may substitute cultivars that display similar proven growth, color, habit, drought tolerance, and disease and insect resistance as patented and named cultivars specified, **but only with review and approval of the Landscape Architect and only if Contractor demonstrates that these cultivars are equal in performance and appearance**. Grass species and proportions of species in mix may not be changed.

Seed shall be fresh, clean, new crop seed. Grass shall be of the previous year's crop and the weed seed content shall not exceed 1% by weight. Where possible, seed stock shall come from a local source. The seed shall be furnished and delivered, in the proportion specified, 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 which has become wet, moldy or otherwise damaged shall not be acceptable. The Contractor shall take care to handle and store the seed according to grower's recommendations and shall not subject the seed to extremes of heat, cold or moist conditions.

Hydromulch

Hydromulch used in hydroseed mixture shall be fiber processed from whole wood chips manufactured specifically for standard hydraulic mulching equipment. Fiber shall not be produced from recycled material such as sawdust, paper, or cardboard. Hydromulch shall conform to MassDOT Standard Specification M6.04.4 and the following:

Moisture content of hydromulch shall not exceed 10%, plus or minus 3% 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.

The hydromulch shall be of such character that the fiber will be dispersed into uniform slurry when mixed with water. It shall be nontoxic to plant life or animal life.

When utilized for seeding only, hydromulch shall contain the non-petroleum based organic tackifier Hydrobond, as manufactured by JRM Chemical, Inc., 4881 NEO Parkway, Cleaveland, OH 44128; 216-475-8488; 800-962-4010; www.soilmoist.com; or approved equal and a green dye to allow for easy visual metering during application. All elements contained within hydromulch slurry shall be noninjurious to plant growth.

Erosion Control Fabric- Biodegradable

Fabric shall SC150BN as manufactured by BioNet, or approved equal. Fabric shall be a Double-Net Straw-Coconut Blanket with 70% straw and 30% coconut fiber, stitched with biodegradable thread between biodegradable, natural fiber top and bottom nets. Fabric shall have 18 month longevity and be manufactured and approved for use on slopes of 2:1 or steeper. Erosion control fabric shall be installed *in addition to hay blanket* in all conditions in meadow seed areas where slopes meet or exceed 3:1, and in drainage channels and depressions.

Hay Blanket

Hay blanket for laying on all seed beds for meadow, wildflower, or coastal mix areas shall be #DS75 100% Straw Blanket manufactured by North American Green, Evansville, Indiana, tel: 812 867-6632, or approved equal. Hay blanket is required in all areas where Seeded Meadow is specified.

Chemicals and Insecticides

Provide chemicals and insecticides only as needed for fungus or pest control for plants and as the MassDEP for the intended uses and application rates and applied only when and where permitted by the Landscape Architect and the City Conservation Commission. *Note: the use of chemicals and insecticides is NOT allowed in any Environmental Resource Area or Resource Area Buffer Zone.*

Water

Contractor shall provide all labor and materials required to furnish consistent application of water to all seeded areas during establishment and until two years following Initial Acceptance at his/her expense. Contractor shall supply temporary soaker hoses, hose connections, temporary irrigation, and any other appurtenances necessary to connect and draw from existing water lines or water trucks. Contractor shall not cause damage to any vegetation or adjacent slopes during the watering operation. Water shall potable, free of salt and other impurities injurious to vegetation.

CONSTRUCTION METHODS

General

For all seeded areas the Contractor will notify the Landscape Architect and Engineer and arrange for inspections at the following times:

1. Before seeding, after loam for lawns and compost topsoil has been spread and amendments have been incorporated (if required).
2. During seeding operations.
3. Upon completion of hand seeding/hydro-seeding operations to establish the Two-Year Maintenance Period.
4. End of Two-Year Maintenance Period to determine Acceptance of Work.

Surface Preparation of Soils

The Contractor shall take all necessary measures to ensure that areas to be seeded are kept dry during preparation, seeding, and establishment of seed.

Bare soils shall be raked to remove large stiff clods, lumps, brush, roots, stumps, litter and other foreign matter. All depressions caused by settlement or rolling shall be filled with additional loam and the surface shall be re-graded and rolled until presenting a smooth and even finish corresponding to the required grades.

Protect all existing structures, existing subgrades to remain, utilities, pavements, lawns, planting and other site improvements from damage due to grading Work.

Submit to Landscape Architect any requests for adjustments in grades and alignments found necessary to avoid interference with special conditions encountered.

Render the site erosion-free as necessary. Submit proposed methods for erosion control if necessary. Approval by the Engineer or Landscape Architect of any method to accomplish this does not relieve the Contractor of full responsibility for controlling erosion and/or sedimentation throughout the construction process.

Stockpile usable excavated materials in locations permitted by and/or where directed by the Landscape Architect or the Engineer. Place, grade and shape stockpiles for proper drainage. Locate and retain soil materials away from edge of excavations. Dispose of waste materials legally.

Backfill excavations as promptly as Work permits, but not until completion of inspection, testing, approval and recording locations of underdrainage, if needed.

Uniformly grade subgrade to pitch a minimum of 1-2% and as shown on drawings including adjacent transition areas, providing minimum gradients for temporary drainage to catch basins and swales, streets, curbs, and away from plantings and structures.

Protect subgrade areas scheduled for planting from traffic and erosion. Keep free of trash and debris. Repair and re-establish grades in settled, eroded and rutted areas to specified tolerances. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape and compact to required density prior to further construction.

The top four (4) inches of subgrade of all areas to be planted and seeded shall be raked of all rubbish, sticks, roots, existing vegetative material and roots, and debris and stones larger than 1-inch and shall be removed off site. Subgrade surfaces shall be harrowed, raked or otherwise loosened to a depth of 4-inches. Subgrade shall be reviewed and approved by the Landscape Architect or Engineer before loam for lawns and compost topsoil is placed (see Contract Drawings for seeding details). The use of herbicides for vegetation removal shall be proposed only with the permission of the Landscape Architect and Owner or Town Conservation Commission. *Note: the use of herbicides is NOT allowed in any Environmental Resource Area or Resource Area Buffer Zone.*

Incorporation of Soil Additives in the Seed Bed:

Soil additives, if required, shall be spread and thoroughly incorporated into the top four (4) inches of the loam layer by harrowing or as part of hydroseed slurry as approved by the Landscape architect. The following soil additives shall be incorporated in areas to receive Lawn seeding only:

Ground limestone as required by soil analysis to achieve a pH of 6.0 to 6.5, but the maximum amount applied shall be one (1) pound per square yard. Soil as measured in a six inch profile in proposed seeded areas that has a pH greater than 7.5 at the time of seeding shall require application of acidifier to reduce the pH to acceptable levels upon retesting by the Contractor as reviewed by the Landscape Architect.

It is expected that no or minimal fertilizer shall be required in Seeded Meadow areas. If soil testing determines that Loam for Lawns does not contain appropriate levels of nutrients for establishment of these native species, as determined by the Soil Testing Laboratory and reviewed by the Landscape Architect, then the addition of these nutrients and minerals shall be required to rates recommended by agronomist. *Note: the use of fertilizer is NOT allowed in any Environmental Resource Area or Resource Area Buffer Zone.*

Fine Grading of Seeded Areas and Preparation of the Seed Bed

The whole surface shall then be fine graded by hand raking. Remove large stiff clods, lumps, brush, roots, stumps, litter and other foreign matter. Remove all stones over one inch (1") in diameter from the top three inches (3") of the seed bed. Loam shall also be free of smaller stones in excessive quantities as determined by the Landscape Architect.

If seed bed is proposed to be seeded by hand broadcasting, smooth surface to meet finished grades with raking and broadcast seed according to requirements specified. Compact with rolling after seeding. If bed is proposed to be drill seeded or hydroseeded, roll and compact bed before seeding. The surface shall be compacted with a roller or other suitable means to achieve a maximum dry density of 88 to 90% for the placed loam in accordance with compaction standards of ASTM D1557, Method D. During the compaction process, all depressions caused by settlement or rolling shall be filled with additional loam and the surface shall be regraded and rolled until presenting a smooth and even finish corresponding to the required grades.

General Installation Methods for Lawn and Meadow Seed

Seed shall be fresh, clean, new crop seed. Seed shall be of the previous year's crop and the weed seed content shall not exceed 1% by weight. Where possible, seed stock shall come from a local source. The seed shall be furnished and delivered, in the proportion specified, 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 which has become wet, moldy or otherwise damaged shall not be acceptable. The Contractor shall take care to handle and store the wildflower seed according to grower's recommendations and shall not subject the seed to extremes of heat, cold or moist conditions.

Limits of seeding shall be as designated on plans and as directed by the Engineer and the Landscape Architect. All areas disturbed outside the limit of seeding shall also be seeded at no additional cost to the Owner. Stake limits of lawn and conservation and steep slope mixes before seeding, for review by the Landscape Architect, to insure that proper seed mix is being installed to appropriate limits. Different methods for seeding are required, depending upon mix being installed.

Application rates for Seeded Meadow shall be: 20 lbs per acre, 25 lbs per acre or 50 lbs per acre depending upon seeding dates and slope, see additional information, this section.

Application rates for Seeded Lawn shall be: 6 lbs per 1,000 sq. ft.

The planting of seed shall be done only during periods within the season, which is normal for such work as determined by weather conditions without additional compensation, but subject to the Landscape Architect's approval of time and methods.

Seeding dates for Seeded Meadow shall be April 1 – May 15th.

Seeding Meadowoutside of season shall occur only with permission of the Landscape Architect and Engineer, and may result in the requirement for re-preparing of seed bed and reseeding the following season until specifications requirements are met. Acceptance will not be given to seed outside of season until all the requirements of the specifications have been fulfilled and the seeded areas have met all grow-in requirements. **Out-of-season seeding during hot weather will require shade mulching with additional netted hay-type erosion control fabric to be specified and approved by Landscape Architect.**

Seed mixes containing wildflowers proposed on slopes at or steeper than 3 to 1 shall be installed during the early spring (April-May) in order to achieve maximum germination and slope stabilization with minimal potential for erosion before winter sets in, unless otherwise permitted by the Landscape Architect.

Seeding dates for mown lawns shall be April 1 - June 1 or August 15 - September 30.

Seed only when the bed is in friable condition, not muddy, dried, or frozen, and not in windy or weather or in weather where temperatures are expected to be less than 45 or higher than 75 degrees Fahrenheit during and for two (2) weeks after seeding. After seeding, the seed bed shall be thoroughly and evenly watered with a fine spray to penetrate the soil to a depth of at least six (6) inches, and the seed bed kept evenly moist until germination and acceptance.

Prepared loam for lawns must be allowed to remain fallow for a minimum of three (3) weeks before seeding to encourage weedy growth from existing seed. Any germinated weeds shall be manually cultivated, removed by hand with roots completely removed and soil rolled before seeding.

Protect all trees to remain with tree protection fencing during construction set to edge of canopy. All loaming and seed work within the fence limit must be done by hand with care not to disturb tree roots (no excavation) or fill more than 2" inches above existing grade. Fencing must remain until seeded lawn areas have been sown and fenced off with protective barriers.

Refer to materials section for rates for sowing seeded areas specifically to each mix.

Seed shall be carefully sown and thoroughly raked in twice at right angles at each pass, overlapping by at least 25%, and lightly rolling after raking to insure good soil to seed contact and even sowing. Specified rates for seeding shall meet or exceed requirements for any method used.

Hay Blanket shall be installed in a separate operation from seeding in all other naturalized seeded areas that are seeded by drill, slice, broadcast methods, or hydroseed, see below for more information.

Install erosion control mat in all areas to be seeded with Meadow Mix where slopes are of one vertical foot to three feet horizontal, or steeper and on all drainage ditches and depressions.

Seeding Meadow on Flatter Slopes (Less than 3:1)

Meadow Seeding shall be installed by hand broadcast method at specified rates, raking in to insure ½" soil cover, and light rolling. Following rolling, water the seeded area thoroughly and evenly with a fine spray to penetrate the soil to a depth of at least two inches (2"). Seeding shall be done in two directions at right angles to each other. Hay Blanket shall be installed in a separate operation from seeding to completely cover all seeded areas that are seeded by broadcast methods.

Two (2) alternative seeding methods shall be:

Seeding Meadow with a Brillion or Slice Seeder: Seed with care to completely mix in light seed mix with bulking sand. Seed shall be applied in rates specified. Hay Blanket shall be installed in a separate operation from seeding to completely cover all seeded areas that are seeded by drill or slice methods.

Hydroseeding Meadow: mix seed in rates specified with minimal hydromulch and tackifier and apply on prepared loam in first application, then follow with installation of Hay Blanket to completely cover first hydroseed application. Install erosion control blanket as needed in drainage ditches or depressions.

Hydroseeding Meadow Mix

Utilize a mobile tank to hydroseed with a capacity of at least 500 gallons, filled with water and seed in quantities so it may be sprayed on prepared loamed bed prepared in the specified proportions per unit of area to be hydroseeded.

In seed mixes that contain wildflowers if hydroseeding is proposed, include as little hydromulch in the water/seed slurry as possible, just enough to color area seeded (maximum of 5 lbs. per 1000 square foot seeded area), in order to locate where the operator has been. This technique is to insure maximum seed to soil contact and minimum suspension of light flower seed in the hydromulch for maximum germination.

The slurry shall be thoroughly mixed by means of positive agitation in the tank. The slurry shall be applied by means of a centrifugal pump using the turret or hose application technique from the mobile tank. The hose or turret shall be equipped with a nozzle of a proper design to insure even distribution of the hydroseeding slurry over the area to be hydroseeded. The hose or turret shall be operated by a person thoroughly familiar with this type of seeding operation.

Differing quantities of hydromulch, superphosphate, and limestone shall be included in slurry mix depending on seed type, application requirements, and recommendations for amendments based on results soil testing.

Seeding Meadow on Slopes Greater Than 3:1

Install seed following one of the three (3) defined methods of seeding listed above. Install erosion control blanket immediately after seeding. Meadow mix seeded with one hydroseed application shall always include the installation of a Hay Blanket and erosion control blanket to protect seed bed.

Hydroseeding Lawn

Hydroseeding with hydromulch and tackifier shall be the preferred method for seeding flat or nearly flat seeded lawn areas where a second application of hydromulch or erosion control is not required. Hydroseed on slopes flatter than 3 to 1 (excluding drainage ditches) for seeding lawn, or topdressing. Utilize a mobile tank to hydroseed with a capacity of at least 500 gallons, filled with water and seed in quantities so it may be sprayed on prepared loamed bed prepared in the specified proportions per unit of area to be hydroseeed.

The slurry shall be thoroughly mixed by means of positive agitation in the tank. The slurry shall be applied by means of a centrifugal pump using the turret or hose application technique from the mobile tank. The hose or turret shall be equipped with a nozzle of a proper design to insure even distribution of the hydroseeding slurry over the area to be hydroseeded. The hose or turret shall be operated by a person thoroughly familiar with this type of seeding operation.

Differing quantities of hydromulch, fertilizer, superphosphate, and limestone shall be included in slurry mix depending on seed type, application requirements, and recommendations for amendments based on results soil testing.

For Hydroseeding lawn (or top dressing and seeding) follow all requirements above AND include 40 lbs./ 1,000 sq. ft. hydromulch with tackifier in seed/water slurry mixture.

Sod Installation

If areas are to be sodded, sod only during the planting season for sod, which shall be from April 1 to October 15. The actual planting of sod 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 and approved by the Landscape Architect. Contractor may take responsibility for planting sod under unseasonable conditions, without additional compensation, and subject to the Engineer and DCR's approval of time and methods.

Schedule delivery of sod to arrive in time for immediate installation. If not planted immediately upon delivery, place in a shaded, ventilated area. Do not place plastic or tarps directly over pallets of sod when in direct sun. Sprinkle to keep sod moist until installation. Do not allow root zone to become dry and brittle. Temporary sod storage will not be permitted for longer than three (3) days. Store so that there is no compression of thickness of sod below minimum required. Store flat sods in pairs of layers such that grass surfaces face each other. Keep piles sprinkled with water and covered with burlap or straw to keep moist but not wet. Sods that become dried out or broken shall be rejected by the Landscape Architect.

Sod only when the bed is in a friable condition, not muddy, dry, hard or frozen. Immediately prior to laying sod, lightly roughen planting soil bed with fine-toothed harrow or hand rake to accept sod mat.

Handle sod pieces carefully to prevent loosening and separation of planting soil from roots. Sod shall be laid in one direction with staggered joints. Seams of sod shall be tightly butted to each other or to edges of existing lawn with no overlap. All sod prices trimmed to fit irregular areas shall be done by evenly cutting or shearing vertically to fit the edge. After initial laying of sod, the sod shall be rolled to flatten all seams. Finished grade at all lawn areas shall be smooth. Seams determined by the Landscape Architect to be inadequately joined shall be rectified at no additional cost.

In all swales and on slopes steeper that 3:1, hold sod in place by fastening alternate lines of sod with wooden pegs at least six (6) inches long, three (3) feet apart and driven flush with sod surface; other methods of fastening may be used at the Landscape Architect's approval. Pegging shall be done immediately after tamping. At least two (2) stakes shall be driven through each sod strip to be pegged and stakes shall be not more that two (2) feet apart. Stakes shall have their wider sides parallel to slope.

All sod planted areas shall be watered immediately after installation, except if installed within three (3) hours of dusk, in which case, water immediately the following morning, adhering to the procedures below.

Seeded Meadow - Watering and Maintenance

The Contractor shall provide all labor and water required to establish all seeded areas. Contractor shall consistently water as required, during the entire two-year maintenance period to insure that one inch of water is applied in the soil to the seeded areas and that water is maintained to a depth of 2 inches or greater.

Watering shall be done in a manner which 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 a minimum of one complete coverage to all seeded areas in each 24 hour period, inclusive of rain for two years following Final Acceptance.

After the grass in seeded areas has appeared, all areas and parts of areas which, in the opinion of the Landscape Architect, fail to show a uniform stand of turf, for any reason whatsoever, shall be reseeded and such areas and parts of areas shall be seeded repeatedly within specified seeding dates seasons until all areas are covered with satisfactory growth of turf. Reseeding together with necessary erosion control, grading and fertilizing shall be done at the expense of the Contractor who shall spread the seed by a method approved by the Landscape Architect and during an approved season.

During the first growing season, the Contractor shall mow all turf areas to control weed competition. When the vegetation in all Meadow Mix areas reaches twelve (12") inches and after seed set in the summer, seeded areas shall be cut back to six (6") inches and clippings distributed evenly in place. If Meadow seed mix does not reach 12" by the summer, cut, leave standing, and mow the following summer. Under no circumstances shall these seeded areas be mown after September 15. Leave turf standing to protect seedlings from frost heaving during winter and to preserve seed heads. Seeded areas in steep slopes shall be mown with line trimmer with care to protect surrounding shrubs once during the growing season after reaching 12" to a height of 6" and clippings distributed in place.

During the two-year maintenance period, any decline in the condition of seeded areas shall require the Contractor to take immediate action to identify potential problems and undertake corrective measures. If required, the Contractor shall, at his own expense, engage professional horticulturists to inspect turf and to identify problems and recommend corrective procedures.

A satisfactory stand of Meadow growth, as determined by the Landscape Architect, shall be required to be acceptable. Seeded areas shall have a close stand of seeded species with no weeds present and no bare spots greater than 3 inches in diameter. At least 90 percent of the meadow, areas established shall be permanent grass and wildflower species that were intentionally seeded during construction. At the time of final acceptance, the Contractor shall remove temporary barriers used to protect turf and seeded areas. Absolutely no debris may be left on the site.

Particular care shall be taken to remove herbaceous and woody weeds in areas seeded with meadow mix.

Seeded Lawn - Watering and Maintenance

The Contractor shall provide all labor and water required to establish all seed lawn areas. Contractor shall water as required, during two-year maintenance period to insure that one inch of water is applied in the soil to the seeded areas and that water is maintained to a depth of 2 inches or greater.

Watering shall be done in a manner which 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 one complete coverage to the lawn in each 24-hour period, inclusive of rain for one year following Final Acceptance.

After the grass in seeded areas has appeared, all areas and parts of areas which, in the opinion of the Landscape architect, fail to show a uniform stand of turf, for any reason whatsoever, shall be reseeded and such areas and parts of areas shall be seeded repeatedly within specified seeding dates seasons until all areas are covered with satisfactory growth of turf. Reseeding together with necessary erosion control, grading and fertilizing shall be done at the expense of the Contractor who shall spread the seed by a method approved by the Landscape architect and during an approved season.

During the first growing season, the Contractor shall mow all turf areas to control weed competition.

During the maintenance period, any decline in the condition of seeded areas shall require the Contractor to take immediate action to identify potential problems and undertake corrective measures. If required, the Contractor shall, at his own expense, engage professional horticulturists to inspect turf and to identify problems and recommend corrective procedures.

A satisfactory stand of turf, as determined by the Landscape Architect, shall be required to be acceptable. Seeded areas shall have a close stand of grass with no weeds present and no bare spots greater than 3 inches in diameter. At least 90 percent of the grass established shall be permanent grass species. At the time of final acceptance, the Contractor shall remove temporary barriers used to protect turf areas. Absolutely no debris may be left on the site.

Preparing and Top Dressing of Areas to be Over Seeded

All areas of existing or damaged grass areas shall be top dressed and over seeded as directed by the Landscape Architect. Mow existing grass to a height of four (4") inches before topdressing and over seeding. Remove and discard all grass clippings and debris from the site.

Contractor shall spread approved, mechanically screened loam in areas of top dressing in accordance with planting soils requirements listed in the contract documents.

Over Seeding

Contractor shall obtain Landscape Architect's written approval of top dressing of screened loam before doing any seeding.

Seed only when the top dressed bed is in a friable condition, not muddy or hard.

Seed type and application rates for over seeding shall be the same as those listed in application rates for the particular seed mix specified for that area in locations as shown on the Drawings.

To maximize seed to soil contact, drill or slice seeding is recommended for all areas to be over seeded. Mechanical seeding shall be undertaken in two separate passes at ninety degrees to each other. Rake soil lightly and roll to ensure seed is in firm contact with soil.

Following rolling, thoroughly and evenly water seeded areas with a fine spray to penetrate the top dressed screened loam to a depth of at least 4 inches.

Seeded Lawn and Overseeding Protection and Maintenance

All seeded areas shall be protected by a three (3) foot high barrier constructed of two (2) inch x two (2) inch wood stakes set 18 inches in the ground at eight (8) foot spacing supporting plastic snow fencing. Barriers must be raised immediately after seeding and shall be maintained until final acceptance. Barriers must be removed at the request of the Landscape Architect and not later than two (2) weeks after acceptance. If grass or seed mix area within fencing is damaged for any reason and fencing has not been kept taut and secure by the Contractor, Contractor shall replace grass within two (2) weeks, if during the growing season for that grass, within first two (2) weeks of next growing season.

Maintenance of Mown Lawns

Lawn maintenance, reseeding, watering, and repair to lawn shall be required during the two-year guarantee period for planting as specified herein.

Watering: Watering shall be no less than two (2) inches of water per week within a given area, reduced by amount of natural rainfall at installation and between the months of April through October. Provide for daily watering of all grass areas to maintain moist soil to depth of at least six (6) inches. Apply one complete coverage in a 24-hour period. Water shall not be applied within three (3) hours of dusk unless specifically approved by the Landscape Architect. Prevent erosion due to excessive watering. Prevent damage to seeded areas by watering equipment. All Work injured or damaged due over- or under-watering shall be Contractor's responsibility to correct and at Contractor's expense.

Fertilizing: Lawn fertilizing shall be required during the first and second growing seasons. Fertilizing is permissible only in April, May, August, or September, and not before two (2) months of growing time after seeding unless fertilizer is manufactured specifically for newly seeded lawns. Use 10-10-10 fertilizer applied at rate according to manufacturer's instructions for new lawns after germination. A second application of fertilizer, as specified herein, shall be applied to all seeded and sodded areas after one (1) season of growth of two (2) months duration. Fertilizer shall be applied only during the months of April, May, August or September at rate according to manufacturer's instructions. Adjust nitrogen type and analysis for season of application (slow release in fall). *Note: No fertilizers shall be applied in any Environmental Resource Area or Buffer Zone.*

Re-sodding: If utilized on the project, the Contractor shall be responsible for maintenance to establish a uniform stand of the specified sod until Final Acceptance. Bare spots, discolored sections or portions that fail to knit properly to planting soil bed shall not be accepted. Sod seams shall not be visible at time of acceptance. After the grass has started, all failing areas shall be re-sodded repeatedly, utilizing sod of the same grass types and mixtures from the same supplier, until all areas are covered with a satisfactory growth of grass.

Disease and insect control: Application of all preventative and reactive insecticides or fungicides shall be performed by a turf specialist certified by the Commonwealth of Massachusetts and only after submittal and approval by the Owner and City Conservation Commission and the Landscape Architect of materials, methods, application rates and schedule. The use of granular materials is preferred over spray applications. Note that the a majority of the project area is within a wetland buffer zone.

Mowing: At the time of the first cutting, mow lawn not less than 3 inches high. Grass shall be maintained between 3 inches and three and a half (3 ½") inches high between April and October 30. Do not remove more than 1/3 of the grass blade at any one time. The last mowing of the season, typically in late October, shall be shorter, typically 1½ inches high, with all lawn areas raked and completely vacuumed of thatch, leaves, and debris. Mowing shall include the mulching of clippings on lawns as well as removal of clippings from pavement surfaces immediately after mowing.

Instructions: Furnish complete written instructions for maintenance of lawn to the Engineer and the Landscape Architect at least ten (10) days prior to the end of the contractual maintenance period.

Acceptance and Guarantee Period of All Seeded Areas

Seeded Meadow Areas:

Seeded areas containing Meadow Mixes shall be under a two (2) year minimum Maintenance Period following the guidelines specified above for initial mowings, cuttings, and clippings care, and watering. Should the 2-year period continue into spring season, all cuttings left in place over the winter shall be removed BY HAND within the seeded Meadow Area in April. All seeded areas shall display a uniform, dense and tightly knitted stand of grass and seeded wildflowers with no weeds present and no bare spots greater than three (3) inches in diameter over greater than 5% of the overall seeded area. At least 90% of the turf established shall be permanent grass or seeded wildflower species.

Seeded, Overseeded and Sodded Lawn Areas:

Following the maintenance period for lawn areas and a minimum of three (3) mowings as specified herein; Contractor shall request an inspection by the Landscape Architect for acceptance of the Work and the beginning of the one-year guarantee for lawns. All seeded and sodded areas shall display a uniform, dense and tightly knitted stand of grass with no weeds present and no bare spots greater than three (3) inches in diameter over greater than 5% of the overall lawn area. At least 90% of the grass established shall be permanent grass species.

The Two (2) year mown lawn maintenance, the two (2) year seeded meadow areas maintenance period and the one (1) year guarantee periods will commence after all necessary corrective work and clean-up has been completed at substantial completion, and the Landscape Architect has accepted the lawn and meadow areas.

Contractor shall request that the Landscape Architect inspect the seeded areas at the end of the one-year guarantee period after acceptance. Contractor shall weed, re-seed, lime, apply disease or insect controls, water, fertilize, or re-sod as required to meet the requirements indicated above, and maintain repaired or refurbished lawns and seeded areas in the manner required and methods indicated above until establishment and acceptance of the corrected work.

The Landscape Architect and Engineer's decision shall prevail in the event a dispute develops with the Contractor as to whether or not the seeded areas have developed into a satisfactory stand and meet performance requirements as to presence of weeds, height, density, etc.

COMPENSATION

METHOD OF MEASUREMENT

SEEDED LAWN, OVERSEEDING and SEEDED MEADOW will each be measured PER SQUARE YARD, installed complete-in-place including all excavation, grading, fine grading, amendments, seeding, hay blanket, hydromulch, cover crop, erosion control fabric, maintenance, watering, mowing, labor, materials, and equipment required or incidental for the satisfactory completion of the work.

Where site conditions require (see contract drawings and as written in this section) hay blanket, erosion control fabric and cover crop shall be included in the payment of each seeding item and shall not be measured or paid for separately.

BASIS OF PAYMENT

Payment for work under these Items 765 Seeded Lawn, 765.1 Overseeding and 765.71 Seeded Meadow will be paid for at the contract unit price per square yard, complete in place, including all equipment, labor, materials, maintenance, watering, mowing and incidentals necessary to complete this work.

When a satisfactory stand of grass has not been established at the time of acceptance, no payment for seeding shall be allowed at the time of acceptance.

Erosion control fabric, hay blanket and cover crop, if required, shall be considered incidental to the work of each item and shall not be measured or paid for separately.

ITEM 765.76 DRY SWALE SEEDING MIX (GI) SQUARE YARD

DESCRIPTION

General

The work under this item shall include furnishing and installing grass seed mix as shown on the contract drawings, and in this special provision. The work under these items shall conform to the relevant provisions of Division II, Section 765, Section 767, Division III, Section M6 of the Standard Specifications for Highways and Bridges and the following:

The work shall include the seeding and maintenance of all proposed dry swale areas within the project limits as shown on the Drawings.

Related Work

The following items of work are specified and included in other Sections of the Specifications:

1. Item 170. Fine Grading and Compacting – Subgrade Area
2. Item 751.3 Dry Swale Planting Soil (GI)

References:

1. OMRI: Organic Materials Review Institute

Submittals:

At least thirty (30) days prior to intended use, the Contractor shall provide the following samples and submittals for approval in conformance with requirements of the General Conditions. Do not order materials until Engineer's approval of samples, certifications or test results has been obtained. Delivered materials shall closely match the approved samples. The Engineer has the right to reject on or after delivery any material that does not meet these Specifications. Acceptance shall not constitute Final Acceptance.

Seed: Submit a manufacturer's Certificate of Compliance to the Specifications with each shipment of dry swale mixing 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.

Fertilizer:

a. Submit the Product literature of seeding fertilizer and certificate showing composition and analysis.
b. Submit the purchasing receipt showing the total quantity purchased for the project prior to installation.

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.

Erosion Control Matting: Submit copies of the manufacturer’s literature and one (1) sample.

Wood Cellulose Fiber Mulch: Submit copies of manufacturer's literature and one (1) material sample.

Peat: Submit a one (1) cubic foot sample and supplier's certification of contents.

All additives needed to amend a specific soil in order to meet these specifications.

Examination of Conditions

The Contactor shall investigate and research, regarding all conditions affecting the work and the amount of work to be done, the labor and equipment needed, and make the bid in sole reliance thereon.

All areas to be planted, shall be inspected by the Contractor before starting work and any defect such as incorrect grading shall be reported to the Engineer prior to beginning this work.

MATERIALS

Planting soil media shall be in accordance with the requirements specified under Item 751.02 Dry Swale Planting Soil.

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 shall be kept cool and dry at all times; do not stockpile in the sun.
Seed may be mixed by an approved method on the site or may be mixed by a dealer. If the seed is mixed on the site, each variety shall be delivered in the original containers that shall bear the dealer's guaranteed analysis. If seed is mixed by a dealer then the Contractor shall furnish the Engineer the dealer's guaranteed statement of the composition of the mixture.

Seeding with annual seed mixtures for erosion control, beyond the seeding time period, shall be as required by the Engineer

Dry Swale Seeding Mix

Seed mix shall be composed of the following species:

% of Mix	**Botanical Name**	**Common Name**
25%	*Bouteloua gracilis*	Blue Grama Grass
20%	*Buchloe dactyloides*	Buffalo Grass
25%	*Carex pensylvanica*	Pennsylvania Sedge
5%	*Carex stipata*	Awlfruit Sedge
10%	*Carex stricta*	Tussock Sedge
5%	*Carex vulpinoidea*	Fox Sedge
10%	*Deschampsia flexuosa*	Wavy Hairgrass

Seeding rate for Dry Swale Seeding Mix shall be 2 pounds per 1,000 square feet, or as otherwise recommended by the supplier.

Limestone

Agricultural limestone containing a minimum of 85 percent calcium carbonate or equivalent.

Wood Cellulose Fiber Mulch

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.

Moisture content shall not exceed 10%, plus or minus 3% 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.

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.

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.

Fertilizers

Fertilizer shall be a commercial product complying with the State and United States fertilizer laws. All planting fertilizers shall be certified for organic use (OMRI Listed).

Deliver to the site in the original unopened containers which shall bear the manufacturer's certificate of compliance covering analysis. All of the nitrogen content by weight shall be derived from organic materials. Fertilizer shall contain not less than the Guaranteed Analysis percentages by weight of ingredients as follows or as recommended by the soil analysis:

Total Nitrogen (N) 2.0%

0.8% Water Soluble Nitrogen

1.2% Water Insoluble Nitrogen

Available Phosphate (P2O5) 3.0%

Soluble Potash (K2O) 3.0%

The fertilizer product shall be blended from the following list of natural ingredients: greensand, rock phosphate, alfalfa meal, sulfate of potash, Chilean nitrate, vegetable protein meal such as peanut meal, and animal protein meal such as feather meal.

If additional macronutrients are required as recommended by the soil analysis then:

Phosphorous shall be supplied by using bone meal. Bone meal shall be fine ground, steam-cooked, packing house bone with a minimum analysis of 23 percent phosphoric acid and 1.0 percent of nitrogen.

Potassium shall be supplied by using natural sulfate of potash (K2SO4). Natural sulfate of potash (K2SO4) shall contain 51 percent soluble potash and 18 percent sulfur with trace amounts of calcium and magnesium.

Water

The Contractor shall be responsible to furnish a 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 held responsible to furnish adequate supplies at no additional cost to the Owner. 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.

CONSTRUCTION METHODS

General

Before the application of limestone, fertilizer and seed, the Contractor shall harrow or roto-till to a depth of 3 inches all areas to receive seed which have not been prepared with 4 inches or more of new dry swale planting soil.

Contractor shall request Engineer's written approval of fine grading prior to seeding.

Limit of grading and earthwork shall be limit of seeding unless otherwise indicated on the Contract Documents. All turf areas disturbed outside the limit of seeding shall be prepared and seeded as specified herein at no additional cost.

The season for seeding work shall be from April 1 to June 1 and from August 15 to September 30. The actual turf construction work 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.

Fine Grading and Spreading Planting Soil Medium for Seeding

In accordance with the requirements of Item 751.02 Dry Swale Planting Soil, of this Specification.

Incorporation of Additives

Soil additives shall be spread and thoroughly incorporated into the top 4 of the loam layer by harrowing or other methods approved by the Engineer. The following soil additives shall be incorporated:

Ground limestone as required by soil analysis to achieve a pH of 6.0 to 6.5, but the maximum amount applied shall be 200 pounds per 1000 square feet with a surface application not in access of 50 pounds per 1000 square feet to establish the turf during the season after Final Acceptance.

Fertilizer at the rate of 39 lbs. per 1000 square feet, or more, as recommended by the soil analysis.

Additional macronutrients, humus or other soil amendments shall be applied as recommended by soil testing analysis.

The whole surface shall then be compacted with a roller or other suitable means to achieve a maximum dry density of 88 to 90 percent for the placed loam in accordance with compaction standards of ASTM D1557 Method D. During the compaction process, all depressions caused by settlement or rolling shall be filled with additional loam and the surface shall be regraded and rolled until presenting a smooth and even finish corresponding to the required grades.

Turf Construction - General

Contractor shall obtain Engineer's written approval of fine grading and bed preparation before doing any seeding or hydroseeding.

For all areas except the dry swales, the Contractor may elect to seed by mechanical means or to hydroseed per the following specifications. For the dry swales, the Contractor shall seed by mechanical means per the following specifications.

Limit of work line shall be as indicated on the Drawings. All areas disturbed outside the work limits shall be seeded.

The season for turf and seeding work shall be from April 1 to June 1 and from August 15 to September 30. The actual turf construction work 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.

Seed only when the bed is in a friable condition, not muddy or hard.

Hydroseeding

Hydroseeding shall be a 2-step process.

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.

For slopes less steep than 3 to 1 step 2 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.

For slopes that are steeper than 3 to 1, step 2 shall consist of a separate application of the bonded fiber matrix immediately following the first step of hydroseeding noted above. Apply the Bonded Fiber Matrix at a rate of 2,000 pounds per acre.

Do not apply the bonded fiber matrix in advance of rainfall. Install bonded fiber matrix to ensure that it dries completely for a minimum of 24 hours prior to rainfall. In the event of rainfall during the required 24-hour drying period, reapply additional seed and bonded fiber matrix to all eroded, slumping or water affected areas as required by the Engineer.

Prior to the start of work, the Engineer shall be furnished with a certified statement for approval 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 hydroseeded.

A mobile tank with a capacity of at least 500 gallons shall be filled with water and seed in quantities so they may be sprayed in the specified proportions per unit of area to be hydroseeded. The slurry shall be thoroughly mixed by means of positive agitation in the tank. The slurry shall be applied by means of a centrifugal pump using the turret or hose application technique from the mobile tank. The hose or turret 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.

Install erosion control matting as specified above.

Mechanical Seeding

Seeding of dry swales shall be by Mechanical Seeding Method specified as follows:

Application rates for seeding shall be as described in Materials, above.

Seeding shall be done in two directions at right angles to each other. Sow the seed with approved seeding device. No seeding shall be done in windy weather.

For slopes not as steep as one vertical foot to three horizontal feet seed shall be lightly raked into the ground, after which the ground shall be rolled and compacted. After compacting spread a light layer of salt marsh hay or certified weed-free straw mulch over the entire seed bed, and thoroughly and evenly water with a fine spray the entire bed to penetrate the soil to a depth of at least 2 inches. Hay which is not salt marsh hay or which is not certified weed-free straw, shall not be used.

For all slopes steeper than or equal to 3 to 1 immediately install erosion control matting as described under Turf Construction - General, above.

Turf Maintenance

Maintenance shall begin immediately after any area is seeded or hydroseeded and shall continue for a minimum of one-hundred-twenty (120) day active growing period following the completion of all turf construction work, and until final acceptance of the project. In the event that seeding operations are completed too late in the fall for adequate germination and growth of grass, then maintenance shall continue into the following spring for the minimum 120 day period and reseeding shall take place as required at that time.

Maintenance shall include reseeding, mowing, watering, weeding, fertilizing, and resetting and straightening of protective barriers. Turf work maintenance shall also include chemical treatments as required for fungus and/or pest control.

Watering

The Contractor shall provide all labor and arrange for all watering required to establish an acceptable turf. Contractor shall water all seeded areas daily, as specified, during maintenance period unless natural rainfall during the previous week has been greater than one inch and the soil in the seeded area is moist to a depth of 2 inches or greater. In the event that the Contractor has not watered seeded areas as required for at least a seven day period, the Department may elect to have the seeded areas watered by others and to reduce the value of the seeding contract item by the amount paid for outside watering.

Watering shall be done in a manner which 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 one (1) complete coverage to the turf areas in an eight (8) hour period.

Protection

All seeded areas shall be protected by a double nylon string barrier. The strings shall be supported by 1 inch x 1 inch hardwood stakes spaced 6 feet on center. Strings shall be located parallel to finish grade at 6 inch and 18 inch elevations. Yellow surveyor's flagging will be attached to the strings at 6 foot intervals.

Barriers shall be raised immediately after turf construction and shall be maintained until Acceptance.

Reseeding

After the grass in seeded areas has appeared, all areas and parts of areas which, in the opinion of the Engineer, fail to show a uniform stand of grass, for any reason whatsoever, shall be reseeded and such areas and parts of areas shall be seeded repeatedly until all areas are covered with satisfactory growth of grass. Reseeding together with required grading, fertilizing, and trimming shall be done at the expense of the Contractor who shall spread the seed by a method approved by the Engineer and during an approved season.

Mowing

The Contractor shall keep all turf areas except the dry swales mowed until Acceptance of the contract by cutting to a height of 3 inches when growth reaches 4 inches or as required by the Engineer.

The Contractor shall keep all dry swales mowed until Acceptance of the contract by cutting to a height of 3 inches when growth reaches 4 inches or as required by the Engineer.

Do not remove and discard clippings and debris generated by each mowing and edging operation.
Clippings shall be mulched and returned to the turf bed.

During the maintenance period, any decline in the condition of turfs or hydroseeded areas shall require the Contractor to take immediate action to identify potential problems and undertake corrective measures. If required, the Contractor shall, at the Contractors own expense, engage professional horticulturists to inspect turfs and to identify problems and recommend corrective procedures.

Following the minimum required maintenance periods for turf work construction, the Contractor shall request the Engineer in writing for a formal inspection of the completed work. Seeded areas shall have a close stand of grass with no weeds present and no bare spots greater than 3 inches in diameter. At least 90% of the grass established shall be permanent grass species. At the time of acceptance, the Contractor shall remove temporary barriers used to protect turf areas.

Absolutely no debris may be left on the site. Excavated material shall be removed as required. Repair any damage to site or structures to restore them to their original condition, as required by the Engineer, at no cost to the Department.

METHOD OF MEASUREMENT

Item 765.76 Dry Swale Seeding Mix (GI) will be measured for payment by the square yard, of planted seed. Amendments, water, and maintenance shall be considered incidental to the work and not paid for separately.

No separate payment will be made for purchase and delivery of seed to the Project Site and follow-on maintenance including watering schedule, but all costs in connection therewith shall be included in the Contract unit price bid.

BASIS OF PAYMENT

Item 765.76 Dry Swale Seeding Mix (GI) will be paid for at the Contract unit price per square yard, which price shall include all labor, materials, equipment and incidental cost required to complete the work.

Placement and fine grading of dry swale planting soil will be paid for under Item 751.3 Dry Swale Planting Soil.

ITEM 767.121 SEDIMENT CONTROL BARRIER FOOT

DESCRIPTION

The work under this Item shall conform to the relevant provisions of Sections 670, 751 and 767 of the Standard Specifications and shall include the furnishing and placement of a sediment control barrier. Sediment control barrier shall be installed prior to disturbing upslope soil.

The purpose of the sediment control barrier is to slow runoff velocity and filter suspended sediments from storm water flow. Sediment barrier may be used to contain stockpile sediments, to break slope length, and to slow or prevent upgradient water or water off road surfaces from flowing into a work zone. Contractor shall be responsible for ensuring that barriers fulfill the intent of adequately controlling siltation and runoff.

Twelve-inch diameter (after installation) compost filter tubes with biodegradable natural fabric (i.e., cotton, jute, burlap) are intended to be the primary sedimentation control barrier.

For small areas of disturbance with minimal slope and slope length, the Engineer may approve the following sediment control methods:

- 9-inch compost filter tubes
- Straw bales which shall be trenched

No straw wattles may be used. Additional compost filter tubes (adding depth or height) shall be used at specific locations of concentrated flow such as at gully points, steep slopes, or identified failure points in the sediment capture line.

When required by permits, additional sediment barrier shall be stored on-site for emergency use and replacement for the duration of the contract.

Where shown on the plans or when required by permits, silt fence shall be used in addition to compost filter tubes and straw bales and shall be incidental to the item.

Sediment control barriers shall be installed in the approximate location as shown on the plans and as required so that no excavated or disturbed soil can enter mitigation areas or adjacent wetlands or waterways. Barriers shall be in place prior to excavation work. No work shall take place outside the barriers.

MATERIALS AND CONSTRUCTION METHODS

Prior to initial placement of barriers, the Contractor and the Engineer shall review locations specified on the plans and adjust placement to ensure that the placement will provide maximum effectiveness.

Barriers shall be staked, trenched, and/or wedged as specified herein and according to the Manufacturer's instructions. Barriers shall be securely in contact with existing soil such that there is no flow beneath the barrier.

Compost Filter Tubes

Compost material inside the filter tube shall meet M1.06.0, except for the following: no peat, manure or bio-solids shall be used; no kiln-dried wood or construction debris shall be allowed; material shall pass through a 2-inch sieve; and the C:N ratio shall be disregarded.

Outer tube fabric shall be made of 100% biodegradable materials (i.e., cotton, hemp or jute) and shall have a knitted mesh with openings that allow for sufficient water flow and effective sediment capture.

Tubes shall be tamped, but not trenched, to ensure good contact with soil. When reinforcement is necessary, tubes shall be stacked as shown on the detail plans.

Straw Bales

Straw bales shall be used if shown on the plans or when specified by Orders of Condition or other permit requirements.

Bales should be placed in a single row, lengthwise on the contour, with ends of adjacent bales tightly abutting one another. All bales should be either wire-bound or string-tied. Straw bales should be installed so that bindings are oriented around the sides (rather than along the tops and bottoms) of the bales in order to prevent deterioration of the bindings.

The barrier should be entrenched and backfilled. A trench should be excavated the width of a bale and the length of the proposed barrier to a minimum depth of 4 inches. The trench must be deep enough to remove all grass and other material which might allow underflow. After the bales are staked and chinked (filled by wedging), the excavated soil should be backfilled against the barrier. Backfill soil should conform to the ground level on the downhill side and should be built up to 4 inches against the uphill side of the barrier.

Each bale should be securely anchored by at least 2 stakes or re-bars driven through the bale. The first stake in each bale should be driven toward the previously laid bale to force the bales together. Stakes or re-bars should be driven deep enough into the ground to securely anchor the bales. For safety reasons, stakes should not extend above the bales but should be driven in flush with the top of the bale.

The gaps between the bales should be chinked (filled by wedging) with straw to prevent water from escaping between the bales. Loose straw scattered over the area immediately uphill from a straw bale barrier tends to increase barrier efficiency. Wedging must be done carefully in order not to separate the bales.

When used in a swale, the barrier should be extended to such a length that the bottoms of the end bales are higher in elevation than the top of the lowest middle bale to assure that sediment-laden runoff will flow either through or over the barrier but not around it.

Silt Fence

Materials and Installation shall be per Section 670.40 and 670.60 of the Standard Specifications and the following:

Silt fence shall only be used if shown on the plans or when specified by Orders of Condition or other permit requirements.

When used with compost filter tubes, the tube shall be placed on a minimum of 8 inches of folded fabric on the upslope side of the fence. Fabric does not need to be trenched.

When used with straw bales, an 8-inch deep and 4-inch wide trench or V-trench shall be dug on the upslope side of the fence line. One foot of fabric shall be placed in the bottom of the trench followed by backfilling with compacted earth or gravel. Stakes shall be on the down slope side of the trench and shall be spaced such that the fence remains vertical and effective.

Width of fabric shall be sufficient to provide a 36-inch high barrier after fabric is folded or trenched. Sagging fabric will require additional staking or other anchoring.

MAINTENANCE

Maintenance of the sediment control barrier shall be per Section 670.60 of the Standard Specifications or per the Stormwater Pollution Prevention Plan (SWPPP), whichever is more restrictive.

The contractor shall inspect the sediment barrier in accordance with relevant permits. At a minimum, barriers shall be inspected at least once every 7 calendar days and after a rain event resulting in 0.25 inches or more of rainfall. Contractor shall be responsible for ensuring that an effective barrier is in place and working effectively for all phases of the Contract.

Barriers that decompose such that they no longer provide the function required shall be repaired or replaced as directed. If the resulting berm of compost within the fabric tube is sufficiently intact and continues to provide effective water and sediment control, barrier does not necessarily require replacement.

DISMANTLING & REMOVING

Barriers shall be dismantled and/or removed, as required, when construction work is complete and upslope areas have been permanently stabilized and after receiving permission to do so from the Engineer.

Regardless of site context, nonbiodegradable material and components of the sediment barriers, including photo-biodegradable fabric, plastic netting, nylon twine, and silt fence, shall be removed and disposed off-site by the Contractor.

For naturalized areas, biodegradable, natural fabric materials may be left in place to decompose on-site. In urban, residential, or other locations where aesthetics is a concern, the following shall apply:

- Compost filter tube fabric shall be cut and removed, and compost shall be raked to blend evenly (as would be done with a soil amendment or mulch). No more than a 2-inch depth shall be left on soil substrate.
- Straw bales shall be removed and disposed off-site by the Contractor. Areas of trenching shall be raked smooth and disturbed soils stabilized with a seed mix matching adjacent seeding or existing grasses (i.e., lawn or native grass mix).
- Silt fence, stakes, and other debris shall be removed and disposed off-site. Site shall be restored to a neat and clean condition.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 767.121 Sediment Control Barrier will be measured and paid for at the contract unit price per Foot of sediment control barrier installed which price shall include all labor, equipment, materials, maintenance, dismantling, removal, restoration of soil, and all incidental costs required to complete the work.

Silt fence, when used in conjunction with compost filter tubes or straw bales, will be incidental to this item.

Additional barrier, such as double or triple stacking of compost filter tubes, will be paid for per Foot of compost filter tube installed.

Barriers that have been driven over or otherwise damaged by construction activities shall be repaired or replaced as required by the Engineer at the Contractors expense.

ITEM 767.95 COIR FIBER LOG BANK STABILIZATION FOOT
ITEM 767.96 COIR EROSION CONTROL MAT SQUARE YARD

DESCRIPTION

The work of these items consists of providing all material, labor, equipment, and incidentals required to construct bioengineering treatment as indicated on the Plans and or as specified herein.

Installation Schedule:

Submit proposed installation schedule, indicating dates for each type of work. Correlate with specified maintenance periods to provide maintenance from date of substantial completion. Once accepted, revise dates only as approved in writing.

Maintenance Instructions:

Submit written instructions recommending procedures to be established by the Department of Conservation and Recreation (DCR) Representative for one full year. Submit prior to expiration of required maintenance period.

Quality Assurance:

The Installer shall provide evidence of successful experience with a minimum of five (5) bank or shoreline excavation or stabilization projects. The Contractor shall demonstrate proficiency in practicing effective erosion and sediment control practices during project implementation. Project monitoring and evaluation reports, photographs, locations of specific projects, client letters of recommendation which refer to specific projects, or written or verbal commentary by public agency personnel shall comprise proof of Installer's qualifications.

MATERIALS

Coir Fiber Log

Coir Fiber Log ("coir logs") shall be biodegradable coir fiber cylindrical bundles with a diameter of 12 inches with the length of each log module at 20 feet or 10 feet as needed to meet the layout requirements as indicated on the Plans. Inner Core shall be 100% unsorted, well-cleaned, coir fiber uniformly distributed along the length of the log. The stuffed density of the coir fiber shall be a minimum of 9 lbs/cubic foot. Outer netting shall be constructed from a minimum 3-ply high strength coir bristle twine or yarn. The netting shall have 2-inch x 2-inch rhombic openings with hand-knotted junctions. The average breaking strength of the coir twine shall be a minimum of 90 lbs. Minimum diameter of the coir twine shall be 3/8 inch. Production tolerance for all the above parameters shall not exceed plus or minus 10%.

Coir Erosion Control Mat

Coir Erosion Control Mat ("coir mat") shall be woven matting, 400 GSM (grams per square meter), comprised of 100 percent coir with a natural/earth tone appearance and manufactured from machine-spun bristle coir twines. Mat shall meet the following minimum criteria.

Property	Typical Value
Thickness	0.30 in
Mass per unit area (min.)	13.6 oz/sq yd Wide
Width Tensile Strength – Dry (MD x CD)	504 x 480 lbs/ft Wide
Width Tensile Strength – Wet (MD x CD)	456 x 360 lbs/ft

Standard roll size shall be 3.28-feet wide and length required for particular application. Coconut Fiber

Rope

Coconut fiber rope ("rope") shall be two-ply braided cord with a breaking strength of 80 pounds and minimum 0.25-inch diameter.

Herbaceous Plant Plug

Herbaceous Plant Plug shall be 2-inch deep nursery grown plugs ("plugs") and fully rooted through a substrate of horticultural planting media in the nursery. Plants shall have a deep green foliage and dense, compact growth. Plugs shall be healthy and well cared for with no evidence of insects or diseases present. Yellowed, wilted, insect-ridden or diseased plants shall be rejected.

Herbaceous plant plugs shall be of the following species:

Eurybia divaricata, White Wood Aster
Carex pensylvanica, Pennsylvania Sedge
Schizachyrium scoparium, Little Blue Stem

Live Stakes

Live stakes shall be dormant live woody cuttings with the branches trimmed off of the species as specified herein. Live stakes shall be healthy and well cared for, with no evidence of insects or diseases present. Insect-ridden or diseased stakes shall be rejected.

Live Stakes shall be 4-foot long stakes with a minimum diameter of 3/8-inch of the following species:

Cornus racemosa, Grey Dogwood
Salix bebbiana, Beaked Willow

It is the intent of the Project to install live stakes at the lowest elevations of banks stabilized by coir logs. To this end place live stakes only along the bottom-most courses of coir logs in all locations. Locate and space live stakes at eighteen inches on center. Live stake installation shall be done after coir logs have been installed. Place live stakes immediately below the coir log as shown on the Contract Documents. The Contractor shall submit to the Engineer a list confirming the quantity of live sakes and species of live stakes available from the above list at the time of planting. List shall be based on linear footage of the bottom courses of coir log installed.

Seeding

Seeding in areas of slope stabilization shall be conducted in either the spring or fall seasons. Appropriate seeding windows are:

Spring: April 1 – May 15
Fall: October 1 – December 1 for dormant seeding

Seed mix shall be as specified below and shall be applied at a seeding rate of 75 lbs PLS/acre. In addition, apply 30 pounds of cover crop (grain oats or grain rye) as appropriate for the season.

Slope Stabilization Mix

Botanical Name	Common Name	%PLS by Weight
Grass		
Cover Crop - Secale cereale/Avena sativa	*Cover Crop - Grain Oats/Rye*	*40.00%*
Schizachyrium scoparium 'Albany Pine'	*Little Bluestem 'Albany Pine'*	*30.00%*
Elymus virginicus	*Virginia Wild Rye*	*8.00%*
Elymus canadensis	*Canada Wild Rye*	*5.00%*
Panicum virgatum	*Switch Grass*	*4.50%*
Agrostis perennans	*Upland Bentgrass*	*3.00%*
Dichanthelium clandestinum 'Tioga'	*Deertongue grass 'Tioga'*	*2.30%*
		92.80%
Herb/Forb		
Echinacea purpurea	*Purple Coneflower*	*3.00%*
Chamaecrista fasciculata	*Partridge Pea*	*2.00%*
Penstemon digitalis	*Beard-tongue*	*0.70%*
Monarda fistulosa	*Wild Bergamot*	*0.30%*
Asclepias syriaca	*Common Milkweed*	*0.20%*
Lespedeza capitata	*Roundhead Bush Clover*	*0.20%*
Rudbeckia hirta-VT ecotype	*Black-eyed Susan-VT ecotype*	*0.10%*
Aster prenanthoides	*Zig Zag Aster*	*0.10%*
Solidago nemoralis	*Grey Goldenrod*	*0.10%*
Aster pilosus	*Heath Aster*	*0.10%*
Aster laevis NY Ecotype	*Smooth Aster NY Ecotype*	*0.10%*
Pycnanthemum tenuifolium	*Slender Mountain Mint*	*0.10%*
Solidago juncea	*Early Goldenrod*	*0.10%*
Asclepias incarnata	*Swamp Milkweed*	*0.10%*
		7.20%
		100.00%
Seeding Rate: 75.0 lbs PLS/Acre		

Any species substitutions shall be with a species having similar characteristics and function. Substitutions must be approved by DCR per the documentation submittal process.

CONSTRUCTION METHODS

Coordination

Work under this item shall begin only after Engineer's acceptance of excavation and grading in adjacent areas.

Layout bioengineering treatment locations through staking and outlining and secure Engineer's acceptance before start of work. Notify the Engineer no less than three (3) days prior to the desired date of inspection of staking to schedule site visit.

Installer of coir materials shall be responsible to coordinate work with earthwork contractor.

1. Earthwork contractor shall be responsible for rough grading and finish grading of adjacent wetland and upland areas. Installer of coir materials shall be responsible for excavation and filling operations specifically required for installation of bioengineering materials and repair of all finished grades disturbed by the Installers installation procedures.

2. Installer of bioengineering materials shall supply all labor, both hand and by machinery, required to complete the Work. Installer shall supply all equipment and materials to complete the work.

Furnishing and installing plant material shall be in accordance with the planting items in this contract. Coordinate planting schedule with installation schedule of coir logs and coir erosion control mat.

Coir Erosion Control Mat Installation

The intent of coir mat is to hold shredded bark mulch in place during flood events. Coir mat shall be installed under coir logs on bank and over mulch in planting beds adjacent to shoreline. A narrow width fabric is specified to fit fabric between planted shrubs more easily. Cutting of fabric to fit around woody plants should be avoided to the extent possible in order to maintain the integrity of the fabric. Wider fabric may be used for panel to be installed under coir logs and over bank face.

Coir mat shall be held in place with wire staples hammered in at edges spaced a maximum of 3 feet apart and in a staggered row in center of mat. Anchor edge of coir mat under bottom of coir logs on bank edge. Overlap edges of panels so the landward edge of panel lies over the channel ward edge of the adjacent panel. Allow minimum 3 inch overlap. Coir mat shall be placed on top of shredded bark mulch and, if possible, after planting woody shrubs.

Coir Log Installation

Coir logs shall be even along top of bank. If necessary to achieve a level profile, a trench may be hand dug or soil placed to create an even surface. Press coir logs in place against the bank to ensure firm contact with soil surface. Soil may be removed from bank by hand digging to fit coir logs between bank and existing boulders.

Boulders shall not be moved or disturbed for installation of the coir mat or coir logs.

Wood stakes shall be driven in five feet on center on both sides of the coir log. Insert stake through netting of the coir logs to a minimum depth of 3-feet.

The coir logs shall be laced together end-to-end with cord to secure a continuous length. End-to- end lacing may be completed before or after placement on bank to facilitate handling.

The upstream and downstream end of the coir logs shall be buried 2 to 4 feet laterally into the bank. Care shall be taken to disturb as little soil as possible outside the work area and to avoid damage to any existing trees and shrubs on or near the bank.

Backfill space between coir log and bank with backfill mix of 75% topsoil and 25% compost topsoil. Backfill mix shall be placed under shredded bark mulch and coir mat.

Installation of herbaceous plants in coir logs shall occur after coir mat and coir log installation has been accepted by the Engineer . Planting holes shall be created in coir logs by separating fibers with a dibble or other tool to make a hole of sufficient size to accept entire root system of plant. Cover roots of plant with surrounding coir fiber material

Maintenance

Maintenance of the bioengineering shall include:

1. Repair of erosion problems.
2. Irrigation and watering of plants until establishment, in the absence of adequate rain, for a one-year period.
3. Reinstall, re-stake or repair materials that become damaged, loose or non-anchored.
4. Replacement of dead plant material.

Guarantee

Contractor shall guarantee that installed coir logs and coir log pads will remain in place and provide erosion control measures required to establish plantings for a period of two (2) years.

Contractor shall guarantee plant to be healthy, active, and growing at the end of the two (2) year period from acceptance. Contractor shall replace all dead, dying, or non-acceptable plants as required by the Engineer at the end of the growing year one and growing year two at no additional cost to the Owner.

METHOD OF MEASUREMENT

Work under Item 767.95 shall be measured by the FOOT, complete and installed.
Work under Item 767.96 shall be measured by the SQUARE YARD, complete and installed.

BASIS FOR PAYMENT

Work under Item 767.95 will be paid for at the Contract Unit price per FOOT.
Work under Item 767.96 will be paid for at the Contract Unit price per SQUARE YARD. Contract Unit prices shall include all labor, materials, equipment and incidental costs required to complete the work. No separate payment will be made for purchase and delivery of coir logs and coir mats to the Project Site and continuing maintenance thereof.

767.7	**AGED PINE BARK MULCH**	**CUBIC YARD**
771.01	**ALLEGHANY SERVICEBERRY, 8'-10' HT. MULTISTEM**	**EACH**
771.02	**AMERICAN ELM VALLEY FORGE – 3"-3.5" CAL.**	**EACH**
771.03	**LONDON PLANE TREE BLOODGOOD, 3"-3.5" CAL.**	**EACH**
771.04	**FREEMAN MAPLE AUTUMN BLAZE, 3"-3.5" CAL.**	**EACH**
771.05	**HERITAGE RIVER BIRCH, 8'-10' HT. MULTISTEM**	**EACH**
771.06	**SWAMP WHITE OAK, 3"-3.5" CAL.**	**EACH**
771.07	**GRANDMASTER SWEETGUM, 3"-3.5" CAL.**	**EACH**
771.08	**TULIP TREE, 3"-3.5" CAL.**	**EACH**
771.09	**WITCH HAZEL, 8'-10' HT. MULTISTEM**	**EACH**
771.10	**APPALACHIAN SNOW DOGWOOD, 8'-10' HT. MULTISTEM**	**EACH**
771.11	**DECIDUOUS SHRUB, 3 GAL.**	**EACH**
771.12	**EVERGREEN SHRUB, 24"-30" HT.**	**EACH**
771.13	**PERENNIAL, 1 GAL.**	**EACH**

DESCRIPTION

General

Include to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

Examine all other Sections of the specifications for requirements which affect Work of this Section whether or not such work is specifically mentioned in this Section.

Coordinate work with that of all other trades affecting, or affected by Work of this Section. Cooperate with such trades to assure the steady progress of all Work under the Contract.

Examine all other Items of the Standard Specifications, Standard Special Provisions and Special Provisions for requirements that may affect the Work of these Items whether or not such work is specifically mentioned. The Work of this Section includes but is not limited to:

Installing trees, shrubs, and perennials as shown on contract drawings

Drainage test pits for all tree plantings,

Test pits for drainage for all trees,

Fertilizing and pruning trees and shrubs,

Guying trees,

Mulching planting beds and tree saucers,

Maintaining and watering all plantings through 2-year guarantee period,

Locating and pre-tagging plant materials specified at nurseries at least two months before construction. Contractor shall also provide full compensation (including fully loaded time and expenses) for Landscape Architect to tag trees at nurseries outside of Massachusetts and for tagging visits to Massachusetts's nurseries where plant material does not meet specifications as determined by the Landscape Architect.

Samples and Submittals

Do not order or deliver materials until required samples, certifications, manufacturers' literature and test results have been reviewed by the Landscape Architect. Delivered materials shall closely match the samples, as judged by the Landscape Architect. If any deviations from specified materials are proposed, submit written request explaining differences and reasons for request. Submit three (3) copies of each document required, or as directed by the Landscape Architect.

Chemicals and Pesticides (if approved): Manufacturers' literature.

Plant Materials: Labels and nursery certificates substantiating that plants, trees and shrubs materials comply with specified requirements set by ANLA and others and were grown within USDA hardiness zones specified.

Tagging and planting schedule: Proposed dates for tagging plants at nurseries, and for planting each type of planting, with consideration for fall-hazard species, work coordination, etc.

Bark Mulch: Two-pound sample and source for review.

Chemicals (lawn and tree herbicides, fungicides, and pesticides): Manufacturer's literature and analysis.

Maintenance: Provide watering and fertilizing schedule to the DCR for approval.

Maintenance Instructions: Submit recommended procedures for routine year-round maintenance of plantings. Instructions shall be submitted as a condition of Substantial Completion of the Project.

Related Work

Examine all other Items of the Special Provisions and all Drawings for the relationship of the Work under this Item and the Work of other trades. Cooperate with all trades and coordinate all Work under this Item herewith.

References

Where references are made in these Specifications to standard specifications, codes, etc., of the U.S. Government, State or local authorities, or professional and industrial societies and associations, the applicable portions thereof shall govern as fully as if they were printed in their entirety, herein, and shall include all revisions thereto issued as of the date of the Notice to Contractors pertaining hereto. Comply with the requirements of the following codes and industry standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

The following references are used herein and shall mean:

MassDOT Standard Specifications: Commonwealth of Massachusetts, Massachusetts Department of Transportation/Highway (formerly Massachusetts Highway Department and Department of Public Works), "Standard Specifications for Highways and Bridges," latest edition and including all applicable Supplemental Specifications, Standard Special Provisions and Special Provisions.

Quality Assurance

Contractor shall have at least five (5) years of experience in Landscape Work similar in materials, design, and extent to that indicated for this project and with a record of successful landscape establishment. Installer shall maintain an experienced supervisor on the project site during all times that landscape construction is in progress. Provide written qualification data for firms and persons to be responsible for Work, to demonstrate their capabilities and experience. Include lists of completed projects, with project names, addresses, phone numbers, and names and address of designers and Owners.

Contractor shall conduct pre-landscape construction conference at Project site as directed by the Landscape Architect, to review landscape construction procedures, site conditions, and submittal requirements required in the Work of this Section, before any products are submitted for review and approval, or landscape construction commences.

To extent possible, provide each plant material species or variety from single source.

No herbicides, pre-emergents, chemical fertilizers, fungicides, and pesticides shall be used unless reviewed and approved in writing by DCR and project Landscape Architect and permitted for use, and applied by appropriately licensed personnel according to manufacturer's recommendations.

Select compatible products where options are provided, provide each material from a single source and only with review and approval of the DCR and Landscape Architect.

Examination of Existing Conditions

Inspect all areas to be planted before starting Work and report any defect, such as incorrect grading, incorrect subgrade elevations, or drainage problems, etc., to the Landscape Architect and DCR prior to beginning Work. Commencement of Work shall indicate acceptance of filled subgrade areas to be planted, and Contractor shall assume responsibility for Work. Inspect areas to be fine graded and seeded before starting work.

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 re-handling plants prior to final installation.

Determine location of above-grade and underground utilities and perform Work in a manner, which will avoid damage. Review the locations of utilities with the Landscape Architect before proceeding. Contact all relevant utility companies, public or private, prior to beginning work; contact DIG SAFE 1-888-344-7233 (serves five N. E. states). Report any conflicts to the Landscape Architect and the DCR in writing before excavating. Hand-excavate as required. Maintain grade stakes until removal is approved by the Landscape Architect.

Coordinate installation of planting materials to assure installation during normal planting seasons for each type of plant material required and as specified in planting schedule. Species designated as “Fall Hazard” by Nursery shall be planted in the spring, indeterminate of other site and project schedules.

Coordinate planting Work with other Work of this contract being performed on site, or work being performed by others.

Coordinate maintenance of landscape areas installed at different times. Protect completed Work as sequence of planting proceeds.

MATERIALS

Plant Materials

Provide quality, size, genus, species, and variety of trees indicated, complying with applicable requirements of the ANLA. No substitutions will be permitted without prior written approval by the Landscape Architect. All plants shall be nursery grown, not collected from natural vegetated areas.

The Landscape Architect, accompanied by the Contractor, will tag plants at their place of growth, after pre-tagging by Contractor. At least one (1) month prior to the expected planting date, request in writing that the Landscape Architect schedule tagging trip(s). The Landscape Architect representative's time and expenses spent to locate plant material shall be paid for by Contractor only if the Landscape Architect is sent to a site where satisfactory plant materials are not located and to nurseries not located in Massachusetts. No plant material tagged by the Landscape Architect shall be delivered to the site of Work without these tags.

The Landscape Architect's selection shall not impair the right of inspection and rejection upon delivery at the site or during the progress of the Work. Contractor shall pay cost of replacement of materials rejected by the Landscape Architect at the site.

Each tree shall be labeled with securely attached, waterproof tag bearing legible designation of botanical and common name according to AJCHN.

Only plant stock obtained from and grown between latitudes 40-49 degrees north and USDA hardiness Zones 1 through 5, will be accepted.

Plants shall be in accordance with ANLA as a minimum requirement for acceptance. Plants shall be typical of their species or variety, have a normal habit of growth, and meet the size and form requirements indicated by the Landscape Architect. The trunk of each tree shall be a single trunk growing from a single intact crown of roots. Trees indicated as "multi-stemmed" in the Plant List shall have three (3) stems, typical.

Measure trees according to ANLA with branches and trunks or canes in their normal position. Take caliper measurements six (6) inches above ground for trees up to 4-inch caliper size, and 12 inches above ground for larger sizes.

The height of trees (measured from the crown of the roots to the tip of the top branch) shall be not less than the minimum size directed by the Landscape Architect or as required by ANLA based upon caliper size designated. Lateral branching of deciduous trees is to begin at no less than seven (7) feet height.

Trees of a larger size may be used if acceptable to the Landscape Architect with a proportionate increase in size of roots or balls. Do not cut root balls to size of smaller plants to fit limited planting area. Do not prune to obtain required sizes.

Trunks shall be free from sunscald, frost cracks, or wounds resulting from abrasions, fire, or other causes. No tree shall have evidence of ever having had basal suckers. The plants must be in a moist vigorous condition, free from dead wood, bruises or other root, bark or branch injuries.

Trees shall not be pruned in preparation for transplanting. No wounds from previous pruning shall be present having a diameter exceeding two (2) inches; such wounds shall show vigorous scar tissue on all edges.

All plant parts shall be moist and show active cambium when cut. Plants shall be sound, healthy, and vigorous, well-branched and densely foliated when in leaf. They shall be certified by the grower as free of disease, insect pests, eggs or larvae.

Balled and burlapped plants shall be moved with root systems as solid units with balls of earth firmly wrapped with untreated natural eight-ounce burlap, firmly held in place by a stout cord or wire. Plants prepared with plastic or other non-biodegradable wrappings will not be accepted except when directed by the Landscape Architect to be container grown. All plastic products must be removed before planting is accepted. Diameter and depth of the balls of earth on balled and burlapped plants must be sufficient to encompass the fibrous root feeding system necessary for healthy development of plant, according to ANLA standards. Top of root ball shall be actual finish grade of tree as grown in nursery; excess soil shall be removed from top of ball prior to delivery. No plant will be accepted when ball of earth surrounding its roots has been cracked or broken prior to or during process of planting or after burlap, staves, ropes, container, or platform required in connection with its transplanting have been removed.

Trees delivered by truck and plants requiring storage on site shall be properly wrapped and covered during delivery to prevent drying of branches, leaves, or buds. Plant root balls shall be firmly bound, unbroken, and reasonably moist to indicate watering prior to delivery and during storage, and tree trunks shall be free from fresh scars and damage in handling.

Tree species designated as “Fall Hazard”, such as Birch and Maples, shall not be substituted with species that are appropriate for fall planting, but shall be planted in the spring, regardless of other project schedules.

Bark Mulch

Bark mulch shall be shredded pine bark aged at least six (6) months and not longer than two (2) years. The mulch shall be dark brown in color, free of chunks and pieces of wood thicker than one-quarter inch. Mulch shall be free of stringy material over four (4) inches in length, and free of chunks over three (3) inches in width. It shall not contain, in the judgment of the Landscape Architect, an excess of fine particles, overly composted or soggy compost material. Bark mulch shall not have an unpleasant odor nor have any evidence of fungus growth.

Planting Fertilizer

All trees installed by Contractor shall be provided with fertilizer through the use of slow-release fertilizer packets which are designed and certified by the manufacturer to provide controlled release of nutrients over a minimum three-year period. Each packet shall consist of four ounces of water-soluble fertilizer with a minimum guaranteed analysis of available elements by weight as follows:

Nitrogen	16%
Phosphoric Acid	8%
Potash	16%

Chemicals and Insecticides

Provide chemicals and insecticides as needed for fungus or pest control for plants as approved by the DCR and the project Landscape Architect. All chemicals and insecticides shall be approved by the MassDEP for the intended uses and application rates.

Tree Wrap

Do not use tree wrap of any type after trees are planted.

Guying and Anchoring Materials

Use brown or black, heavy duty woven poly-corded guying tape manufactured specifically for tree guying, such as 'Arbortape', in samples as approved by the Landscape Architect, to tie trees to stakes, using expanding knots as indicated in manufacturer's instructions. Do not use cable encased in hose. Use tapered hardwood stakes driven at an angle below grade as deadmen to anchor guys below grade as shown in the Drawings.

Tree Paint/Tree Wound Dressing

Tree paint or tree wound dressing of any type shall not be used on tree wounds. Allow wound to heal and weather naturally, after trace cutting ragged or loose damaged bark back to live cambium.

CONSTRUCTION METHODS

Site Preparation Prior To Commencing Planting

Refer to MassDOT Standard Specifications for rough grading which shall be performed before planting commences.

Before starting work, locate existing underground utilities in areas of Work; call DIG SAFE and other sources of information as necessary. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, notify the Landscape Architect. Cooperate with the Engineer and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of the utility companies, the DCR, and property owners involved. Do not interrupt existing utilities serving facilities occupied or used by others, during occupied hours, except when permitted in writing by DCR and any property owners and then only after acceptable temporary utility services have been provided. Provide

minimum of 48-hour notice to the DCR and any property owners, and obtain written notice to proceed before interrupting any utility.

Protect all existing structures, existing subgrades to remain, utilities, pavements, lawns, planting and other site improvements from damage due to grading Work.

Submit to Landscape Architect any requests for adjustments in grades and alignments found necessary to avoid interference with special conditions encountered.

Render the site erosion-free as necessary. Submit proposed methods for erosion control if necessary. Approval by the Engineer or Landscape Architect of any method to accomplish this does not relieve the Contractor of full responsibility for controlling erosion and/or sedimentation throughout the construction process.

Stockpile usable excavated materials in locations permitted by and/or where directed by the Landscape Architect or the DCR. Place, grade and shape stockpiles for proper drainage. Locate and retain soil materials away from edge of excavations. Dispose of waste materials legally.

Backfill excavations as promptly as Work permits, but not until completion of inspection, testing, approval and recording locations of underdrainage, if needed.

Uniformly grade subgrade to pitch a minimum of 1-2% including adjacent transition areas, providing minimum gradients for temporary drainage to catch basins and swales, streets, curbs, and away from plantings and structures.

Protect subgrade areas scheduled for planting from traffic and erosion. Keep free of trash and debris. Repair and re-establish grades in settled, eroded and rutted areas to specified tolerances. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape and compact to required density prior to further construction.

The top four (4) inches of subgrade of all areas to be planted shall be raked of all rubbish, sticks, roots, existing vegetative material and roots, and debris and stones larger than 1-inch and shall be removed off site. Subgrade surfaces shall be harrowed, raked or otherwise loosened to a depth of 4-inches. Subgrade shall be inspected and approved by the Landscape Architect before planting soil is placed. The use of herbicides for vegetation removal shall be proposed only with the permission of the Lowell Conservation Commission.

Scheduling of Planting

Locate plant material sources and ensure that plants are shipped in timely fashion for installation. All trees shall be planted during the same planting season they are dug. Balled and burlapped and potted plant materials from cold storage shall be rejected.

Seasons for Planting:

Spring: Deciduous and Evergreen materials – April 1 through June 15
Perennials and Groundcovers – April 15 through June 1

Fall: Deciduous materials – October 1 through November 15
Evergreen materials – April 1 – Nov. 1

Summer digging of trees shall not be permitted for any reason. Contractor shall schedule his work and coordinate his schedule for planting, so that summer digging and substitutions of species that are fall hazards (fall digging/planting) does not occur.

Contractor shall secure plant material as soon as possible and with recent Massachusetts's regulations in mind, regarding importing clean out of state nursery stock inspected for the Oak bark and Asian Long-horned beetles.

Refer to the Drawings for Fall Hazard Species, such as certain Oaks, Maples, Birch, etc: These species must be planted in the spring and substitutions shall not be permitted without approval of the Landscape Architect.

Evergreens planted in April or July-August, or out of season shall be sprayed with anti-desiccant twice during the guarantee period, once at planting and once in mid-winter.

Plant Material Delivery, Storage and Handling

Deliver and plant only freshly dug trees. Do not use plants "heeled-in" from previous season. Balled and burlapped plant materials from cold storage shall be rejected. Do not prune before delivery, except as approved by the Landscape Architect. Protect bark, branches, and root systems from sunscald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy natural shape. Provide protective covering during delivery.

Contractor shall be present at time of delivery of all plants to the site. Remove all tree wrapping at delivery and inspect tree trunks for damage. Report damaged plants immediately to the Landscape Architect. Wrap shall not be replaced except as specified herein.

Handle balled and burlapped stock by root ball, not by trunk or branches.

Deliver trees after preparations for planting have been completed and install immediately. If planting is delayed more than six (6) hours after delivery, set plants vertically in their natural growing orientation in shade, protect from weather, dust and mechanical damage, and keep roots moist. Set balled stock on ground or heeled into ground, and cover ball with soil, mulch, or as approved by the Landscape Architect. Storage for more than two (2) weeks shall not be allowed without permission from the Landscape Architect. Plant damage due to Contractor's planting delay shall be the responsibility of the Contractor.

Water root systems of trees stored on site with a fine-mist spray. Water as often as necessary to keep root systems moist during storage and planting.

Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from damage during delivery and while stored at site.

Underdrainage

Testing Pits for drainage:

Notify the Landscape Architect of five representative tree pits to be tested at least ten days in advance of the testing day. A representative of the Landscape Architect shall be present during all percolation testing. Locate areas where tree planting will occur as shown on the Drawings. Test existing drainage capacity, percolation, of subsoil that shall exist at time of planting in a minimum of five sample tree pits. Tree pits shall be representative of the different tree planting areas of project site. The test shall be conducted by filling representative pits with a minimum of fifty gallons of water within a ten-minute period.

Prepare a report indicating pits tested, numbered pit locations on a site plan, time it took for pits to drain after filling, and submit the result to the Landscape Architect with analysis. If water has not completely drained from pit within two hours, an underdrainage system shall be designed by the Contractor, submitted to the Landscape Architect for approval, and installed by the Contractor for trees in areas where drainage failed. Plant elevations may have to be adjusted, locations changed, or underdrainage lines installed to compensate for drainage problems at no additional cost.

Tree and Shrub Planting

Fill entire shrub bed or planting area to depths indicated on Drawings with approved planting soil, according to requirements in this Section.

Take care not to disturb any adjacent site improvements. If, in the opinion of the Landscape Architect, any damage to adjacent materials occurs as a result of planting operations, repair the damaged materials at no cost to the DCR.

Stake location for all trees for review by the Landscape Architect before any plant pits or beds are dug, and before plant delivery to site. Stake locations with stakes or flagging, outline planting areas for massed planting, and obtain the Landscape Architect's review and acceptance before the start of planting work. The Landscape Architect reserves the right to determine the exact location of every tree and to change the location of any tree to an area of similar conditions.

Keep plant roots and earth balls moist and protect from sun and wind during entire planting operation.

Set balled and burlapped stock plumb in staked location. If top of root ball needs to be raised to conform to proposed finished grade, use leveling bed of compacted planting soil or existing subgrade to set ball. Set top of root ball for trees slightly higher (½ inches) than surrounding grade, judging planting height to allow for settling, to meet grade after settling as plant grew in nursery; refer to detail drawing. Scarify soils on sides of pit to facilitate integration of backfill with existing soil for better root penetration as plants grow. Roll back top 12 inches of burlap and remove wire baskets from tops and sides of ball but do not remove materials from under large tree root balls. Planting stock with root balls cracked or broken before or during planting operation will be cause for rejection. Remove all non-biodegradable wrapping or binding material or containers from shrubs.

Place planting soil around ball in six-inch layers, tamping to settle backfill and eliminate air pockets. When pit is approximately half backfilled, water thoroughly until no more is absorbed. Water again after placing and tamping final layer of backfill. Compact planting soil and planting soil mix to approximately 85% maximum dry density. Do not over-compact planting areas; the Landscape Architect reserves the right to reject over-compacted soil installation and request removal and replacement of soil and plants.

All plant roots and earth balls shall 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. Remove container plants from containers prior to planting. All plants shall be planted in the center of the holes and at the same depth as they previously grew. After completion of planting installations, remove rope, wires, etc. from the top of the root balls. Remove burlap only from top third of root ball. Planting soil mix shall be backfilled in layers of not more than 6 inches and each layer watered sufficiently to settle before the next layer is put in place. Enough planting soil mix shall be used to bring the surface to finished grade when settled. A saucer shall be formed around each plant at a depth of 6 inches for trees and 4 inches for shrubs. All trees shall be planted 3 inches higher than the surrounding grade beyond the saucer.

Fertilize plantings only with compost as entire project area is within a wetland buffer zone. Incorporate compost into entire area of the sides of rootball zone of the plant, but not under the rootball.

Within one (1) day of planting, place mulch to 3” depth as indicated on detail drawings, over saucer areas of individual trees and over area of planting beds to a depth of three (3) inches after settlement. No mulch shall be spread within 4-inch diameter from tree or shrub trunk. Mounding of mulch will not be permitted.

All plants shall be watered immediately following planting as necessary to thoroughly moisten root ball and planting soil and thereafter shall be inspected frequently for watering needs and watered, as required, to provide adequate moisture in the planting pit. 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, immediately notify the Landscape Architect.

Tree Pruning

Pruning shall be done only to ameliorate minor damage to branches incurred during shipping and planting; any plants with major damage shall be replaced as directed by the Landscape Architect. Remove only dead wood, damaged branches, crossed branches, and suckering shoots, in accordance with TCIA standards, minimizing amount of live growth removed. Shape trees only if additional direction is given by the Landscape Architect, maintaining natural form. Tree pruning shall be consistent to full height of tree to avoid uneven appearance and structural imbalance. Do not apply tree wound dressing. Prune in accordance with TCIA Standards for Class I, “Fine Pruning,” to preserve natural character of the plant.

Never cut tree leader, unless permitted by the Landscape Architect.

Tree Wrapping

Trees and trunks shall be wrapped with protective fabric during transport and delivery to storage. Trees shall not be wrapped after planting, to avoid accumulation of moisture on bark, which increases susceptibility to hidden insect infestation, and mold.

Guying and Staking

Contractor shall use caution in installing stakes for trees, insuring that stakes do not penetrate utility lines or structures. Three equally spaced stakes shall be installed according to the Drawings, securely anchored in undisturbed or compacted sub-grade.

Install woven tape tree guys according to manufacturer's instructions, with ties that allow for tree growth (specified, expandable knots) and to allow for some movement and to avoid girdling. Guys shall be securely fastened to notched, wood stakes with appropriate knots, at an angle to keep guys tight.

Tree guying and anchoring systems shall be secure, installed so that tree ball does not rock and tree trunk and canopy remain plumb or nearly plumb in the wind, without holding tree so tight or at such an angle and height that there could be rubbing or structural damage to trunk in strong winds. Guys shall be installed to allow for tightening after installation and during the one-year maintenance period.

Cleanup and Protection

Protect work from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged Work as directed by the Landscape Architect.

Remove excess planting soil, waste material, and excess subsoil, unsuitable soil, trash, and debris, and legally dispose of material off site.

Repair damage to site or structures to restore them to their original condition at no cost to the Owner.

Maintenance Requirements for Plantings

Begin maintenance immediately after each area is planted and continue until the end of the two-year guarantee period after Final Acceptance.

Maintenance shall consist of keeping plants in healthy growing condition and shall include but not be limited to watering, weeding saucers, grass areas, and planting beds, mowing, cultivating, re-mulching, tightening and repairing of guys, removal of trash, injured and dead material, resetting plants to proper grades or upright position, and maintaining mulched planting saucer.

Inspect plants for watering needs at least twice each week and water as required to promote plant growth and vitality.

Watering for all plantings shall be provided on a consistent basis to ensure establishment of small plant materials with shallow roots. Contractor is responsible for providing temporary irrigation systems, as needed, to ensure adequate and consistent watering is done throughout the maintenance period and until the end of the two-year guarantee period after Final Acceptance.

Keep planting and grass areas free of weeds, and maintain mulched saucers at required depths and size.

Remove and replace immediately plants that die during the maintenance period and repair, re-seed, or re-sod all lawn areas and erosion control devices, from installation through the two (2) year guarantee period.

Tighten guy tapes as required.

Chemicals, pesticides, fungicides, insecticides or herbicides within planted areas shall be applied by personnel licensed to do so in the Commonwealth of Massachusetts and only after obtaining written permission from the Landscape Architect, indicating the materials and dispensing methods allowed, the dates, time and weather conditions under which procedures will occur, and traffic control, resident and pedestrian protection plan proposed. Spraying for insects, pests and diseases shall conform to the TCIA Standards under the section entitled "Standards for Pesticide Application Operations", as currently adopted.

Remove trash from all planted areas weekly or as directed by the DCR.

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 horticulturists 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 DCR.

Acceptance Inspection Procedures

The Landscape Architect shall review work upon written request of Contractor, which shall be received by the Landscape Architect at least ten (10) days before the anticipated dates of inspection. Request inspection for acceptance of the plantings only after all aspects of planting operations are completed and maintained according to Specifications, all pertaining test results are acceptable, irrigation system is operating properly, and all extraneous equipment, materials and debris are removed from the project site. Do not request inspections for partially completed work. There will be no acceptance 'in parts' for planting work. All items on the punch list shall be completed to the satisfaction of the Landscape Architect and the DCR before the initiation of the two-year plant establishment period (guarantee period) can commence.

The Landscape Architect shall inspect work with Contractor present. At time of inspection if, in the Landscape Architect's opinion, a substantial amount of planting, materials or workmanship is deficient, Contractor's responsibility for maintenance of all work shall be extended until plant replacements are made or other deficiencies are corrected.

A written report, or "punch list," issued by the Landscape Architect shall indicate to Contractor remedial items to be corrected before Final Acceptance is given.

Acceptance: Acceptable plants are those that are to size and species as shown on the Drawings or accepted by the Landscape Architect, which show at least 85% live growth, actively growing or possessing live buds, with no indication of injury, disease, insect infestation, or decline due to environmental or other factors, which are plumb, mulched, guyed, and balls moist.

All unsatisfactory plants shall be removed promptly. Replacement plants shall conform in all respects to Specifications for the originals and shall be planted and maintained in same manner until initial acceptance is made.

Inspection request and procedure shall be repeated when remedial items are completed. Date of final acceptance of completed remedial work shall establish end of installation and initial maintenance period and commencement of guarantee period.

Submit typed maintenance instructions for all plantings for the Owner's use.

Plant Establishment Period, Guarantee, and Final Inspection

Guarantee specified herein shall not deprive the DCR of other rights it may have under other provisions of Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of Contract Documents.

The Contractor shall guarantee the plantings for two (2) year after acceptance. During guarantee period, make monthly inspections of plant material during April through November to document condition of plants and to provide remedial measures. Continue maintenance (including watering) as specified. Submit inspection reports to the Landscape Architect. Dead plants and plants with less than 85% live wood noted in inspections shall be replaced with new plants of same size and species within one (1) month or in first month of next growing season, whichever comes first, as permitted by specifications. Replacement plants shall be installed according to the Drawings and Specifications.

Notify the Landscape Architect at least ten (10) days in advance of requested date of inspection at end of two-year guarantee period. Submit to the Landscape Architect, before inspection, a list of plants replaced during guarantee period with species, location, and replacement dates.

All plants will be inspected by the Landscape Architect two (2) year after final acceptance and shall be alive and in satisfactory growth at the end of that time. Trees, which have settled out of plumb shall be reset, plumb or be replaced. All trees planted at the initial planting time one year previously shall have all stakes and guys removed.

At end of guarantee period, all guying material shall be removed from plants, all saucers flattened, mulch areas re-mulched and weeded, dead wood pruned and removed and all replacements completed. All dead or unsatisfactory grass areas shall be weeded, top-dressed, repaired, fertilized, and/or bed prepared and re-seeded until satisfactory growth with intended species has occurred, as a condition of completion of all Work at final inspection.

COMPENSATION

METHOD OF MEASUREMENT

ITEM 767.7, AGED PINE BARK MULCH will be measured per CUBIC YARD, installed, complete-in-place including all grading, fine grading, amendments, maintenance, excavation, transportation, labor, materials, and equipment required or incidental for the satisfactory completion of the work.

ITEMS 771.01-771.12, PLANTING- (ETC.) will be measured per EACH, installed, complete-in-place including all excavation, grading, fine grading, compaction, labor, materials, equipment, amendments, and all maintenance activities including watering and pruning, required or incidental for the satisfactory completion of the work until Final Acceptance at conclusion of the 2-year maintenance period.

BASIS OF PAYMENT

All Planting Items will be paid for at the Contract Unit Prices and shall include all labor, equipment and materials required such as preparation, compaction and maintenance until Final Acceptance at conclusion of the 2-year maintenance period.

ITEM 801.32 3 INCH ELECTRICAL CONDUIT TYPE NM – (DOUBLE) FOOT

ITEM 804.2 2 INCH ELECTRICAL CONDUIT TYPE NM -PLASTIC - (UL) FOOT

ITEM 804.3 3-INCH ELECTRICAL CONDUIT TYPE NM - PLASTIC - (UL) FOOT

The work under this Item shall conform to the relevant provisions of Section 800 of the Standard Specifications and the following:

The work shall include the furnishing and installation of 2 or 3-inch non-metallic conduit for traffic signal and lighting systems in accordance with the plans and as required by the Engineer. The conduit material shall be Schedule 80 polyvinyl chloride (PVC) plastic conduit. The conduit quantity may be increased or decreased by the Engineer depending upon actual conditions encountered as provided for in Section 4.06 of the Standard Specifications.

When more than one conduit is to be installed in one trench, the width of the trench shall be increased by the sum of the outside diameters of the conduits, plus 4 inches for each additional conduit.

Conduit in Grass or in Planted Areas

Where new conduits are installed in grass and planted areas, no separate payment shall be made for the excavation, sand bedding, gravel backfill, including necessary compaction, restoration, or incidental materials, but all costs in connection therewith shall be included in the contract unit price for each respective item.

Conduit under Sidewalk, Median or Driveways

Where conduit is installed in a sidewalk, paved median or asphalt driveway areas, no separate payment shall be made for the saw-cutting, excavation, sand bedding, gravel backfill, including necessary compaction, or incidental materials, but all costs in connection therewith shall be included in the contract unit price for each respective item. Payment for cement concrete or asphalt pavement shall be paid for separately under their respective pay items.

Conduit Crossing Roadways

Trenches in existing bituminous concrete pavements not subject to full depth reconstruction shall be sawcut to a width of 18 inches. The existing pavements shall be sawcut through their full depth and the pavement removed.

After conduit installation, the trench shall be backfilled with controlled density-fill (CDF). CDF shall be Type 2E and shall be specified in Section M4.08.0 of the Standard Specifications. The finished grade of the CDF shall be below existing pavement surface as shown on the construction details.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Where conduit crosses roadways, no separate payment shall be made for the saw-cutting of pavement, excavation, sand bedding, restoration, or incidental materials, but all costs in connection therewith shall be included in the contract unit price for Item 804.3.

Payment for Item 801.32, Item 804.2 and Item 804.3 shall be at the contract unit price per foot, for furnishing and installing conduit of the appropriate size and kind to include all labor, equipment, conduit fittings, supports, saw cutting of pavement, removal and off-site disposal of pavement, excavation, backfill, sand, detectable caution tape, compaction, restoration of surface to match existing, penetrations into new handholes and pull boxes, connection to existing conduits, pull wires, and warning tape. Surface restoration shall include, but is not limited to, restoration of roadway surface, sidewalk surface, and grass areas.

Control Density Fill, when used, shall be measured and paid for under Item 153. Controlled Density Fill – Excavatable.

ITEM 810.1 ELECTRICAL CONDUIT DUCT BANK AND HANDHOLES LUMP SUM

DESCRIPTION

Work under this item shall conform to the relevant provisions of Section 801 of the MassDOT Standard Specifications and the following:

The work under this item shall consist of furnishing and installing electrical handholes and 4-inch schedule 40 PVC conduit in accordance with the requirements of this specification, as directed on the plans and as required by the engineer. Work will occur across Memorial Drive and along the north side of the existing roadway near the Hawthorn Street intersection.

MATERIALS

Conduit shall be constructed of underground plastic utilities duct type EPC-40-PVC RNC, complying with NEMA TC 2 and UL 651, with matching fittings complying with NEMA TC3 by same manufacturer as duct.

Precast Concrete Handholes shall be 2’ x 2’ x 3’, factory fabricated, reinforced-concrete with weatherproof cast-iron frame and cover. Nonskid finish shall have a minimum coefficient of friction of 0.50. Cover legend shall be “ELECTRIC”. Handholes shall be installed per detail on drawing.

Crushed stone base for conduit duct bank shall be installed in accordance with the Plans and shall meet the requirements of M2.01.0.

Cement concrete for duct bank shall be 4,000 psi ¾-inch, 610 Cement Concrete

COMPENSATION

METHOD OF MEASUREMENT

Item 810.1 Electrical Conduit Duct Bank and Handholes shall be measured per LUMP SUM per location.

BASIS OF PAYMENT

The lump sum price bid for this item shall be full compensation for furnishing and installing all conduits and handholes, including all fittings, jointing compound, sealing compound, excavation and backfill of the trench, sawing the existing pavement or sidewalk as required for excavation, bedding or hanging of the conduit, cement concrete encasement of the conduit and all incidental costs required to complete the work as shown on the drawings and as required by the engineer.

ITEM 811.22 ELECTRIC HANDHOLE – SD2.022 EACH

GENERAL

All work performed under this item shall be in accordance with the relevant provisions of Section 801 of the Standard Specifications, and to the requirements of these specifications:

Metal cover and frame are to be bonded (grounded). Drill and tap frame for mechanical ground lug connection. Install a post top servit (split bolt) grounding connector suitable to accommodate one bare #6 conductor. Extend #6 ground conductor through frame lug to bond cover. Provide 42" of slack from frame lug to bond cover. Exothermically weld ground conductor to cover.

Electric handholes shall be manufactured by an approved MassDOT pre-cast manufacturers.

Cast iron frame shall be mortared to the pull box surface of the precast hand hole. Mortar depth shall extend vertically from finished grade to 1" below top of pull box and extend horizontally a minimum 1" beyond the edge of the pull box.

Covers for proposed lighting system handholes shall be labeled with the function of the pull box "Lighting" in one inch lettering. Covers for proposed traffic signal system handholes shall be blank.

MATERIALS

Precast units and ductile iron covers shall be sourced from a fabricator listed on the MassDOT QCML or approved traffic materials list.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

The work of this section shall be measured by each handhole provided by the Contractor complete in place, and approved by the Engineer.

Measurement and payment for Item 811.22 shall be at the contract unit price per each, complete, accepted in place, which price shall include full compensation for all materials, concrete, form work, excavation, backfill, gravel sub-base, surface restoration, handhole, handhole cover and frame, ground rod, grounding bushings, conduit end bells, pull irons, and all equipment, tools, labor and work incidental thereto.

ITEM 812.09 LIGHT STANDARD FOUNDATION – PRE-CAST EACH

GENERAL

The work to be done under this Item consists of furnishing and installing light standard foundations in accordance with the Standard Specifications for Highways and Bridges, Contract Drawings, and as hereinafter specified.

SUBMITTALS

Submittals for light standard foundations shall include all manufactures data sheets, and shop drawings, as applicable, and specified herein. Foundations shall be provided by an approved MassDOT pre-cast manufacturers.

Shop drawings shall be submitted for Light Standard Foundation showing concrete, reinforcing steel, conduit sweeps, and anchor bolt. Drawing shall indicate strength of concrete and reinforcing steel and direction of conduit. Pole foundation plans shall be stamped by a Professional Engineer registered in the Commonwealth of Massachusetts shall be included with the drawings.

MATERIALS

Materials shall meet the requirements specified in the following Subsections of Division III, Materials:

Cement and Cement Concrete Materials	M4
Metals and related Materials	M8
Gravel	M1.03.0, Type c

CONSTRUCTION METHODS

Light standard foundations shall be provided with the anchor bolts, reinforcing rods, conduit sweeps, as shown on the Contract Drawings and in accordance with the applicable requirements of Section 901 Cement Concrete Masonry and Section 801.62 Foundations. Light standard foundations shall be used in all locations as indicated on the Contract Drawings.

The Contractor shall take all precautions not to cause any harm to the existing utilities during all phases of construction. The Contractor shall provide temporary sheeting as required to protect adjacent roadway, utilities, or property.

Where light standard foundations are installed in existing sidewalk, or paved median areas to remain, the work shall include replacement of the gravel base material and the surface pavement to match pre-construction conditions. No separate payment will be made for this work, but all costs in connection therewith shall be included in per each price bid.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

The work of this section shall be measured by each Light Standard Foundation provided by the Contractor, complete in place, and approved by the Engineer.

Payment for Item 812.09 Light Standard Foundation-Pre-cast will be paid at the contract unit price per each, complete, and accepted in place, which price shall include full compensation for all materials, reinforcing rods, anchor bolts, concrete, form work, excavation, backfill, surface restoration, temporary sheeting, gravel sub-base, dewatering, and all equipment, tools, labor and work incidental thereto.

ITEM 813.40	**WIRE TYPE 8 NO. 10 DIRECT BURIAL**	**FOOT**
ITEM 813.42	**WIRE TYPE 8 NO. 6 DIRECT BURIAL**	**FOOT**
ITEM 813.43	**WIRE TYPE 8 NO. 4 DIRECT BURIAL**	**FOOT**
ITEM 813.521	**WIRE TYPE 10 NO. 10 GROUNDING AND BONDING**	**FOOT**
ITEM 813.522	**WIRE TYPE 10 NO. 6 GROUNDING AND BONDING**	**FOOT**
ITEM 813.523	**WIRE TYPE 10 NO. 4 GROUNDING AND BONDING**	**FOOT**

All work performed under these items shall be in accordance with the relevant provisions of Section 813 of the Standard Specifications and the following:

GENERAL

The Contractor shall furnish and install all materials, equipment and labor required to completely wire and operate the street lighting system. All materials and wiring procedures shall conform to the specifications contained herein and to the requirements and standard practices of the Section 800 and the following:

All wire and connectors shall conform to the standards of the National Electrical Manufacturers Association or the Underwriters' Laboratories, Inc., whichever is applicable. All materials and workmanship shall conform to the requirements of the National Electrical Code, Standards of the American Society for Testing and Materials, and any local ordinances that may apply.

Wherever any reference is made to the standards mentioned above, the reference should be construed to mean the standard that is in effect on the day the Notice to Proceed to the Contractor for the work is dated.

Wire sizes shall be based on American Wire Gage (AWG), as applied to copper conductors.

MATERIALS

The WIRE TYPE 8 conductor shall be composed of soft drawn 7-strand copper of the gauge shown on the drawings. The insulation shall be installed as a single jacket of cross-linked polyethylene of Underwriter's Laboratories Type USE-2 or RHH-2-RHW-2 rated at 90 degrees C continuous in wet and dry locations, 600 volt as per the National Electrical Code.

Wire and cable furnished and used shall be new and shall have the size, grade of insulation, voltage and manufacturer's name permanently marked on the outer covering at regular intervals. Wire and cable shall be delivered to the site in complete coils or reels with identifying size, type and insulation tags. Wire and cable shall be protected from weather and damage during storage and handling.

WIRE TYPE 10 conductors shall be bare copper conductor in accordance with the relevant provisions of Section 813 of the Standard Specifications.

Splicing Materials: Shall be in accordance with Section 813.60C and the contract drawings.

CONSTRUCTION METHODS

No wire shall be drawn in to any conduit until all work that may cause damage to the wire is complete.

All wire shall be continuous from handhole to handhole without running splices in conduits. A splice will be required for each circuit wire at every handhole. All wires shall extend 24-inches above the handhole, connected at ends and rolled back into the handhole.

All wire terminals, taps and splices shall be made secure with connectors, splicing materials and methods as hereinafter specified.

All splices in handholes shall be with solderless connectors. The neutral and ground connection in the pole top shall be with an insulated pressure connector. The hot line and neutral connection in the pole handhole shall be with an approved street light fuse connector.

All incoming wires and outgoing wires in highway lighting load centers; handholes and poles shall be banded with 6-inches of colored plastic marking tape. Colors to match standard MassDOT Specifications.

GROUNDING

Coatings and rust on conduits and grounding rods shall be removed at the location where the ground fittings are to be installed.

The bare copper conductor shall be connected to the continuous insulated bonding lead, which shall be identified with green plastic marking tape as noted in the specifications. Bonding leads for lighting fixtures on poles shall be an insulated #10 AWG, marked green, which shall be extended to the nearest handhole and interconnected to the bare copper ground wire in the handhole of gauge shown on the contract drawings and the pig tail conductor shall be connected to the ground rod. The ground wire shall also connect to the ground lug on the handhole frame.

A conductor with the same insulation of the power leads shall be installed in all conduits as a continuous bond wire. All bonding leads from fixtures, pole, control boxes, fittings and ground rods shall be connected to the continuous insulated bonding lead which shall be identified with green plastic marking tape as noted in the specifications.

All grounding shall conform to the applicable provisions of the National Electrical Code.

FIELD TESTS

Upon the completion of each wiring system, and before any connection is made to operating equipment, the Contractor shall perform, in the presence of the Engineer, the following tests of each circuit to determine whether the installations are in acceptable working order.

a. Tests for continuity
b. Tests for ground
c. Tests for insulation resistance (Megger Test) from circuit wires to ground, and between circuit wires.

Tests for ground shall be performed in accordance with the relevant provisions of Section 813 of the Standard Specifications.

The entire electrical wiring system shall be tested for continuity, grounds, resistance to ground, insulation, shorts and opens. This shall be done by means of a megohm meter test.

After installation of the wiring system is complete with the required splices, the lamp ballast primary shall be disconnected and each circuit shall be tested with a 1000 volt megger. Tests on each circuit shall be between each conductor. When the measured value is less than 200 megohms between two conductors, the Contractor shall locate the point or points at fault, make proper corrections, and then demonstrate by further test the elimination of such faults.

These tests shall be performed in the presence of the Engineer.

The test results shall be submitted to the Engineer for review and approval. If any results are questionable or inconsistent, the Contractor shall repeat the tests and make any required corrections at the request of the Engineer. No wiring system will be accepted until these are satisfactorily performed and approved.

The Contractor shall furnish the Engineer with a report of the megohm-meter readings for a permanent project record.

All tests and any required repairs or replacements that are indicated by the Engineer to produce a fault-free system will be performed at the Contractor's expense.

WARRANTIES

The Contractor shall provide a performance warranty for one year on the entire work performed under this contract including the performance of all equipment and components of the highway lighting system specified. The performance warranty responsibility of the contractor shall commence after official letter of acceptance by MassDOT or the Engineer.

NOTE: The Contractor shall be completely responsible for all maintenance, repairs and replacement of damaged equipment during the functional test and throughout the performance warranty period.

If within 48 hours after notification by the Engineer of a malfunction, and the Contractor fails to make such repairs as required, the Engineer will undertake repairs of which all costs are to be borne by the Contractor. The cost of any maintenance required, except electrical energy, shall be at the Contractor's expense and will be considered as included in the price paid for the Contract item involved and no additional compensation will be allowed therefore.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Payment for these Items will be made at the respective unit price and be measured by the foot along the center line of the conduit in which the conductor is placed, complete in place, which price shall constitute full compensation for furnishing, installing and connecting the street lighting cables, the grounding of the system, testing the lighting circuit wiring, grounding wire testing, and for furnishing any equipment and/or materials required.

No allowance will be made for the required lengths of slacked cable laid around the sides of manholes, handholes, junction boxes, pull boxes, or extending from foundations for making splices, taps in cable, and connecting the internal components of control cabinets. No allowance will be made for cable in controllers, light poles or other items other than conduit.

ITEM 815.2	**TRAFFIC CONTROL SIGNAL LOCATION NO. 2**	**LUMP SUM**
ITEM 815.4	**TRAFFIC CONTROL SIGNAL LOCATION NO. 4**	**LUMP SUM**
ITEM 816.01	**TRAFFIC SIGNAL RECONSTRUCTION LOCATION NO. 1**	**LUMP SUM**
ITEM 816.03	**TRAFFIC SIGNAL RECONSTRUCTION LOCATION NO. 3**	**LUMP SUM**

The work to be done under these Items shall conform to the relevant provisions of Section 815 and the following:

The work to be done under these Items consists of furnishing and installing a traffic control signal system at:

- Location 2 – Memorial Drive at Mid-Block Crosswalk (Pedestrian Hybrid Beacon)
- Location 3 – Memorial Drive at Hawthorn Street
- Location 4 – Memorial Drive at Mid-Block Crosswalk (Pedestrian Hybrid Beacon)

The work to be done under these Items also consists of traffic signal timing changes and/or signal equipment modifications at the following locations:

- Location 1 – Memorial Drive at Gerrys Landing Road

A list of major items required is included on the Traffic Signal Plan for each location. Individual work items shall include furnishing and installing all or part of the following items: traffic signal controllers; cabinet and foundation with concrete pad; mast arm assemblies with anchor bolts and foundations; signal posts and foundations; signal heads; backplates; pedestrian signals with countdown timers; accessible pedestrian signal (APS) push buttons with signs; signal heads; single point video detection system; pull boxes; all necessary cable and wiring; ground rods, equipment grounding and bonding; and all other equipment, materials and incidental costs necessary to provide complete, fully operational traffic control signal system as specific herein and as shown on the plans.

The existing traffic signal systems to be modified under this item shall be maintained in operation throughout the construction period and until the reconstructed/new traffic signal equipment is installed, tested and ready for operation.

Also included in the work is the dismantling and stacking of the existing traffic signal control equipment, as identified on the plans, to be transported to DCR's Maintenance Yard, as required by the Engineer. Any of the existing traffic signal control equipment not accepted by DCR shall become property of the Contractor.

Within 30 days following execution of the Contract, the Contractor shall submit shop drawings for signal supports, a list of equipment, and manufacturer's equipment specifications to the Engineer in accordance with the relevant provisions of Section 815.20. All equipment shall be listed on MassDOT's Qualified Traffic Control Equipment List.

No work shall be commenced by the Contractor until approval of the shop drawings and manufacturer's data has been received in writing from the Engineer. Approval of these drawings will be general in character and shall not relieve the Contractor from the responsibility of, or the necessity of, furnishing materials and workmanship conforming to the plans and specifications.

The Contractor shall deliver to the Engineer a certificate of compliance by the manufacturer for all materials purchased from the manufacturer.

The inspection of signal systems will be scheduled after the signal has operated continuously (stop and go) for at least 30 days without failure.

Regulations and Code

All electrical equipment shall conform to the standards of the NEMA and U.L. wherever applicable. In addition to the requirements of the Contract Drawings, Standard Specifications, and Special Provisions, all materials and workmanship shall conform to the requirements of the NEC, ASTM, OSHA and/or ANSI, all applicable State and Local codes and Department of Public Safety regulations.

Fine Tuning, Adjustment and Testing Period

After the Contractor has finished modifying the controller and installing all other associated signal equipment to operate as specified in the contract documents, the fine tuning, adjusting and testing period shall begin. During this period, the Contractor under the direction of the Engineer, will make necessary adjustments and conduct tests to insure safe and efficient operation of the equipment. This period shall not last for more than 30 days. No request for final acceptance will be considered until successful completion of the testing period.

Maintenance of Traffic Signals

It shall be the responsibility of the Contractor to provide all labor, equipment and material required for the maintenance of the proposed traffic signal control equipment within the project limits, including damage by automobile accident from the date of written notice given to the Engineer that the Contractor will begin work on the proposed traffic signal control system until the date of acceptance of the completed project. This written notice must be given before the Contractor may proceed with any traffic signal system work.

Guarantees of the Traffic Signal System

The Contractor shall diagnose (troubleshoot) the system and at his own expense replace any part of the traffic signal control equipment installed by the Contractor that is found to be defective in workmanship, material, or manner of functioning within six months from date of final acceptance of the installation under this Contract.

The one-year warranty period on equipment stipulated in Subsection 815.20 of the Standard Specifications still applies.

As-Built Plans & Wiring Diagrams

The Contractor shall provide as-built traffic signal plans and wiring diagrams to DCR in AutoCAD 2023 DWG, DWF and PDF formats.

Entering Private Utility Company Facilities

Service connections shown on the plans are approximate only. The Contractor shall determine exact location from the servicing utility, arrange to complete the service connections, and be responsible for all charges incidental thereto.

The electrical service conduit and cable from the utility pole, to the traffic signal control cabinet will be provided by the Contractor. The local electric utility company will connect the terminals of the control cabinet to the source of supply.

The installation of conduit and wiring on or in local electric utility company facilities shall be in strict accordance with the regulations of the utility company. All work performed by the Contractor at local electric utility company structures shall be performed under the direct observation of a utility company inspector or representative.

The Contractor will be responsible for coordinating the electrical work in the vicinity of the control cabinets and for notifying the local electric utility company that construction has started and arranging the necessary time schedule with them for installation of electrical service to the control cabinets. Under no conditions shall the Contractor make permanent patch to the roadway or apply the final roadway surface if the roadway is to be resurfaced, or until services to the control cabinets have been completed.

The Contractor will be responsible for all costs and fees related to the service connection provided by the utility. Their payment shall be the sole responsibility of the Contractor and considered incidental to the item.

For the purpose of these paragraphs, the phrase "Traffic Signal Control Equipment" is intended to include, but is not limited to: controllers, detectors, signal housings, supporting structures, cabinets, wires, conduit and all other ancillary electrical equipment used for traffic control.

Controllers and Cabinets

The controllers, malfunction management units, detector amplifiers, bus interface units and all other ancillary traffic signal control components included in the traffic control cabinet shall comply with the National Electrical Manufacturers Association (NEMA) Standard No. TS 2-2016(v03.07), Traffic Controller Assemblies with National Transportation Communications for ITS Protocol (NTCIP) Requirements. The controller cabinet shall include a slide out shelf with the ability to store equipment manuals.

The top of the concrete base for the controller cabinet shall be 18 inches above grade. Anchor bolts shall be internal to the cabinet. A cement concrete work pad shall be installed facing the door of the controller cabinet for the full width of the cabinet foundation by 3 feet perpendicular.

TS 2 Type 1 Controllers and Cabinet Assemblies

Controllers shall conform to Section 3, Controller Units of NEMA No. TS 2, Traffic Controller Assemblies. Specifically, the controller unit (CU) shall be supplied as an actuated controller with NTCIP capabilities; defined as Type A1N in Subsection 3.2 of the NEMA TS 2 Standard.

The controllers shall be supplied in an 8-phase TS 2 Type 1 configuration. Controllers shall utilize an input/output interface conforming to Section 3.3.1 of the NEMA TS 2 Standard for all input/output functions with the backpanel terminals and facilities, the malfunction management unit, detector rack assemblies and auxiliary devices. The controller unit shall also meet the requirements of Paragraph 3.3.6 of the NEMA TS 2 Standard. The controller unit shall be supplied with Port 1, Port 2, and Port 3 as defined by the requirements of Subsections 3.3.1, 3.3.2, and 3.3.3, respectively.

The local controller shall be capable of being operated in the full-actuated mode, in the free mode and as semi-actuated in the coordinated mode. The controller shall be Type 8DW, keyboard entry, menu-driven unit mounted in an eight-phase cabinet. The controller unit shall meet all applicable requirements of the N.E.M.A. Standard Publication No. TS-2, Type 1, MassDOT's Current Standard Specifications, and include the following as minimum requirements for the "Keyboard Entry Controller Unit":

a. The Keyboard Entry Controller Unit must be type-tested and approved by the Department.

b. The controller shall have hard-wire interconnect capability and internal time base coordination logic. The coordination control shall have the capabilities to operate as described under Section 815.41 of the Standard Specifications.

c. The controller shall have a data transfer/printer port for data transfer to another controller, printer or laptop PC computer. A port shall be provided for uploading or downloading controller-operating parameters from a laptop PC computer.

d. The controller shall have a security code function.

e. The controller unit shall have internal fire preemption control capabilities.

f. The phase or phases selected for "call to non-actuated" (C.N.A.) modes shall be determined as needed by keyboard entries.

The unit shall consist of a mainframe suitable for shelf mounting, with appropriate interface harnesses.

Operator programmable data entry shall be accomplished through a menu driven keyboard and a display located on the front panel.

Connectors shall be provided for interconnecting all inputs and outputs with their external control circuits.

Timing shall be accomplished by digital methods and with power applied shall use the power line frequency as the time base.

All components shall be operated in accordance with good commercial practice to optimize life and performance.

The design goal shall be such that, under 24 hour a day operating conditions in their circuit applications, all components shall have a life of not less than 5 years.

The circuit reference designation for each component on the printed circuit board shall be clearly marked immediately adjacent to the component.

Electrical

The controller shall be designed for use of nominal 120 volt, 60 Hz single phase alternating current. It shall operate correctly in the voltage range of 95 to 135 volts AC.

All DC inputs and outputs shall conform to NEMA TS2 - Type 1 standards for transition zone, response time, current capability, surge and noise immunity, as well as all other applicable electrical specifications.

Environmental

The controller shall maintain all its programmed functions from -30 degrees F to +165 degrees F.

The unit shall perform to this specification when operated in relative humidity from 5% to 95%.

The unit shall conform to all applicable portions of the Environmental and Operating Standards as described in the NEMA Standards TS2-1992.

Functional

The control equipment shall also be capable of providing a yearly time program for selecting four

cycle lengths, three splits, and three offsets plus flashing operation for control of local controllers. The schedule shall be as included and/or as shown on the plans.

The controller shall be fully compatible with all existing and proposed local controllers and capable of communicating with a computer at a remote location - via a dialup or cable modem. The interface shall be through an RS232 port. The modem shall have a 5-year warranty. The modem shall meet the environmental aspects of the NEMA specifications for controllers and corollary equipment.

The Contractor shall provide graphics required for intersection and system monitoring. These graphics shall be customized to reflect the exact geometry, detection, and signalization of the intersections included in the subsystem listed herein. All street names shall be labeled.

The Contractor shall program each programmable local hardware component according to the "Time of Day Schedule" as follows:

TIME OF DAY SCHEDULE (BACK UP)

	7 AM-10 AM	**10 AM-11 AM**	**11 AM-3 PM**	**3 PM-6 PM**	**6 PM-7 PM**	**7 PM-7 AM**
Mon - Fri	Free	Free	Free	Free	Free	Free
Sat	Free	Free	Free	Free	Free	Free
Sun/Hol	Free	Free	Free	Free	Free	Free

NOTE: CYCLE-SPLIT-OFFSET

Note: Following implementation of the system, thresholds shall be revised as fine tuning occurs.

Cabinet

The TS 2 Type 1 cabinet shall meet the requirements of configuration 3 as defined in Table 5.3.1-1, "Type 1 Configurations" of the NEMA TS 2 Standard. The cabinet shall be fabricated of sheet aluminum to size six (6) dimensions as specified in Table 7.3-1 of the NEMA TS 2 Standards.

It is intended that equipment be mounted and that all necessary provisions for mounting and wiring all equipment shall be made at the factory of the controller equipment manufacturer prior to shipping the cabinet and the control components. All necessary terminal strips, brackets, etc., shall be installed at the factory. Thus, the amount of field wiring shall be kept to a minimum. Terminals for auxiliary equipment to be installed shall be clearly and permanently labeled as to functions.

No equipment components shall be stacked. Brackets, shelves, hangers, or other supports designed to assure convenient accessibility for inspection and maintenance shall be installed at the factory. Adjustable aluminum shelving is required. No plywood shelving, side panels or rear panels shall be used in any cabinet.

A meter socket approved by the local electric utility shall be mounted on the side of the cabinet. The Contractor shall furnish and install the meter socket and the electric utility company shall furnish and install the meter. Service disconnect, shall be a standard type circuit breaker, encased in a NEMA Type 3R raintight enclosure that can be padlocked.

A separately fused, grounded duplex outlet and a light receptacle shall be installed. Adequate 120V AC power terminals shall be provided.

A thermostatically controlled exhaust fan rated at 100 cubic feet per minute, minimum, shall be mounted in a screened opening in the top of the cabinet. Screened intake vent louvers near the bottom and/or sides shall have an effective area at least twice that of the opening provided for the exhaust fan. Standard size, replaceable, fiberglass air filters shall be provided.

The Contractor's attention is directed to Table 2, Required Signal Light Switching Assemblies, Section 815.41 of the Standard Specifications. The Contractor shall furnish the appropriate type and number of load switches and place unutilized load switches in the control cabinet for future use. Load relays shall be easily replaced using a screwdriver. Component relays requiring soldering are not acceptable.

In addition to the convenience outlet as described under Subsection 815.41 of the Standard Specifications, a lamp with an on/off switch shall be installed in the controller cabinet.

Each main door shall be designed to open easily and to close securely while retaining weatherproof quality. Handle and latch mechanisms shall be designed for trouble-free operation. A latching mechanism shall be supplied to hold the main door in the open position for use when servicing equipment.

A second hinged door, mounted on the main door, shall give access to designated switches on a "police panel". This door shall be provided with a different lock and key. There shall be two switches for the police door: 1) Main power switch and 2) A switch for switching the controller from automatic to flashing operation and vice versa, with the controller “power: off” in flashing operation. The cabinet doors shall be switch-wired for an alarm.

The cabinet shall be wired with a normally closed switch connected to a user defined input to the controller for later remote monitoring of the control cabinet’s door open status.

Where applicable, the cabinet shall be installed with the door opening positioned in order to allow general observation of the flow of traffic and the inside of the cabinets at the same time.

A 1/2-inch bead of silicone sealant is required to form a waterproof seal between the controller cabinet and the top of the concrete foundation.

Cabinet Power Supply

Separate power supply shall be supplied and installed in the TS 2 Type 1 cabinet. As a minimum, the power supply shall meet all requirements of Paragraph 5.3.5 of the NEMA TS 2 Standard. The

unit shall be AC line powered and provide regulated DC power, unregulated AC power, a line frequency reference for the load switches and other auxiliary cabinet equipment as required.

The power supply shall be either shelf or rack mounted.

The unit shall contain four LED indicators on the front panel to indicate the four outputs;

1. + 12 VDC +/- 1 VDC @ 2.0 amps,
2. + 24 VDC +/- 2 VDC @ 2.0 amps,
3. 12 VAC @ 250 milliamps, and
4. 60 Hz line frequency reference.

A test point terminal shall also be located on the unit front panel for + 24VDC and logic ground testing.

All work within the traffic control cabinet shall be done by an IMSA Certified Traffic Signal Field Technician, Level II.

Surge Suppression

The Contractor shall supply and install surge suppression in the traffic controller cabinet in accordance with the manufacturer's recommendations. At a minimum surge suppression shall be provided for loop detectors, power service, and emergency preemption.

Flasher

Flashers shall comply with Subsection 6.3 of the NEMA TS 2 Standard and be equipped with two output indicator lights which will show flashing power out to the cabinet assembly.

Flash Transfer Relays

Flash transfer relays shall comply with Subsection 6.4 of the NEMA TS 2 Standard.

The field electrical loading for flash operation shall be wired through the transfer relays such that the load on the 2-circuit flasher is a balanced as possible within the limitations of the signal phasing. A full complement of flash transfer relays to accommodate each available position of the back panel shall be provided.

Load Switches

Load switches shall comply with Subsection 6.3 of the NEMA TS 2 Standard and be equipped with two output indicator lights which will show flashing power out to the cabinet assembly. All load switches shall utilize optically isolated encapsulated modular solid state relays. Discrete components on circuit boards are not acceptable. A full complement of load switches to accommodate each available position of the back panel shall be provided.

Bus Interface Units

The Bus Interface Unit (BIU) shall comply with Section 8 of the NEMA TS 2 Standard. The BIU shall be fully interchangeable with any other manufacturer's unit and interchangeable in a NEMA TS 2 Type 1 cabinet assembly.
The BIU shall perform the interface function between port 1 at the controller unit, the malfunction management unit, detector rack assembly (video detection), and the backpanel terminal and facilities. The cabinets shall be supplied with the appropriate number of BIUs required to provide an operating traffic control signal according to the plans and these specifications.

At a minimum, two LED indicators shall be provided on the BIU front panel. One indicator shall serve a dual use: as a power-on indication and as a diagnostic indicator for proper operation of the device. The second indicator shall serve as a transmit indicator illuminating each time data is transmitted.

Malfunction Management Unit

The malfunction management units (MMU) shall comply with Section 4 of the NEMA TS 2 standard, as defined by amendment 4-2012. The MMU shall be supplied as a NEMA MMU designation "MMU2" as defined in table 4-1 of the NEMA standards. The MMU shall operate as either a Type 16 with 16 channels (8 vehicle, 4 pedestrian and 4 overlap) or a Type 12 with 12 channels (8 vehicle, 4 overlap). The MMU supplied shall be configured to operate as a Type 16 unit. The MMU shall be supplied with an Ethernet port and shall support Ethernet communications.

The MMU in either the Type 16 or Type 12 configuration shall operate in a NEMA TS 2 Type 1 cabinet, a NEMA TS 2 Type 2 cabinet, or a NEMA TS 1 cabinet without loss of functionality.

All MMU's shall be capable of flashing yellow arrow (FYA) operations.

Spare Equipment

The Contractor shall provide the following spare signal equipment in each of the traffic signal controller cabinets:

1. A full complement of load switches to accommodate each available position of the back panel;
2. A full complement of flash transfer relays to accommodate each available position of the back panel;
3. Two (2) Bus Interface Units (BIU)
4. A 25-foot RS-232 cable for communication function with a laptop computer.

Vehicle Detection

Vehicle detection shall be installed as the locations as shown on the plans, including stop line and detection on intersection approaches and departure legs. The selected vehicle detection system and a plan showing the location of the equipment, additional supports for detection equipment and detection zones shall be submitted for approval by DCR prior to installation.

The Contractor shall furnish and install vehicle detection systems that detect vehicles on a roadway by processing images sent from a sensor to an interface board with detector outputs that can be received by the traffic signal controller. These traffic sensors shall be installed at the locations shown on the plans and in accordance with these specifications. The detection system shall be non- intrusive (i.e. above ground) and shall consist of:

a. Mounting brackets
b. Traffic sensor and detection module
c. Communications cable

The detection system also, at a minimum, shall be able to:

- Collect and store volume, speed, and classification of vehicles and bicycles;
- Stop bar detection; and;
- NEMA TS 2 compatibility

The Contractor shall use one of the following vehicle detection systems, and shall meet the approval of DCR. **Note: As part of the shop drawing submission the Contractor shall provide written approval of the video detection system from DCR:**

- GRIDSMART Technologies Street Smart System;
- Miovision SmartView 360 Camera with TrafficLink
- or approved equivalent

The detection system shall be connected, via Ethernet, to the server to allow for remote monitoring and control.

Components of the detection system shall all be the same as to make and model.

Mounting Bracket - The mounting brackets associated with the detection system shall be per the manufacturer's recommendations.

Vehicle Detection Zones - The Contractor shall be responsible setting the vehicle detection zones as shown on the plans. The Contractor may be required to adjust and readjust the location of existing and proposed vehicle detection zones in the presence of the Engineer, at no additional cost, to properly set the detection areas.

Installation and Training - The manufacturer of the vehicle detection system, or their representative, shall design sensor layout, placement and lens size, and supervise the installation and testing of the equipment. A factory certified representative from the supplier shall be on-site for a minimum of one day.

Under Item 816 the Contractor shall provide eight (8) hours of personnel training in the use of the vehicle detection system and software. This training is to be conducted with DCR. The Contractor is to coordinate with DCR as to the exact location and time of the training. It is the responsibility of the

Contractor to provide training manuals, class notes, and other instructional materials for up to six attendees at the training session.

No training shall begin unless and until the final inspection process indicates, in the opinion of the Engineer, that the vehicle detection system is sufficiently complete and operational such that training would be useful at the time.

The manufacturer shall provide 3 complete sets of maintenance manuals for the installed equipment. These manuals shall have complete set-up, maintenance and troubleshooting procedures presented in an organized format. A PDF copy of the manuals shall also be submitted.

Warranty, Maintenance and Support - The traffic sensor shall be warranted by its supplier for a minimum of ten (10) years.

The vehicle detection system shall be warranted by its supplier for a minimum of two (2) years.

During the warranty period, the supplier shall provide technical support by telephone during normal business hours and request for support by telephone shall be answered by factory certified personnel within one (1) hour.

During the warranty period, certified personnel from the supplier shall be on site within seventy- two (72) hours if required.

Vehicle Detection Communications Cable

The vehicle detection communications cable shall be supplied and installed per the manufacturer's recommendations.

Vehicle Detection Software Management System

The Contractor shall provide and install a management system designed to allow for remote monitoring, data collection and control. The management system shall be compatible with the detection system supplied as part of this project.

No additional hardware, software items and/or subscription fees/ costs shall be needed/ allowed to satisfy the requirements in these specifications for the life of the project.

Mast Arm Assemblies

All mast arm assemblies shall be Type II, conforming to the "Massachusetts Department of Transportation Highway Division – Overhead Signal Structure & Foundation Standard Drawings", Dated December 2015. The length of mast arm shaft shall be according to the plans.

The Contractor is not required to submit load calculations for mast arm designs that conform to Massachusetts Department of Transportation Highway Division – Overhead Signal Structure & Foundation Standard Drawings Dated December 2015. Shop drawings should be limited to identifying the dimensions of the mast arm and foundation. For proposed loading conditions that

exceed these typical designs, the design shall conform to the latest version of the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals utilizing the same or more conservative design parameters such as design life and design wind speed. Non-standard designs shall be stamped and signed by a Structural Engineer registered in the Commonwealth of Massachusetts and shall also include design calculations. Only poles of MassDOT prequalified manufacturers shall be used. A list of prequalified manufacturers can be obtained from the Bridge Engineer of the Massachusetts Department of Transportation (MassDOT).

The street name signs being attached to the traffic signal mast arm pole shall have sufficient hardware to prevent the sign panel from being deformed by wind pressure, including an aluminum double tee mounting bracket along the entire length of the sign.

Any traffic signs being mounted to mast arm must be bolted through the sign face, and cannot hang from the mast arm.

Mast Arm Foundations

Cement Concrete foundations for mast arm structures shall conform to the "Massachusetts Department of Transportation Highway Division – Overhead Signal Structure & Foundation Standard Drawings", dated December 2015. No pre-cast foundations shall be used.

The Contractor shall submit Shop Drawings of any bolt circle details for approval by the Engineer. The Contractor shall request written approval from the Resident Engineer before the placement of any concrete for foundations for mast arms, signal posts, and cabinets. Anchor bolts shall be set accurately and tops shall be formed neatly.

The top forming of cast in place units shall extend downward for a minimum of 24 inches on the side of the foundation. The lower portion of all foundations shall be placed directly against undisturbed earth. No forms or reinforcing for foundations for mast arms and control cabinet shall be set, nor shall concrete be placed until the excavation has been inspected by the Engineer and approval to proceed has been given. The top of the mast arm foundation, when installed in the sidewalk, shall be flush with the sidewalk. Foundations that protrude above sidewalk grade will not be accepted. Foundations shall not obstruct sidewalks or crosswalks and shall be located such that an accessible sidewalk width is maintained.

All sweeps to be installed in mast arm bases shall be 3 inch (PVC) sweeps with sufficient 3 inch PVC riser to project above the finish grade of the base. One spare sweep and riser, capped at both ends, shall be poured in place in each mast arm base. The Engineer shall determine the location of the spare sweep. No more than three sweeps shall be in any foundation.

Concrete foundations shall be constructed of 4,000 psi, 1.5 Inch, 565 Cement Concrete. Unless otherwise required by the Engineer, poles shall not be erected on a concrete foundation until the concrete has set for at least 28 days.

If utilities or other underground obstructions are encountered, the Contractor shall backfill the area to its original condition until an alternate design has been provided by the Design Engineer and

approved by DCR.

It is noted that if significant utilities are present in many areas of this project, special foundation excavation and installation methods, such as vacuum truck excavation and/or hand digging, at the direction of the Engineer, may be required. No separate payment shall be made for these activities, but all costs in connection therewith shall be included in the lump sum bid price.

No separate payment will be made for work considered incidental to the excavation, including but not limited to, mast arm foundations, dewatering, etc. but all costs in connection therewith shall be included in the lump sum bid price.

The Contractor shall be responsible for performing all mast arm soil borings and soil classifications associated with the mast arms and poles. Reference is made to Items 191., 191.10, 191.11, and 193. for more information. Soil classifications shall be submitted for review by the Engineer.

The Contractor is responsible for the design of all mast arm foundations and shall submit the design and calculations for review by the Engineer. Standard mast arm foundations shall be assumed for bidding purposes to be 3'-6" diameter, 14'-0" deep, cored foundations in accordance with MassDOT Overhead Signal Structure & Foundation Drawings. If the soil borings and subsequent design calculations dictate a different depth, the variance from the 14' depth will be addressed in accordance with subsection 801.62 Foundations via pay Item 815.98, Footing Cost Adjustment on a per foot basis. All reinforcing steel required for these foundations shall be paid for under the Traffic Signal pay items and no adjustment will be made for any variance.

All shop drawings and calculations shall be stamped by a Professional Engineer registered in the Commonwealth of Massachusetts and provided to the Engineer.

Where soil conditions are such that, in the opinion of the Engineer, the typical foundation design is not suitable, the Engineer will provide a modified design for the foundation. Alternative foundation types could include spread footings, coring and socketing into rock or other foundations previously used to support similar loads.

Signal Housings

Materials

Vehicle Signal Heads - All indications shall be equipped with a tunnel visor, and red, yellow, and green LED signal modules.

Pedestrian Signal Heads - All indications shall be equipped with a hood visor, and lunar white and portland orange LED signal modules.

Construction Methods

The final adjustment of the facing of signals shall be made as required by the Engineer after all the signals at an intersection are operating, but prior to installing the through bolt above.

Light Emitting Diode (LED) Signal Module

Any LED signal module that has been type-tested and approved and listed on MassDOT's Qualified Traffic Control Equipment list, according to section 815.21 of the Standard Specifications, prior to the date of award of this Contract will be considered as meeting these Specifications.

To prevent the LED module warranty from being voided, the connecting leads on the module shall not be cut. The original LED module leads shall be connected to the signal head terminal block as continuous wire without splices.

The LED signal module will be replaced or repaired by the manufacturer if it exhibits one of the following:

- A failure due to workmanship or material defects within the first 60 months of field operation.
- A greater than 40 percent light output degradation or a fall below the minimum intensity levels (as defined by the latest ITE performance specifications) within the first 36 months of field operation.

Signal Housing Brackets

All signal housing brackets must be installed to manufacturer's specifications and must be properly torqued. Signal heads mounted on mast arms shall be rigidly attached to the mast arms. Signal heads attached on mast arms shall be mounted in such a way that the bottom of all signal heads are at the same height.

Backplates

Backplates shall be aluminum with a louvered profile on span wire mounted locations or a non-louvered profile on mast arm mounted locations. Backplates shall have a 5 inch border width and which includes a 3 inch reflectorized yellow border. The border shall be made from an adhesive-backed retroreflective yellow micro-prismatic sheeting, conforming to ASTM D4956 Type VIII or better, and cover the entire perimeter of the backplate.

Visors

All vehicular traffic signal indications shall come equipped with tunnel visors.

Pedestrian signal heads shall come equipped with tunnel visors.

Pedestrian Signal Heads – Heavy duty blind clamp fittings are required for mounting hardware.

Where mast arm mounting is required, including at intermediate arm locations, signal heads shall be all vertically fixed-mounted.

The final adjustment of the facing of signals shall be made as required by the Engineer after all the signals at an intersection are operating, but prior to installing the through bolt above.

Traffic Signal Posts and Bases

Octagonal transformer bases with steel collar inserts shall be of aluminum alloy permanent mold casting. Hardware shall include templates, ¾ inch anchor bolts, nuts, washers and shims. The height of base shall be approximately 14 inches, and the height of the base is included in the height of the shaft. The bottom of the base shall be designed for anchorage on a 12-3/4 inch bolt circle. The bases and posts shall be aluminum with a satin brush finish. Bases shall be provided with a door opening and a cast aluminum door, complete with a cap screw fastening device and a tapped hole for a grounding lug.

Concrete Bases

Foundations for 8 foot and 10 foot traffic signal posts shall be provided at locations shown on the Contract Drawings and shall be in conformance with the MassDOT Standard Specifications and the MassDOT Standard Drawings.

All sweeps to be installed in concrete bases shall be ¾ inch steel sweeps with sufficient three inch steel riser to project above the finish grade of the base.

One spare sweep and riser, capped at both ends, shall be poured in place in each signal support foundation or base. The Engineer shall determine the location of the spare sweep. In any case no more than three sweeps shall be in any foundation.

Traffic Signal Intersection Cable

All traffic signal cable placed underground in conduit shall be stranded copper No. 12 AWG per IMSA 20-1. All traffic signal cable placed from the transformer base to the signal shall be stranded copper No. 14 AWG per IMSA 20-1.

Circuit protective device for the tap from No. 12 AWG to No. 14 AWG at the signal base shall not exceed 15 amps and shall comply with the N.E.C.

All traffic cables shall be labeled with suitable, durable, permanently legible tags or markers. Individual conductors, when not enclosed by the cable outer jacket, shall be bundled by phase and labeled with the appropriate phase designation.

A single cable shall be used in all conduit runs requiring up to 30 conductors. No more than 2 cables may be used for runs of 31 to 60 conductors, and no more than 3 cables may be used for runs of 61 to 90 conductors. These shall be the only cables carrying signal or pushbutton circuits in any one conduit.

A minimum of five (5) spare conductors shall be provided in the base of each signal post, mast arm pole and strain pole. Openings, where cables enter the base of a cabinet, shall be sealed with an approved elastic sealing compound. The open ends of conduits entering or leaving mast arms, posts and pull boxes shall also be sealed with the approved elastic sealing compound.

Service Connection

Service connections shown on the plans are approximate only. The Contractor shall determine exact location from the servicing utility, arrange to complete the service connections, and be responsible for all charges incidental thereto.

The respective utility company is responsible for making the connection from the respective riser to the overhead wires, or the from the electric manhole for the underground service connection.

All service cable shall be stranded copper No. 6 AWG. All power supply cable shall be labeled.

The Contractor shall furnish and install, or cause to be installed, all service equipment (120 volt, 60 cycle) to the satisfaction of the utility company (120/240 volt service connection will not be acceptable).

A 100 Ampere meter socket approved by the local electric utility shall be mounted on the side of the cabinet. The Contractor shall furnish and install the meter socket and the electric utility company shall furnish and install the meter.

One 3 Inch PVC conduit (approved by the local electric utility) connection shall be installed between the utility pole and the traffic signal control cabinet. Pull boxes used in the conduit run shall be of a type that is approved by the local electric utility.

Service connections shall also conform to MassDOT's latest Overhead Traffic Signal Service Connection Detail.

Wiring Diagrams

Five sets of modified wiring diagrams for the control cabinet and all accessories shall be furnished including one mylar reproducible copy for the control cabinet when installed. All actual and potential terminal strip connections shall be shown. Accessory equipment includes flashers, switches, relays, logic modules, detectors, etc. All identification on the diagrams shall be as installed, and all field labeling shall be consistent with the diagrams. Furthermore, the format symbols, identifications, operating sequence, etc., common to all the intersection wiring diagrams shall be standardized and consistent with appropriate MassDOT standards. Before acceptance of the job, the five copies of all operating and maintenance manuals and complete and accurate parts lists shall be supplied.

All tests and any necessary repairs and replacements required to produce a fault-free system shall be included in the lump sum price bid for this Item.

Pedestrian Signal Heads with Countdown Timers

The pedestrian signal heads shall be 16 inch countdown pedestrian signals. The signal shall consist of international symbols of an LED upright hand symbolizing "DON'T WALK" and a walking person symbolizing "WALK". The internal countdown module shall be comprised of two 7 segment digits, 8 inches high and made of 88 red LED's. The countdown module shall display the

number of seconds remaining throughout the flashing "DON'T WALK" pedestrian, and blank out when not activated. All LED indications on the pedestrian signal shall have an automatic dimming circuit for night illumination to reduce long-term degradation to the LED's.

Pedestrian Push Buttons

Pedestrian push buttons shall be located as close as practicable to the sidewalk curb ramp serving the controlled crossing and shall permit operation from a clear ground space. If two crosswalks, oriented in different directions, end at or near the same location, the positioning of pedestrian push buttons and/or legends on the pedestrian push button signs should clearly indicate which crosswalk signal is actuated by each pedestrian push button.

The pedestrian push button shall be within ten inches (10") horizontally of and centered on the clear ground space. See 521 CMR 21.10.4. Pedestrian push-button extenders, if required, will be considered incidental to this item.

Immediately above each pedestrian push button a 5 inch x 8 inch (nominal) metal sign shall be installed on the crosswalk side of the post or pole. The plunger shall be a maximum of 42 inches above the finished sidewalk and a minimum of two inches in the smallest dimension. The force required to activate controls shall be no greater than 5 lbs. This sign and saddle shall be used in locations where a pushbutton is shown on the plans

Accessible Pedestrian Signal Pushbuttons

The Accessible Pedestrian Signal (APS) pushbuttons shall provide information in non-visual formats (such as audible tones, speech messages, and/or vibrating surfaces). The APS pushbuttons and shall be compliant with the 2009 MUTCD. At a minimum the APS pushbuttons shall be provide with the following features:

- Pushbutton locator tone
- A visible and audible indicator that the button press has occurred
- A vibro-tactile arrow
- A speech walk message for the "WALKING PERSON" indication

The APS pushbuttons shall provide visually disabled pedestrians with a locator tone that will allow them to find the pushbutton to activate the walk signal. Once the pushbutton call has been placed, the signal will provide both an audible and tactile response during the related "WALK" portion of the cycle. A sunlight visible LED latches "ON" to confirm the button has been pushed.

The audible response shall be a percussion tone, indicating when the phase is started.

Housing and Pushbutton Unit – Shall meet the following minimum requirements:

- Constructed of cast aluminum with a powder coated finish.
- Highly vandal resistant and pressure activated with essentially no moving parts.
- Operating temperature range -34 degrees Celsius to 65 degrees Celsius.

- Operating voltage range 12 to 36 VDC.
- Button cap must be made of solid 316 stainless steel.
- Pushbutton must activate with 5 lbs of force or less.
- Unit must have an LED display to give indication that of pushbutton being pushed.
- Pushbutton must fully operate immediately after being completely immersed in water for 5 minutes (electrical terminals isolated from water).
- Pushbutton must not allow ice to form such that it would impede function of pushbutton or pushbutton cap.
- All switch electronics must be sealed within the housing.
- All sounds shall emanate from the back of the of the APS pushbutton unit via a weatherproof speaker that is protected by a vandal resistant screen.

Tactile Arrows and Locator Tones – Shall meet the following minimum requirements:

- APS pushbuttons shall incorporate a locator tone at the pushbutton the locator tone, measured at 3 feet from the APS pushbutton, shall be 2dB minimum and 5dB maximum above ambient noise level in standard operation and shall be responsive to ambient noise level changes. Tones shall consist of multiple frequencies with a dominant component of 880Hz. The duration of the locator tone shall be 0.15s and shall repeat at intervals of 1.0s.
- APS pushbuttons shall be a minimum of 2 inches across in diameter and shall contract visually with their housing and mounting.
- APS pushbuttons shall include a vibro-tactile arrow aligned parallel to the crosswalk direction. The arrow shall be raised 0.03 inches minimum and shall be 1.5 inches minimum in length. The arrow head shall be open at 45 degrees to the shaft and shall be 33 percent of the length of the shaft. Stroke width shall be 10 percent minimum and 15 percent maximum of arrow length. The arrow shall contrast with the background.
- The arrow shall vibrate during the “WALK” portion of the cycle.

Speech Walk Message

The speech walk message shall be audible from the beginning of the associated crosswalk. The speech walk message and associated APS pushbuttons shall be as follows:

PEDESTRIAN PUSHBUTTON	SPEECH WALK MESSAGE
All	Walk sign is on to cross *Street Name*

Mounting Requirements

A maximum mounting height of 42 inches above the finish sidewalk grade shall be used for APS pedestrian pushbuttons.

The Contractor is hereby notified that they are ultimately responsible for constructing all pedestrian push button elements (clear ground space, forward and side arm reaches) in strict compliance with the current AAB rules, regulations and standards.

All construction elements in this project associated with pedestrian push buttons are controlled by 521CMR – Rules and Regulations of the Architectural Access Board. Pushbutton Frame Extenders shall be used only if approved or directed by the Engineer.

The Contractor shall establish clear ground space at all pedestrian push button locations, and shall set arm reach lengths according to the AAB rules (or to the details shown on the plans).

The project has been designed to conform to all AAB rules, and the Engineer is not aware of any required variances for the work presented on the design plans. The Contractor shall notify the

Engineer of any project element related to the pedestrian push buttons that will not comply with 521 CMR prior to constructing said pedestrian push button elements.

Installation

The APS pushbuttons shall be installed by Contractor and as recommended by the manufacturer and documented in installation materials provided by the manufacturer. The Contractor shall be responsible for the proper programming of the APS pushbuttons, orientation of the pushbuttons, and all other work necessary to provide a complete and operational APS pushbutton system. The Contractor may be required to adjust volume levels as directed by the Engineer. When the setup is complete and the APS pushbuttons are ready for operation, the values of all parameters that were set during the process shall be delivered to the Engineer in printed and computer-readable form.

Warranty

Each APS pushbutton shall be warranted free from defects in material and workmanship for a period of at least 2 years from the date of installation by the Contractor and acceptance from the owner.

During the warranty period, technical support shall be available from the supplier to the owner via telephone within 4 hours of the time a call is made by a user, and this support shall be available from factory-certified personnel without charge.

Equipment Finish and Color

Under this Item the traffic signal equipment including but not limited to signal posts, bases, vehicle signal heads, pedestrian signal heads, visors (outside), doors, mast arms/poles, controller cabinet (outside), meter socket boxes, pedestrian pushbutton housing, hardware, and rigid mounting brackets for signals and signs shall be primed and finished in accordance with the following DCR General Paint Specifications as follows:

General Surface Preparation:

1. Treatment of Steel in the Field:
   SSPC SP-1, Solvent Cleaning plus SP-3, Power Tool Cleaning
2. Treatment of Steel in the Shop:
   SSPC SP-1, Solvent Cleaning plus SSPC SP-6, Commercial Blast Cleaning.
3. Treatment of Galvanized Steel or Aluminum in the Shop:
   SSPC-SP1, Solvent Cleaning plus SSPC-PC-PT3, Basic Zinc Chromate Vinyl Butyral Washcoat. Coating shall meet Standard Specifications M7.04.10.*

* Alternate to wash primer, use in the Field:
SP-1 to clean, prime with TT-P-641G, Type II, final coats with TT-E-489F.

Primer - TT-P645 Primer, paint Zinc Chromate, Alkyd Type.

Top Coat (MDC Gray) - Color Number 16357 Gray to meet Federal Specifications TT-E-489F Enamel, Alkyd, Gloss (for exterior and interior surfaces) Class A Air Drying, Composition L Limited Use.

The finish on mast arms and poles shall be guaranteed by the manufacturer not to chalk, peel, blister, or fade for five (5) years after acceptance of the project.

The interior of controller cabinets shall be white.

The work performed under these items shall conform to the requirements for lead paint presented in sections 961.65 through 961.69 of Standard Specifications.

METHOD OF MEASUREMENT

Item 815.2 Traffic Control Signal Location No. 2, Item 815.4 Traffic Control Signal Location No. 4, Item 816.01 Traffic Signal Reconstruction Location No. 1 and Item 816.03 Traffic Signal Reconstruction Location No. 3 shall be measured per LUMP SUM per location.

BASIS OF PAYMENT

Traffic Control Signal Location No. 2, Traffic Control Signal Location No. 4, Traffic Signal Reconstruction Location No. 1 and Traffic Signal Reconstruction Location No. 3 will be paid for at the Contract Lump Sum price for Items 815.2, 815.4, 816.01 and 816.03, respectively, which prices shall include all labor, materials, equipment, and incidental costs to complete the work. The prices shall also include vehicle detection equipment and electric service connection, including all hardware, software and supports for detection equipment, as necessary.

Electrical conduit shall be paid for separately under Item 804.3 3 inch Electrical Conduit Type NM - Plastic - (UL).

Pull Boxes shall be paid for separately under Item 811.31 - Pull Box 12 X 12 Inches - SD2.031 at all four locations and Item 811.22 – 24” X 13” X 36” Electric Handhole – SD2.022 at Location No. 3 where two larger pull boxes are needed.

Mast arm soil borings shall be paid for under Items 191., 191.10, 191.11, and 193.

The cost of maintenance of the proposed traffic signal equipment shall be deemed to be included in the Lump Sum bid price for these items, and no additional payments shall be made therefor, except as provided by the Standard Specifications.

The work performed under these items shall conform to the requirements for lead paint in Sections 961.65 through 961.69 of the Standard Specifications.

All tests and any repairs and/or replacements required to produce a fault-free system shall be included in the Lump Sum bid price for that item.

ITEM 815.98 MAST ARM FOOTING COST ADJUSTMENT FOOT

The contract lump sum price for Items 815.2, 815.4, 816.01 and 816.03 includes the cost of the mast arm footing based on a 14'-0" deep and 3'-6" diameter foundation for bidding purposes. The actual existing soil type will be determined from soil borings taken under this Contract. If the Engineer agrees that, based on the design provided by the Contractor, that the soil conditions requires the use of a foundation deeper than 14'-0", the Contractor shall install the designed foundation and the Contractor will be paid for the difference in depth at the contract unit price for Item 815.98.

Inversely, if it is determined that the soil conditions require a foundation less than 14'-0', the Owner will be credited for the difference in depth at the Contract unit price for Item 815.98.

METHOD OF MEASUREMENT

Item 815.98 Mast Arm Footing Cost Adjustment shall be measured per FOOT of foundation depth installed in place per foundation and then subtracting 14 feet per foundation.

BASIS OF PAYMENT

Mast Arm Footing Cost Adjustment will be paid for at the Contract unit price for Item 815.98, regardless of the diameter of foundation installed. For foundations 14 feet or less, the Owner will be credited the difference in depth between 14 feet and the actual depth of foundation installed in place at the Contract unit price for Item 815.98.

ITEM 816.813 TEMPORARY TRAFFIC CONTROL SIGNAL LOCATION NO. 3 LUMP SUM

The work under this Item shall conform to the relevant provisions of Section 800 of the Standard Specifications, the latest adopted edition of the Manual on Uniform Traffic Control Devices (MUTCD) as amended and supplemented, and the following:

The work shall include the furnishing and installation of part or all of the following items to supplement the existing traffic signal control equipment during the entire construction period: the controller, cabinet; temporary signal supports (including temporary span assemblies), temporary concrete foundations; signal heads; signal poles; vehicle detection device supports, pull boxes; pedestrian push buttons; conduit; all cable and wiring; ground rods, equipment grounding and bonding; service connection; and all other equipment, materials and incidental costs necessary to provide a complete, fully operational traffic control signal system as specified herein, as shown on the plans and to the satisfaction of the Engineer. Temporary traffic signals are required to maintain full vehicle and pedestrian signal control at all times, including, but not limited to when temporary traffic control lane configurations are not able to be aligned with existing traffic signal indications as defined by the MUTCD and to the satisfaction of the Engineer. Modifications shall be made to the existing traffic signal equipment or temporary equipment shall be installed. At the completion of construction, all existing and temporary traffic signals shall be removed and replaced with the new permanent proposed traffic signal equipment.

The intersection location is as follows:

- Location 3 – Memorial Drive at Hawthorn Street

The scope of work is expected to include, at a minimum:

- Installation of temporary traffic signal equipment;
- Modification of existing traffic signal equipment to accommodate temporary traffic staging;
- Installation and maintenance of vehicle detection (all intersection approaches) for use during construction;
- Maintenance of existing traffic signal equipment, including covering or storage of existing traffic signals not in use;
- Work to include providing and maintaining pedestrian controls at crosswalks;

Within 15 days following execution of the Contract, the Contractor shall order the proposed traffic signal equipment and submit proof of this order to the Engineer. The Contractor shall deliver to the Engineer a certificate of compliance with the manufacturer for all materials purchased from the manufacturer. All traffic signal equipment shall be listed on MassDOT's Qualified Traffic Control Equipment (QTCE) list.

FLASHING OPERATION

Changes from automatic flashing to stop-and-go operation and from stop-and-go to automatic

flashing operation shall occur as set forth in Section 4D.12 of the MUTCD.

SERVICE CONNECTION

The cost of power supply used by the temporary traffic signal control equipment will be paid for by the Contractor.

ELECTRICAL CONDUIT

The Contractor shall provide a design for temporary conduit layout at the intersections in order to provide a fully operational traffic control signal systems as shown on the plans and as required by the Engineer. The conduit material shall be Schedule 80 polyvinyl chloride (PVC) Type NM (UL).

Where new conduits are installed in existing paved areas, disturbed areas are to be restored to their original condition. No separate payment will be made for this work, but all costs in connection therewith shall be included in the Contract Lump Sum Price.

CONTROLLER AND CABINET

If required, the Contractor shall supply and install a NEMA TS-2, Type 1, 8 phase traffic signal controller at Location 3. The controller shall conform to the Standard Specifications. Controller and cabinet size shall be compatible with each other.

TESTING OF THE GROUNDING SYSTEM

The Contractor shall perform testing of the equipment grounding system in the presence of the Engineer in accordance with the Standard Specifications.

SIGNAL TIMING & PHASING

Signal timing and phasing from the existing traffic signal system shall be retained. Adjustments may be required by the Engineer throughout the construction period to optimize traffic operations.

TEMPORARY PORTABLE TRAFFIC SIGNAL UNIT

If required, Temporary Portable Traffic Signal units shall be trailer mounted, be of a sufficient length to provide two overhead arm mounted traffic signals over the approach travel lane and be listed on MassDOT's Qualified Traffic Control Equipment list. The Temporary Portable Signal unit shall operate using AC power.

TEMPORARY SPAN WIRE ASSEMBLY

If required, wood or metal span wire support poles shall be provided. Wood poles shall be either Douglas Fir or Southern Yellow Pine. Metal poles shall be in conformance with MassDOT's Overhead Signal Structure & Foundation Standard Drawings. The Contractor shall submit shop drawings for approval for all temporary span wire components. Structural drawings and calculations, stamped by a Professional Engineer registered in the Commonwealth of

Massachusetts, shall be provided to demonstrate that the poles submitted are capable of withstanding 130 MPH wind loads.

SIGNAL HEADS

Signal heads with 12" L.E.D. lenses shall be provided. Signal heads mounted on temporary supports shall be rigidly attached to the support, with the bottom of all signals at the same height.

PEDESTRIAN PUSH BUTTONS

Pedestrian push buttons shall clearly indicate which crosswalk signal is actuated by each pedestrian detector.

VEHICLE DETECTION

Vehicle detection shall be provided on all intersection approaches. Detection shall be provided using MassDOT approved devices and mounted on temporary supports, if required.

TEMPORARY TRAFFIC SIGNAL MAINTENANCE

Maintenance of the traffic signal system (temporary and existing equipment) shall be the responsibility of the Contractor for the duration of the Contract. The Contractor shall make necessary adjustments and tests to ensure safe and efficient operations, as required by the Engineer.

The Contractor shall make all necessary adjustments to signal heads and signal timing to accommodate the construction staging.

In the event of equipment failure, the Contractor shall repair or replace the malfunctioning parts or equipment, faulty workmanship, regardless of cause, within twenty-four (24) hours after having been notified. Failures caused by defective equipment, materials or workmanship shall be corrected to the satisfaction of the Engineer.

The Contractor shall provide the Engineer with the name and telephone number of the person to be notified in the event of failures or malfunctions.

COMPENSATION

METHOD OF MEASUREMNT AND BASIS OF PAYMENT

The lump sum price bid for Item 816.813 shall be full compensation for all labor, materials and equipment necessary or incidental to the installation, relocation of and final removal of and operation of a complete, fully operating temporary traffic control system during each phase of construction, including the removal or relocation of existing signal equipment as necessary, providing new and relocation of temporary equipment and all related items functioning in the manner specified and shown on the contract documents. No separate payment will be made for pull boxes and conduit.

The cost of the electric power, consumed by the operation of the traffic control equipment during the construction, shall be borne by the Contractor. The construction period is deemed to end when DCR accepts the traffic control equipment.

All tests and any necessary repairs and replacements required to produce a fault-free system shall be included in the Lump Sum bid price for that item.

ITEM 821.101 ORNAMENTAL SINGLE LIGHTING POLE EACH
ITEM 821.103 ORNAMENTAL POST TOP LIGHTING POLE EACH

All work performed under these Items shall be in accordance with the relevant provisions of Section 820 of the Standard Specifications for Highways and Bridges, as detailed on the contract drawings, and the following:

The work under these Items shall conform to the relevant provisions of Section 820 of the Standard Specifications for Highways and Bridges and shall consist of furnishing and installing poles and bracket arms for luminaires located and detailed on the Contract Plans, and the following:

GENERAL

These Items includes pole and arm assemblies to be used with the Highway Lighting Luminaire specified under Item 823.101 and Item 823.103. All poles, arms and luminaires shall be of the same design shape; dimensionally, aesthetically, and supplied by the same manufacturer. All poles shall be in accordance with MassDOT manufacturing and submittal standards.

Manufacturer's data shall be submitted for the following:

Lighting poles.

Shop drawings shall be submitted for the following:

Lighting poles, dimensions, wind loading calculations, pole deflection and other applicable information. Wind loading calculations shall be stamped by a Professional Structural Engineer registered in the Commonwealth of Massachusetts.

MATERIALS

Ornamental Single Lighting Pole

Lighting poles shall be provided and designed in accordance with AASHTO LTS-6 while supporting the luminaire.

Lighting poles shall be designed in conjunction with offset luminaires and shall conform to the criteria set forth above for the luminaires.

The poles shall have a nominal length of indicated on the contract drawings and provide a luminaire mounting height above the roadway surface indicated on the contract drawings. Wind load calculations and shop drawings verifying conformance to AASHTO publication "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals", 2009 addition shall be provided. Wind velocity used for the calculation shall be the 3-second gust basic wind speed (Figure 6-1 of ASCE 7-05) for the site location. Lighting poles shall be anchor-base type designed for use with underground supply conductors. The poles shall be designed to AASHTO's groups 1, 2, and 3 with the AASHTO recommended safety factor for each group.

AASHTO breakaway requirements shall not apply. Manufacturers shop drawings and calculations shall be submitted, stamped by a professional engineer registered in the Commonwealth of Massachusetts.

The highway light pole, bracket arm, and banner arm assembly shall be as manufactured by King Luminaire / WJM Poles Catalog No. KSB88 / ART-A-080-F-253-PT6-R-FP, KA24-T-1-6', and Banner Saver – Small w/H.D. Straps or equivalent products as specified below and as detailed on contract drawings and in compliance with these specifications.

Pole manufacturer of the light pole and luminaire shall have been in the business of manufacturing outdoor lighting products for a minimum of (10) years.

Each highway light pole shall include the following major components:

Ornamental Base Section – The base cover shall be a two piece round cover made from cast iron, mechanically fastened with stainless steel screws. The clam shell base shall be 17 inches in diameter and be set flush to the finished sidewalk elevation allowing for proper ADA clearance (36 inches minimum).

Highway Pole Shaft – The pole shaft shall be made from a round tapered carbon steel – 7 gauge.

Maintenance Opening – A 4 inch x 6 inch maintenance opening shall be provided complete with a weatherproof cover and a copper ground lug.

Anchor Bolts – Anchor bolts shall be made of ASM F1554 grade 55 steel having a minimum yield strength of 55000 psi. Nuts shall be made of ASTM A563 grade A steel or better. The thread fit is ANSI class 2B. Washers shall be made of ASTM grade F-844 or better steel. All galvanized parts are hot dip galvanized per ACNOR G-164 minimum.

Arm Assembly – The bracket arm shall be made from schedule 40 steel pipe arm, Steel flat – Stock Ornamental Truss Support, Cast Steel Tenon Adapter. The Cross Arm shall be Mechanically fastened to the pole or tenon. The bracket shall meet the AASHTO 2001 standard specifications for structural support for luminaires.

Highway Pole Accessories – Two aluminum banner arms shall be provided as shown on the contract drawings. They shall be attached to the pole in accordance with the manufacturer's instructions

Finish – Finish shall be in accordance with the AAMA 2603 standard. Application of polyester powder coat paint. Provide a finish with discoloration resistance in accordance with the ASTM D2244 standard, luster retention in keeping with the ASTM D523 standard, and humidity proof per the ASTM D2247 standard. Finish shall achieve a minimum of 2000 hours for salt spray resistance in accordance with testing performed and per the ASTM B117 standard.

Warranty – The manufacturer shall repair or replace at no cost any mechanical component defects for a minimum of five years from date of installation.

Ornamental Post-Top Lighting Pole

The light pole design shall be a replica of a circa 1913 design as originally manufactured by the Westinghouse Electric and Manufacturing Company. The light pole shall be constructed per the following specifications and as detailed on the contract drawings.

The lamp post shall be Model "NHP- AMB" as manufactured by Alloy Castings Co. – Bridgewater Ma. Light poles manufactured by Spring City Electrical Mfg. Co. and King Luminaire will be considered as equals to the specification.

The light pole shaft shall consist of a 12" diameter x ¾" thick base plate with (4) 1" diameter slip holes equally spaced on a 7" bolt circle for ¾" diameter anchor bolts. The anchor bolts shall be ¾" x 24" long with 3" hook per ASTM A36 and fully hot dipped galvanized per ASTM A153. The base plate shall be circumferentially welded top and bottom to the 7 foot long, 4" Schedule 80 (4 ½" O.D.) lower pole shaft. The lower shaft shall include a 2 ½" x 4" reinforced and covered hand hole to facilitate wiring connections and provide access to fuse holders. The upper shaft section shall consist of a 4 ½' long section of 2 ½" schedule 80 aluminum pipe (2 7/8" O.D.) designed to insert into the lower shaft and welded circumferentially in place. The top of the upper shaft assembly shall act as a luminaire's mounting tenon.

DECORATIVE POST TOP CAST ALUMINUM BASE

Each pole shaft shall include (1) decorative slipover aluminum casting used to provide an aesthetically pleasing transition from the lower to upper shaft sections. The casting shall be a heavy wall design and equipped with (3) 3/8" diameter stainless steel set screws for connection to the upper pole shaft section.

DECORATIVE POST TOP FINISH

The finish for all aluminum and cast aluminum components shall be TGIC polyester powder coated. All exterior surfaces shall be coated to an average dry film thickness (DFT) of 3.0 mils. The powder is electro statically applied and then cured in a gas fired convection oven at a temperature range of 350 degree F – 400 degree F. The thermosetting powder resin provides both intercoat as well as substrate fusion adhesion that meets 5A and 5B classifications of ASTM D3359. The powder characteristics shall provide 50 gloss units. The color shall be black.

INSTALLATION

The Drawings show, in general, the location of the roadway lighting systems. They are diagrammatic only, but shall be followed as closely as actual conditions as the site will permit.

All lighting standards shall be set plumb, with vertical plane of arms perpendicular to the roadway centerline. The factory furnished protective wrapping shall not be removed until the Engineer so requires.

Poles shall be erected and secured to concrete structures and at grade foundations in a manner as described herein.

A 6-inch galvanized threaded stud shall be screwed into the other end of the coupling engaging half of the coupling threads. The bolt shall be rigidly placed into the foundation form using a bolt circle template so that the top of the coupling becomes level with the top of the concrete after pouring and setting. A galvanized leveling nut shall be placed on the stud as close to the concrete as practicable. A galvanized flat washer shall be placed over the leveling nut.

The pole shall be erected with the shoe base placed over the flat washers. Galvanized lock washers shall be placed over the shoe base. Top nuts shall be placed over the lock washers and hand tightened.

Lateral support shall be provided as required. Top and leveling nuts shall be adjusted until pole is plumb. Top nuts shall be tightened to manufacturer's recommended torque. Anchor bolt covers or base covers shall be installed on the shoe base with stainless steel screws.

Cable shall be installed through the pole with adequate slack to connect to the luminaire terminals. Adequate slack cable shall be left at the base of the pole to permit connections to the roadway lighting circuits. Install fuse and fuse holder at base to make ready the pole for erection and connection to the roadway lighting circuits.

After erection, all unpainted parts, accessories, or hardware shall be field painted the same color as the poles. Galvanized and stainless steel parts shall be properly prepared and primed before final painting.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Measurement for Item 821.101 Ornamental Single Lighting Pole and Item 821.103 Ornamental Post Top Lighting Pole shall be made per EACH unit, complete-in-place, tested, and accepted by the Engineer.

Payment for Item 821.101 Ornamental Single Lighting Pole and Item 821.103 Ornamental Post Top Lighting Pole shall be at the contract unit bid price for each unit, complete-in-place, which price shall include all labor, materials, tools, equipment, light poles, decorative bases, bracket arms, anchor bolts, pole wiring, fuses, street light fuse connector, vibration damper and mounting hardware including banner arms, and connections, and all incidentals to complete the work of this item as required.

ITEM 821.102 ORNAMENTAL SINGLE LIGHTING POLE - REFINISH ONLY **EACH**

GENERAL

The work under this Item shall include the furnishing of all labor, equipment, and mobilization for the repainting of ornamental street light poles as shown on the Contract Drawings and as required by the Engineer. Light poles and fixtures shall be thoroughly cleaned, primed, and painted in accordance with industry standards, and as specified in this document. The worksite shall be secured before, during, and after all work is performed. All pedestrian and vehicular traffic within the worksite or adjacent areas must be thoroughly protected from injury or damage caused by paint, solutions, or the processes of cleaning and painting. Additional protection shall be provided for all public and private property within the worksite or adjacent areas including landscape features, infrastructure, structures, and other surfaces not to be painted but within the work zone. All surfaces shall be cleaned and prepared in accordance with industry standards prior to painting. The worksite and adjacent areas must be completely restored to the general condition and appearance as was before the work began.

SUBMITTALS

A written scope of work detailing surface preparation and painting procedures shall be submitted for approval prior to performing the work. The Contractor should also provide the coating manufacturer's name, product data for each coating, including generic description, complete technical data, surface preparation, and application instructions. The Contractor shall procure coatings and coating application accessories from a single coating manufacturer. Samples of the color specified shall be submitted for approval.

The coating manufacturer shall be specialized in the manufacture of coatings with a minimum of ten (10) years of experience. The coatings manufacturer shall be able to demonstrate successful performance on comparable projects.

Applicator's Qualifications - The Contractor shall be experienced in the application of specified coatings for a minimum of five (5) years on projects of similar size and complexity and should be considered as an Industrial Coatings Contractor. The Contractor shall employ persons trained for the application of the specified coatings.

ENVIRONMENTAL REQUIREMENTS

The Contractor shall prepare surfaces and apply and cure coatings within the air and surface temperature range in accordance with the manufacturer's instructions. The Contractor shall prepare surfaces and apply and cure coatings within the relative humidity range in accordance with the coating manufacturer's instructions. The Contractor shall not prepare surfaces or apply coatings in rain, snow, fog, or mist. The Contractor shall not spray coatings if wind velocity is above the coating manufacturer's limit. 4

Dust and Contaminants - The Contractor shall schedule coating work to avoid excessive dust and airborne contaminants, and shall take the necessary steps to protect work areas from excessive dust and airborne contaminants during the coating application and curing process.

The Contractor shall protect surrounding areas and surfaces that are not scheduled to be coated from damage during surface preparation and the application of coatings. The Contractor shall immediately remove coatings that fall on surrounding areas and surfaces that are not scheduled to be coated.

SURFACE PREPARATION

Cleaning - All surfaces to be painted shall be scraped or wire brushed to remove all flaking or loose paint. Wire wheels and/or cup brush grinder attachments may be used. All welds should be inspected and any failed welds should be reported prior to painting. All metal surfaces shall be thoroughly cleaned of oil, grease, soil, rust scale, and all other foreign substances. Oil and grease may be removed with clean rags saturated in mineral spirits. After cleaning metal surfaces and before applying paint, the Contractor shall clean the pole and the paved area surrounding the base of all sand, dust, or other foreign matter in order to prevent such materials from being blown on to the freshly painted surface. All surfaces that are not to be painted (glass/plastic panels, attached signs, light pole inventory number, hand-hole screws, etc.) shall be protected from paint and painting operations.

Rust Treatment - Any areas showing signs of oxidization shall be thoroughly wire brushed and treated with a rust converter that has been approved by the project manager. This process is necessary to arrest oxidization and ensure proper primer adhesion. The rust treatment must be applied in accordance with label instructions.

Primer - All surfaces must be primed prior to painting with an appropriate rust-inhibiting and/or rust-stabilizing lead-free alkyd oil-based red-oxide primer prior to application of finish coats. The primer must be approved in advance by the City’s project manager and must be applied in accordance with label instructions

Color - The finish color shall be Federal Standard color #14036 and a sample must be submitted to and approved in advance by the DCR. Coatings shall be applied in accordance with coating manufacturer's instructions. A minimum of two (2) finish coats of urethane enamel paint shall be applied and shall match the sheen of the powder coat paint on the new poles. All application equipment, tools, pressure settings, and techniques shall be used in accordance with manufacturer’s instructions. Mixing and thinning of coatings, including multi-component materials shall be in accordance with coating manufacturer’s instructions. Containers shall be kept closed when not in use to avoid contamination. The Contractor shall not use mixed coatings beyond pot life limits. After the primer is cured, the Contractor shall brush-apply a stripe coat to critical locations on the steel such as welds, corners, and edges using a specified intermediate coat.

Uniformly apply coatings at spreading rate required to achieve specified dry film thickness (DFT) per the manufacturer’s instructions. The application of all coatings, including exterior coatings shall be free of film characteristics or defects that would adversely affect the performance of the

coating system and affect appearance. All work shall be warranted for material and workmanship (peeling or washing) for a minimum of one (1) year.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Existing light poles repainted and refinished shall be measured and paid for per Each unit. The unit price bid for this Item shall include all labor, tools and equipment necessary to safely prepare, sand, repair, prime and paint the existing light poles designated for repainting. Masking unintended paint areas and containment systems are considered incidental to this item

ITEM 823.101 ORNAMENTAL PENDANT LUMINAIRE EACH

ITEM 823.102 ORNAMENTAL POST-TOP LUMINAIRE EACH

All work performed under these Items shall be in accordance with the relevant provisions of Section 820 of the Standard Specifications for Highways and Bridges and the following:

GENERAL

The work under these Items shall consist of furnishing and the installation of luminaires mounted at the locations as shown on the plans and as required by the Engineer, complete in place.

Submittals for all lighting equipment shall be made in a timely fashion including photometric data, shop drawings, and reports and shall employ the terminology, classifications, and methods prescribed by the IES Lighting Handbook, as applicable, for the lighting systems specified.

Manufacturer's data shall be submitted for the following:
Luminaries, including lamps, drivers.
Photocell Switches
Lamp Sockets and Lampholders
Independent Testing Laboratory Photometric Data

Shop drawings shall be submitted for the following:
Each luminaire, including fabrication and assembly drawings, bill of material.

Luminaire photometric data conforming to IESNA-LM-79-08 and IESNA-LM-80-08, including isolux lines of horizontal footcandles based on required mounting height; average and minimum ratio, computerized candlepower distribution data graphically representing in polar coordinates the average vertical transverse through 75 degree lateral, coefficients of utilization curves (street and house side).

Electronic Photometric files in IES format on a CD

Mounting brackets.

Photoelectric switch (photocell) receptacle.

Samples shall be submitted for the following:

Each type of roadway luminaire

Calculations:
Lighting Calculations shall be submitted indicating computerized horizontal illumination levels in footcandles at ground level, taken every 5 feet (maximum). Average maintained footcandle level, average/minimum ratio, and maximum/minimum ratio shall be included. Distribution data shall be ANSI/IES classification type as defined in IES Lighting Handbook, latest edition.

Calculations shall demonstrate that the luminaire can achieve conformance with all applicable illuminance, uniformity and veiling luminance standards of IESNA/ANSI RP-8-22. For the purposes of the lighting design, the walkway includes cement concrete sidewalk for pedestrians only as well as the hot mix asphalt shared-use path for bicycles and pedestrians.
Lighting calculation areas shall have separate grids to indicate conformance with the following lighting design requirements:

The required maintained average illuminance for roadway is 1.6 footcandles minimum with an average to minimum uniformity ratio of 4.0.

The required maintained average illuminance for all roadway intersections is 2.2 footcandles minimum with an average to minimum uniformity ratio of 4.0.

A maximum light loss factor (LLF) of 0.70 shall be used in the calculations to account for lumen deprecation, dirt accumulation on the lens, non-ideal conditions, etc.

Luminaires and accessories shall be shipped securely packaged and labeled for safe handling in shipment and to avoid damage. Luminaires and accessories shall be stored in a secure and dry facility and in original packaging in a manner to prevent soiling, physical damage, wetting or corrosion prior to installation.

Fixtures shall be grounded in accordance with Massachusetts Electric Code.

MATERIALS

Ornamental Pendant Luminaire

This item includes luminaires mounted on poles specified on the plans. All luminaires specified in this section shall be delivered and clearly marked with the manufacturer's name and catalog number, voltage, light source, maximum wattage and driver Luminaire

Construction – The luminaire shall be a decorative style pendant mounted type as detailed on the contract documents and be designed for secure mounting and wiring to the specified light pole. The highway luminaire shall be King Luminaire K811-P4SH-III-120(SSL)-8084-120:277V-KPL31-PR7-3K with CIMCON iSLC-3100-7P-S or equivalent.

The manufacturer shall have been in the business of manufacturing LED lighting products for a minimum of 5 years.

The luminaire shall be mechanically assembled to the bracket arm with a Plumizer KPL31.

The luminaire shall consist of an aluminum alloy housing that acts as the enclosure for the engine and is of adequate thickness to give structural rigidity. The engine must be affixed to the inside of the housing with stainless steel screws. The bottom decorative portion of the K811 fixture is comprised of a one-piece spun aluminum alloy with a minimum thickness of 0.09". the spinning is permanently affixed to the cast housing with the use of stainless steel hardware
The light source shall be a flat array – shallow lens.

Electrical – Each luminaire to be furnished with (1) internally mounted driver with auto-adjusting universal voltage input for operation at 120 to 277 volt for both line to line and line to neutral applications. Total harmonic distortion shall be 20% maximum. The driver shall be capable of operating from -40°F to 130°F. Driver shall be compatible with 0-10 volt dimming.

LED Engine – The light engine shall include an array of 60 or 84 solid state Cree X-series high power LEDs. The emitters shall be mounted to a metal core circuit board using SMT technology. The LEDs and circuit boards shall then be mounted to a high-performance heat sink which is vented to the outside ambient air to provide dynamic airflow for cooling the system.

The LED Light engine shall produce a color temperature of 3000K.

The distribution of the luminaire shall be Type III per ANSI/IESNA RP-8-22. The photometric results must be performed to LM-79 requirements by a DOE recognized and approved testing facility.

Finish – The housing is Finished with a 13 step KingCoat superDurable polyester TGIC powder coat. Federal Standard color #14036.

Warranty – The manufacturer shall repair or replace at no cost any failed LED light engines, drivers, surge modules or any mechanical component defects for a minimum of five years from date of installation.

Submittals – For any equivalent luminaires, luminaire manufacturer's submittal data shall be submitted for the following:

LEDs (LM-80) and drivers
Certified LM-79-08 Photometric Test Report from a NVLAP certified independent testing laboratory.
Electronic version of certified photometric files in IES format on a CD*
Photometric report shall conform to the requirements of IES-LM-79-08.
Integrating Sphere Test – Color Rendering Index (CRI) shall be 70 (minimum)

Surge Protector: The surge protector shall be tested in accordance with ANSI/IEEE C62.45 per ANSI/IEEE C62.41.2 Scenario I Category C High Exposure 10kV/10kA waveforms for Line Ground, Line Neutral and Neutral Ground, and in accordance with U.S. DOE (Department of Energy) MSSLC (Municipal Solid State Street Lighting Consortium) model specification for LED roadway luminaires electrical immunity requirements for High Test Level 10kV / 10kA.

All materials and construction procedures shall conform to the specifications contained herein, and as shown on the contract drawings or as required by the Engineer.

The complete luminaire shall conform to and meet all the current requirements of the National Electrical Manufacturers Association; American Standards Association; The Illuminating Engineering Society of North America; and the National Electric Code, wherever such standards shall apply, and in addition, the following specification shall apply.

Luminaires shall be of the IESNA distribution type, style, and appearance specified on the contract drawings.

Ornamental Post-Top Luminaire

The luminaire shall be functionally and aesthetically compatible with the ornamental light pole specified under Item 821.103 and shall consist of the following major components described below and as detailed in the contract drawings. The luminaire shall be model K330 Versailles (Post Top) as manufactured by the King Luminaire/StressCrete Group.

LED ENGINE
Light engine shall include an array of 30 solid state Cree XSeries high power LEDs (light emitting diodes). The emitters shall be mounted to a metal core circuit board using SMT technology. The LEDs and circuit boards shall then be mounted to a high performance heat sink which is vented to the outside ambient air to provide dynamic airflow for cooling the system.

OPTICS
External light control shall consist of high precision refractive lenses mounted above the LED emitter arrays in such a way to achieve optimum uplight control. The lenses shall also control horizontal light distribution so that Type II, III, IV or V IESNA distribution patterns are achieved.

LENS
The K330 Versailles is available with an acrylic or polycarbonate lens that shall maintain a minimum thickness of 0.15”. The lens is secured by means of a cast aluminum holding ring that is gasketed to provide an IP66 ingress rating.

LUMINAIRE CONSTRUCTION
The luminaire shall consist of a heavy cast aluminum housing that acts as the enclosure for the engine and is of adequate thickness to give structural rigidity. The engine must be affixed to the inside of the housing with stainless steel screws.

With the K330 Versailles post top fixture, the housing is attached to the cast aluminum capital with two aluminum struts. The capital shall have an opening at the base tenon body to allow the luminaire to be mounted to a tenon of 3” maximum diameter. The luminaire shall be locked in place by means of heavy duty, stainless steel setscrews.

The K330 Versailles pendant has a similar construction to the post top fixture with the exception of a 1-1/4” NPT hole in the lid for the levelling device and a decorative end cap that is welded to the tenon adaptor.

PLUMBIZER
The K330 Versailles comes with multiple mounting options including the KPL10, KPL11, KPL20, KPL21, KPL30, KPL31 and KPL40. Please contact King Luminaire for more details and specifications.

DRIVER
The LED universal dimmable driver will be class 2 and capable of 120 - 277V or 347 - 480V input voltage, greater than 0.9 power factor, less than 20% total harmonic distortion. The case temperature of the driver can range from -40°C up to 70°C. Each LED system comes with a standard surge protection designed to withstand up to 20kV/10kA of transient line surge as per IEEE C62.41.2 C High. An in-line ferrite choke is utilized to provide protection against EFT's. The driver assembly will be mounted on a heavy duty fabricated galvanized steel bracket to allow complete tool-less maintenance. Dimming capable using 1-10vdc (10% to 100%), 10v PWM, or resistance.

PHOTOMETRICS
Fixtures are tested to IESNA LM79 specifications. These reports are available upon request. CHROMATICITY High output LED come standard at 3000K & 4000K (+/- 300K) with a minimum nominal 70 CRI. Additional CCT emitters are available upon request.

LUMEN MAINTENANCE
Reported (TM21) and Calculated (L70) reports are available upon request with a minimum calculated value of 100,000 hrs.

WIRING
All internal wiring and connections shall be completed so that it will be necessary only to attach the incoming supply connectors to Mate-N-Lok connectors or to a terminal block. Mate-N-Lok shall be certified for 600V operation. Internal wire connectors shall be crimp connector only and rated at 1000V and 150°C. All wiring to be CSA certified and/or UL listed, type SFF-2, SEWF-2, or SEW-2 No. 14 gauge, 150°C, 600V, and color coded for the required voltage.

THERMALS
Fixtures tested to DOE sanctioned standards to determine the maximum in-situ solder-point or junction-point temperatures of the LED emitters. This report is available upon request.

FINISH
Housing is finished with a 13 step KingCoat™ SuperDurable polyester TGIC powder coat. Standard colors include strobe white, brown metal, marina blue, gate gray, Chicago bronze, standard gold, standard black, federal green and rain forest. Please see our website for a complete list of colors. RAL and custom color matches are available.

MISCELLANEOUS
All exterior hardware and fasteners, wholly or partly exposed, shall be stainless steel alloy. All internal fasteners are stainless steel or zinc coated steel. All remaining internal hardware is stainless steel, aluminum alloy, or zinc coated steel.

WARRANTY The K330 Versailles LED luminaire comes with a 7 year limited warranty

The light fixture shall mount to a 3.0" OD x 4" tall tenon. The fixture shall be secured to the tenon by means of three (3) 5/16"-18 stainless steel socket head set screws, black passivated for additional corrosion resistance.

All prepared metal surfaces shall be free of visible defects and blemishes prior to finishing. The paint finish shall consist of a two tone TGIC polyester powder coat (black and gold-bronze). Manufacturer shall submit color samples to the owner for approval prior to fabrication.

INSTALLATION

The luminaire shall not be installed until the related control cabinet and underground wiring has been completed and tested.

All wiring shall be complete and shall only require attachment of the power supply leads. All power supply leads shall be clearly identified by means of a permanently attached metal tag. A color lead for bonding the luminaire shall be furnished with each unit in addition to the power supply leads. Any required splicing in the luminaire shall be accomplished with insulated, compression type connectors. Under NO CONDITIONS shall wire nuts or non-compression type connectors be allowed.

Luminaires shall be wired with #10 AWG cable as per specification with a fused streetlight connector, with appropriate fuse in the power lead with ampere rating as per luminaire manufactures recommendation. Luminaire pole installations shall be fused in the pole handhole.

All cables shall be identified with the appropriate colored marking tape. Neutral and Bonding leads shall be connected using insulated pressure connectors. Power leads from the handhole to the luminaire shall be rated for 600-volts only.

Upon completion of the installation, an operating test shall be conducted to demonstrate that the roadway lighting systems and associated equipment operate in accordance with the requirements of this Section.

The Contractor shall measure horizontal foot-candles on roadways and at other locations designated by the Engineer. Sufficient measurements shall be made to assure that distribution characteristics of luminaires conform to accepted luminaire photometric data. The photometer used for measurements shall measure illumination from 0.1 to 20.0 foot-candles. Instrument shall be calibrated by an accepted testing laboratory within 30 days of the test. Roadway illumination tests shall be performed in accordance with IES LM 50.

Prior to acceptance, the Contractor shall conduct a performance test involving operating the roadway lighting system, sunset to sunrise, for ten (10) consecutive days without interruption or failure. If a LEDs or drivers fails, it shall be immediately replaced. This shall not require a restart of the test. The Contractor shall record each fault, the method and date of correction of each, and the beginning and end of the ten (10) day test.
If the performance test is conducted prior to all other tests, the Contractor shall energize and manually operate the entire lighting system, including control equipment for a minimum period of one hour to ensure that all connections were restored after testing.

The Contractor shall arrange to supply the electric power required to conduct the performance test if the permanent power is not available.

The luminaire shall be aimed so that the “street side” is toward the centerline of the adjacent roadway.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Measurement for Item 823.101 Ornamental Pendant Luminaire and Item 823.102 Ornamental Post-Top Luminaire shall be made per EACH respective unit, complete-in-place, tested, and accepted by the Engineer.

Payment for Item 823.101 Ornamental Pendant Luminaire and Item 823.102 Ornamental Post-Top Luminaire shall be at the contract unit bid price for EACH respective unit, complete-in-place, which price shall include all labor, tools, equipment, materials, lamps, drivers, all wiring, connections, testing and all incidental expenses required to complete these items as required.

ITEM 823.60 HIGHWAY LIGHTING LOAD CENTER LUMP SUM

All work performed under this Item shall be in accordance with the relevant provisions of Sections 813 and 820 of the Standard Specifications for Highways and Bridges, and the following:

GENERAL

The work to be done under this Item shall consist of furnishing and installing a Highway Lighting Load Center or electric manhole of the type specified herein, and as detailed on the drawings. Highway Lighting Load Center, inclusive of an electric service connection, shall be provided at the location shown on the plans and as required by the Engineer. The Contractor shall provide the Highway Lighting Load Center enclosure, concrete foundation, all electrical equipment, wiring, conduit, and raceways, within the enclosure as specified herein and shown on the contract drawings. The Contractor shall coordinate the electrical connection with the electrical utility company. The electrical utility company will own the power feed up to the meter control cabinet(s) and will own and maintain the complete lighting system beyond that point.

The Contractor shall coordinate the switchover from the existing system to the new lighting system to ensure uninterrupted operation of a lighting system is maintained throughout the duration of construction.

A warranty for the electric service connection shall be provided to the utility company that all of the materials and workmanship meet the utility company's specifications and shall be free from defects for a period of five (5) years from the date the line is ready to be energized.

MATERIALS

The Highway Lighting Load Center shall be constructed by the manufacture and factory wired to include all the components listed herein. The Highway Lighting Load Center shall be UL 508 listed. The Highway Lighting Load Center shall be Milbank, Myers Power Products (MEUG16), VIT Strong Box, or approved equivalent.

The Highway Lighting Load Center shall be NEMA 3R and shall be constructed of aluminum or stainless steel to the minimum dimensions shown on the contract drawings. All seams shall be welded solid and ground smooth. Door hinges shall be continuous and constructed of stainless steel. The enclosure shall be provided with all required mounting hardware and anchor bolts to be mounted to the specified concrete foundation. Paint finish shall match signal equipment.

The Highway Lighting Load Center shall be provided with a customer compartment and a separate, lockable section for Electric Utility Metering equipment and electric service terminations. The distribution equipment in the customer compartment shall be behind an internal door.

The doors on the enclosure shall be constructed from the same material as the enclosure. The external door for the customer compartment shall be provided with louvers in the lower section and with filter frame and paper filter element on the inside of the enclosure. Additional hardware shall include a brass padlock, directory frame and eight sets of keys. Two sets of keys

shall be sent to the electrical utility company and six sets of keys shall be sent to the Department of Conservation and Recreation.

Anchor bolts shall be provided with the enclosure. The anchor bolts shall be galvanized steel. Galvanized steel nuts, lock washers, and flat washers shall be provided with the anchors bolts.

The Highway Lighting Load Center shall include the meter socket, panelboard, lighting contactor, HOA switch, receptacle, internal light fixture, and photo-electric switch control. All required electrical equipment shall be provided in the Highway Lighting Load Center by the manufacturer. All electrical equipment shall be factory wired. The Highway Lighting Load Center shall be shipped to the site ready for installation by the Contractor.

The Highway Lighting Load Center shall be suitable for use for a 120/240 Volt, one (1) phase, three (3) wire electric service. The service and distribution equipment located within the cabinet shall be rated for 100 Amperes, minimum, with a fault current interrupting capacity of 10,000 Amperes symmetrical.

The Highway Lighting Load Center shall be labeled as follows:

DCR
LIGHTING
CONTROL

The label shall be factory stamped into the door of the Highway Lighting Load Center or aluminum placard. Text height shall be 1-inch tall. Prior to fabrication, the Contractor shall submit the label as part of the shop[drawing process to confirm acceptance by the City.

INSTALLATION

All work shall be constructed as shown on the plans or as required by the utility company and required by the Engineer. The Contractor shall give adequate notice to the utility company for scheduling of work by utility.

Highway Lighting Load Center foundation shall be constructed as detailed on the Contract Drawings and to the relevant provisions of Section 801 of the Standard Specification for Highways and Bridges.

The Highway Lighting Load Center shall be installed atop the foundation as noted in this Specification and the Contract Drawings. The cabinet door shall face away from the roadway, or as required by the Engineer. It shall be determined that no obstruction, including a light pole, will interfere with opening, closing, or access to the controller.

Each location, as shown on the plans, may be diagrammatic only, and the location shall be such as to not interfere with access to private property or to detract from the general appearance of the area. The location shall not also inhibit pedestrian travel of the public way, including minimum obstruction free access of 3 feet. The Contractor shall call to the attention of the Engineer a location that may look objectionable before commencing work at the controller site.

The electrical equipment to be installed in each controller shall be securely fastened to the backboard in a neat and workmanlike manner. Electrical equipment shall be arranged in the controller and wired in accordance to the wiring diagrams on the detail sheets, or as specified herein.

Within the controller, the Contractor shall bind wire groups together with cable ties; and all conductors shall be permanently identified with circuit numbers using vinyl cloth, plasticized card stock tags with pre-printed legends. Tags shall be fastened to cables with cable ties.

The Contractor shall submit for approval a wiring diagram of the controller interior and a scaled diagram of the cabinet and all components.

The photoelectric switch (cell) shall be located to the nearest pole to the load center.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 823.60 Highway Lighting Load Center shall be measured as a complete Lump Sum installation, inclusive of the electric service connection, service conduit, riser, utility ground rod, service conductors, concrete foundation, and two ground rods, fully operational, tested, and approved by the Engineer.

Payment for Item 823.60 Highway Lighting Load Center, inclusive of the electric service connection, complete with conduit and wire, will be paid for at the Contract Unit Price per Lump Sum, complete, operational, tested, and accepted in place, and for all equipment, tools, labor and work incidental thereto, including concrete foundation, two ground rods, photocell on luminaire nearest load center, pole riser and all electric service connection related fees charged by the Electric Utility Company.

ITEM 823.72 HIGHWAY LIGHTING POLE, LUMINAIRE AND BASE REMOVED AND DISCARDED EACH

GENERAL

The work under this Item shall include the removal of the following existing lighting system components as shown on the plans and as required by the Engineer: light poles and standards, luminaires, wiring, lamps, photoelectric switches, ballasts, and any other ancillary components related to the removal of the existing street lights including disconnection from the electric utility. The work under this Item shall also include all coordination with Eversource Utilty, DCR and processing of any disconnect fees.

DESCRIPTION

Existing light poles shall be removed from the site and discarded in accordance with local and state regulations by the Contractor.

The Contractor may encounter luminaires that include ballasts containing Mercury Vapors. All materials which consist of hazardous substances such as Mercury Vapors, etc., shall be disposed of in accordance with state and federal environmental regulations and these Special Provisions.

This item shall include the removal and off-site legal disposal of all materials indicated to be removed and discarded. Concrete encased conduit or direct buried conduit which does not need to be removed as a part of the excavation required to install new work may be abandoned in place.

Existing light pole foundations shall be removed to 3 feet below finished grade.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 823.72 Highway Lighting Pole, Luminaire and Base Removed and Discarded shall be measured per Each unit removed and discarded.

Payment for Item 823.72 Highway Lighting Pole, Luminaire and Base Removed and Discarded shall be paid for per the unit price Each which price shall include all labor, tools and equipment necessary to safely remove, load, transport and discard the existing light poles and foundation materials. Removal of existing wiring and abandoning of existing foundations shall be incidental to this Item. Removal and disposal of existing luminaires shall be indidental to this item.

ITEM 823.73 UTILITY POLE AND LUMINAIRE REMOVED AND DISCARDED — EACH

GENERAL

The work under this Item shall include the removal of the following existing lighting system components: utility poles and standards, luminaires, wiring, lamps, photoelectric switches, ballasts, and any other ancillary components related to the removal of the existing street lights including disconnection from the electric utility. The work under this item shall also include all coordination with Eversource Utilty, DCR and processing of any disconnect fees.

DESCRIPTION

Existing utility poles shall be removed from the site and discarded in accordance with local and state regulations by the Contractor.

The Contractor may encounter luminaires that include ballasts containing Mercury Vapors. All materials which consist of hazardous substances such as Mercury Vapors, etc., shall be disposed of in accordance with state and federal environmental regulations and these Special Provisions.

This item shall include the removal and off-site legal disposal of all materials indicated to be removed and discarded. Concrete encased conduit or direct buried conduit which does not need to be removed as a part of the excavation required to install new work may be abandoned in place.

Existing light pole foundations shall be removed to 3 feet below finished grade.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 823.73 Utility Pole and Luminaire Removed and Discarded shall be measured per Each unit removed and discarded.

The unit price bid for Item 823.73 Utility Pole and Luminaire Removed and Discarded shall include all labor, tools and equipment necessary to safely remove, load, transport and discard the existing utility poles and foundation materials. Removal of existing wiring and abandoning of existing foundations shall be incidental to this Item. Removal and disposal of existing luminaires shall be indidental to this item.

ITEM 829.05 **ROADSIDE GUIDE SIGN (G) - REMOVED AND RESET** **SQUARE FOOT**

DESCRIPTION

The work under this Item shall be in accordance with the relevant provisions of Section 800 of the Standard Specifications and the following:

The work done under this Item includes removing and resetting an existing guide sign panel on Gerrys Landing Road at approximately Station 106+00 RT ("Memorial Drive") on new ground-mounted supports to a new location.

MATERIALS

Materials for guide signs removed and reset shall be the existing signs. If, in the opinion of the Engineer, the existing sign panel is unsuitable for reuse, a new sign panel of a size and composition equal to the existing sign panel shall be furnished as required by the Engineer, under Item 829.2 Roadside Guide Sign (MR) Aluminum Panel – (Type B) – DCR.

The hardware used to attach the sign panel to the new sign supports shall be the existing bolts, brackets or clamps, or new and equal quality equipment furnished by the Contractor, as required by the Engineer.

CONSTRUCTION METHODS

Roadside Guide Sign panels to be removed and reset shall be cleaned before being remounted on new sign supports. The Contractor shall replace, at his own expense, all sign panels or sign supports that are damaged or lost either directly or indirectly as a result of his carelessness.

METHOD OF MEASUREMENT

Roadside Guide Signs (G) Removed and Reset shall be the actual total number of square feet of sign panel for each sign classification.

BASIS OF PAYMENT

The Contract price paid per square foot for Roadside Guide Sign (G) - Removed and Reset shall include full compensation for furnishing all labor, tools, materials, equipment and incidentals, and for doing all work involved in removing and resetting sign panels. It shall also include all necessary mounting fixtures (nuts, bolts and other miscellaneous items) to complete the work.

Supports and foundations for the reset sign panel will be paid for under Item 844.202 Supports for Guide Sign (G2) – Steel – DCR. Removal and disposal of existing supports and foundations will be paid for under Item 829.062 Roadside Guide Sign (G) Support Removed and Discarded. If, in the opinion of the Engineer, the existing sign panel is unsuitable for reuse a new sign panel is to be provided, the new panel shall be paid for under Item 829.2 Roadside Guide Sign (MR) Aluminum Panel – (Type B) – DCR.

ITEM 829.062 ROADSIDE GUIDE SIGN (G) SUPPORT REMOVED AND DISCARDED EACH

DESCRIPTION

The work under this Item shall include the removal and disposal of an existing ground-mounted sign support at approximately Station 106+00, RT. along Gerrys Landing Road including foundation, associated excavation, the supplying and placing of compacted gravel, and the restoration to original condition of any natural features disturbed in any way or manner by the operation.

The existing sign support that is removed shall become the property of the Contractor and shall be properly disposed of off the project site. The existing sign panel is to be removed and reset at the location shown on the plans.

Work shall also include the excavation (including Class "B" Rock) of any existing foundation to be removed to a depth of at least 12 inches below grade.

METHOD OF MEASUREMENT

The quantity of existing Roadside Guide Sign (G) Support Removed and Discarded shall be measured by EACH sign support actually removed and discarded.

BASIS OF PAYMENT

Payment for Item 829.062 Roadside Guide Sign (G) Support Removed and Discarded from the location shown on the plans or as required by the Engineer, will be made at the Contract Unit Price per EACH complete installation removed and discarded. Payment shall include the removal and disposal of all items, including the existing sign panel if deemed unsuitable for reuse by the Engineer.

The Contract Price shall constitute full compensation for furnishing and installing all materials, labor, equipment, tools, appurtenances, and incidentals necessary to satisfactorily complete the work as accepted by the Engineer.

No separate payments will be made for excavation, including Class "B" Rock Excavation, gravel backfill, compaction and restoration work but all costs in connection therewith shall be included in the unit price bid.

ITEM 829.2 **ROADSIDE GUIDE SIGN (MR) – ALUMINUM PANEL(TYPE B) – DCR** **SQUARE FOOT**

The work under this Item shall be in accordance with the relevant provisions of Section 828 of the Standard Specifications, Sections A2-7.3 and A2-15 of the 1986 DCR/MDC Graphic Standards Manual for Directional Signs appended herein, and the following:

Legend, border and background of signs shall be fabricated from Prismatic Enclosed Lens retroreflective sheeting material meeting or exceeding ASTM requirements for Type VII, Type VIII, Type IX, or Type X sheeting.

METHOD OF MEASUREMENT

The quantity of Roadside Guide Sign (MR) – Aluminum Panel (Type B) – DCR shall be the actual total number of square feet of sign panel installed.

BASIS OF PAYMENT

Payment for Roadside Guide Sign (MR) – Aluminum Panel (Type B) – DCR will be made at the contract unit price per square foot which shall be full compensation for fabricating, furnishing, erecting and attaching the completed sign panel, preparing all reflectorized materials. Backgrounds, legends, borders, arrows, shields, paints, hardware and all other materials and labor required for the completion of the signs as specified.

ITEM 844.201 **SUPPORTS FOR GUIDE SIGN (G-1) STEEL – DCR** **LUMP SUM**

ITEM 844.202 **SUPPORTS FOR GUIDE SIGN (G-2) STEEL – DCR** **LUMP SUM**

The work under these Items shall be in accordance with the relevant provisions of Section 840 of the Standard Specifications, Section A2-15 of the 1986 DCR/MDC Graphic Standards Manual for Directional Signs, and the following:

The work done under these Items includes fabricating and installing new ground mounted sign supports for a new guide sign G-1 at approximately Station 100+75 RT Gerrys Landing Road and the relocated "Memorial Drive" sign G-2 at approximately Station 107+20 RT Gerrys Landing Road.

Natural features disturbed in any way or manner by the operation, shall be restored to its original condition.

METHOD OF MEASUREMENT

The foundation, excavation, backfilling and compaction for foundations and the structural supports shall be considered one Lump Sum unit at each respective location.

BASIS OF PAYMENT

Compensation for the work under Items 844.201 and 844.202 shall be by the Lump Sum bid price for each respective item. The Contract price shall be full compensation for designing, furnishing, and erecting the supports, including construction of the concrete bases, steel reinforcement and anchor bolts; and all excavation, including Class B Rock, gravel backfill, the restoration to original condition of any natural features disturbed in any way or manner by the operation and all incidental items necessary to complete the work as specified.

ITEM 847.2 SIGN SUPPORT – ROUND POST - STEEL EACH

DESCRIPTION

Work under this item consists of furnishing and installing round steel posts for use with destination and distance signs as shown on the plans. The work shall conform to the applicable provisions of Section 840 of the standard specifications.

MATERIALS

The post shall be galvanized steel with an outside diameter of 2 3/8 inches. Posts shall be furnished with a galvanized acorn shape cap. All components shall be painted black.

METHOD OF MEASUREMENT

Item 847.2, Sign Support – Round Post - Steel, shall be measured as a complete unit, per EACH post actually installed.

BASIS OF PAYMENT

Payment for this item will be made at the contract unit price EACH and will include all equipment, material, excavation and labor required to complete the work. Sign panels will be paid separately under Item 832.

ITEM 852.11 TEMPORARY PEDESTRIAN BARRICADE FOOT

ITEM 852.12 TEMPORARY PEDESTRIAN CURB RAMP EACH

DESCRIPTION

Work under these items shall consist of furnishing, deploying, maintaining in proper operating conditions, relocating, and removing temporary pedestrian barricades and temporary pedestrian ramps as part of a Temporary Pedestrian Access Route (TPAR) in order to guide pedestrians around fully or partially closed access. These devices are intended to prevent pedestrians from entering the work area and to prevent pedestrians from inadvertently entering the vehicle travel lane by providing visual and physical separation between each space.

MATERIALS

The Temporary Pedestrian Barricade shall have a continuous bottom rail or edge no more than two (2) inches above the ground and eight (8) inches in height (minimum) to accommodate cane users, have a smooth and continuous hand railing along the top edge no less than 32 inches above the ground and not obstruct or project into the pedestrian path of travel. Barricade walls shall be nearly vertical and generally within the same plane.

If exposed to traffic, Temporary Pedestrian Barricades shall be crashworthy.

The Temporary Pedestrian Curb Ramp shall provide a 48-inch minimum width, with a firm, stable, and non-slip surface. Protective edging with a two (2) inch minimum height shall be installed when the curb ramp or landing platform has a vertical drop of six (6) inches or greater.

The Temporary Pedestrian Curb Ramp walkway and landing area surface shall be of a solid, continuous, contrasting color abutting up to the existing sidewalk.

If a Temporary Pedestrian Curb Ramp leads to a crosswalk, a detectable warning pad must be used at the base of the ramp; if it leads to a protected path that does not conflict with vehicular traffic then a detectable pad shall not be used.

CONSTRUCTION METHODS

The Temporary Pedestrian Barricade shall be placed in an area that will provide pedestrians with a TPAR on a smooth, continuous hard surface for its entirety. The geometry and alignment of the facility shall meet the applicable requirements of the "Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities" and the Massachusetts Architectural Access Board.

The recommended width of the TPAR is 60 inches, but if constraints exist a minimum clear width of 48 inches shall be provided along its entirety. If a 60-inch width cannot be accommodated in full, a 60 inch by 60 inch passing space shall be provided every 200 feet or less along the TPAR. Turning areas shall be 60 inches by 60 inches minimum.

Lateral joints between any surfaces shall not exceed 0.5 inches. Lateral edges may be vertical up to 0.25 inches high and shall be beveled at 1V:2H between 0.25 inches and 0.5 inches.

The TPAR shall be kept clear of debris, snow, and ice and the Temporary Pedestrian Barricades and Temporary Pedestrian Curb Ramps shall not obstruct drainage.

Removal and/or relocating/resetting of Temporary Pedestrian Barricades and Temporary Pedestrian Curb Ramps shall be considered incidental.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Measurement and payment for Temporary Pedestrian Barricades will be made at the contract unit price per Foot, installed in place, including all incidental items. This price shall include the cost of furnishing, installing, relocating/resetting, removal, and maintaining the temporary pedestrian barricade in good working condition.

Measurement and payment for Temporary Pedestrian Curb Ramps will be made at the contract price per Each unit installed in place, including all incidental items. This price shall include the cost of furnishing, installing, relocating/resetting, removal, and maintaining the temporary pedestrian curb ramp in good working condition.

ITEM 864.05 PAVEMENT ARROWS AND LEGENDS SQUARE FOOT
REFLECTORIZED BLUE (THERMOPLASTIC)

DESCRIPTION

Work under this Item shall conform to the applicable provisions of Section 860 of the Standard Specifications and the following:

The work consists of painting a square blue background for the accessible parking space markings, in the dimensions and at locations shown on the Drawings.

Materials and Construction methods shall be consistent with Section 860 of the Standard Specifications.

METHOD OF MEASUREMENT

The measurement for Item 864.05 Pavement Arrows and Legends Reflectorized Blue (Thermoplastic) shall be the actual total number of square feet of installed markings.

BASIS OF PAYMENT

Payment for Item 864.05 Pavement Arrows and Legends Reflectorized Blue (Thermoplastic) will be made at the Contract unit price per square foot which shall be full compensation for all material, labor and equipment required or incidental to the satisfactory completion of the work.

ITEM 866.104 **4 INCH REFLECTORIZED WHITE LINE (THERMOPLASTIC)** **FOOT**

ITEM 867.104 **4 INCH REFLECTORIZED YELLOW LINE (THERMOPLASTIC)** **FOOT**

DESCRIPTION

This work under these items shall consist of furnishing all equipment, materials and labor for the satisfactory application of reflectorized thermoplastic pavement markings within the DCR parking lot and on the shared-use path, as applicable, and in accordance with the Contract Drawings, as specified in these Special Provisions, and where required by the Engineer. The materials for, and the application of reflectorized thermoplastic pavement markings, shall be in conformance with the applicable provisions and requirements of Section 860., Reflectorized Pavement Markings of the "MassDOT Standard Specifications", except as amended herein.

CONSTRUCTION METHODS

Pavement markings installed under Item 866.104 shall be 4 inch wide reflectorized white thermoplastic markings.

Pavement markings installed under Item 867.104 shall be 4 inch wide reflectorized yellow thermoplastic markings.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Pavement marking lines are to be measured and paid for by the Contract unit price per FOOT based on the actual length of lines applied in accordance with the Contract Drawings and as specified herein under the various items of the Contract.

ITEM 874.2 TRAFFIC SIGN REMOVED AND RESET EACH
ITEM 874.41 TRAFFIC SIGN REMOVED AND DISCARDED EACH

DESCRIPTION

The work under these Items shall conform to the relevant provisions of Section 840 of the Standard Specifications and the following:

The work to be done consists of removing and resetting existing street name, warning and regulatory signs, to new locations and new supports as shown on the Plans and as required by the Engineer.

The Contractor shall replace, at his own expense, all sign panels and supports that are damaged or lost either directly or indirectly as a result of his actions.

The work shall also consist of removing and discarding existing regulatory, warning, street name, directional signs, and other miscellaneous signs and supports as shown on the Plans and as required by the Engineer.

Signs and attached hardware shall be carefully removed from their supports. The supports and existing foundations shall be removed to a depth of at least 6 inches below grade in proposed loam and seed areas, 12 inches below grade in proposed sidewalk areas and 36 inches below grade in proposed roadway areas. The holes backfilled with gravel and the surface shall be restored with a material to match the existing ground or as required by the Engineer.

The work includes dismantling, loading, transporting and discarding of the signs and supports as designated above, the excavating and disposal of the existing foundation, the supplying and placing of compacted gravel backfill where foundations and posts are removed, and the restoration of the existing surface, including all labor, material and incidentals to complete the work as shown on the Plans and as required by the Engineer. If signs are attached to existing light poles, utility poles or traffic poles, only the sign panel and attached hardware shall be removed and discarded.

MATERIALS

Materials for street signs and traffic signs removed and reset shall be the existing signs. If in the opinion of the Engineer, the existing sign panel is unsuitable for reuse, a new sign panel of a size and composition equal to the existing sign panel, shall be furnished, as required by the Engineer.

CONSTRUCTION METHODS

Traffic signs removed and reset shall be mounted in accordance with the 2009 Manual on Uniform Traffic Control Devices (MUTCD) and the 1990 Standard Drawings for Signs and Supports.

When the visibility of the relocated sign panels is obstructed by trees and other vegetation, the Contractor shall clear the obstruction for proper sight distance. All clearing shall be done within the roadway layout, as approved by the Engineer.

Traffic sign and street name sign panels to be removed and reset shall be cleaned before being reset.

Damage during removal or resetting to any sign panel designated for reuse by the Engineer shall be repaired or replaced by the Contractor at no additional expense.

METHOD OF MEASUREMENT

Item 874.2 Traffic Sign Removed and Reset shall be measured per Each traffic sign removed and reset, complete in place.

Item 874.41 Traffic Sign Removed and Discarded shall be measured per Each traffic sign removed and discarded, as shown on the Plans and as required by the Engineer.

BASIS OF PAYMENT

Item 874.2 Traffic Sign Removed and Reset shall be paid for at the contract unit price per Each and shall include full compensation for furnishing all labor, tools, materials, equipment and incidentals necessary to complete the work, including excavation and backfill, involved in removing and resetting signs. The unit price shall also include all required mounting fixtures (nuts, bolts and other miscellaneous items) to complete the work.

Clearing of vegetation shall be paid for under the contract unit price for Item 101., Clearing and Grubbing.

As indicated on the Plans, or if required by the Engineer, new sign posts for Traffic Signs shall be paid for separately under Item 847.1, Sign Support (Not Guide) and Route Marker with 1 Breakaway Post Assembly – Steel.

If required by the Engineer, new Traffic Sign panels shall be furnished, installed and paid for under Item 832. Warning – Regulatory and Route Marker - Aluminum Panel (Type A).

The contract unit price paid for Item 874.41 Traffic Sign Removed and Discarded shall include full compensation for furnishing all labor, tools, materials, equipment and incidentals required to complete the work as described above. Payment shall include dismantling, loading, transporting, and discarding the signs and supports as designated above, the excavating and disposal of the existing foundation and the supplying and placing of compacted gravel backfill where foundations and posts are removed, and the restoration of the existing surface.

ITEM 945.021	**HELICAL PILE AND BRACKET ASSEMBLY, INSTALLED – TYPE A**	**EACH**
ITEM 945.022	**HELICAL PILE AND BRACKET ASSEMBLY, INSTALLED – TYPE B**	**EACH**
ITEM 945.03	**STATIC LOAD TEST**	**EACH**

GENERAL

1.1 GENERAL PROVISIONS

A. General Provisions of the Contract, including GENERAL and SUPPLEMENTARY CONDITIONS AND GENERAL REQUIREMENTS (if any), apply to the work specified in this Section.

B. Examine all other Sections of the Specifications for requirements which affect work of this Section, whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all other trades or contracts affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 DESCRIPTION OF WORK

A. The Contractor shall be responsible for designing and furnishing all work and materials for installation of helical anchors (helical piles) to support the deck structure for two Viewing Platforms. Helical anchor work includes but is not limited to the following:

1. Furnish all labor, equipment, tools, materials and incidentals required to design, deliver to the site, and install helical anchors as shown on the Drawings and as specified herein. The helical anchors shall be designed to provide the allowable capacities specified herein.

2. Provide all equipment necessary for the installation of the helical anchors at the locations indicated on the Drawings. Each helical anchor shall be installed to the minimum length determined by the Contractor, subject to verification by static load testing, and using installation torque indicative of the design allowable capacities.

3. Provide equipment and materials for the protection of existing utilities, vehicles, pedestrians, and other facilities located within the work area.

4. Install helical anchors through whatever material is encountered to the required depth to achieve design capacity. Predrilling may be required to install helical anchors through cobbles and boulders in the fill.

5. Helical anchors shall be cut-off, as needed, at the elevations required to enable connection of bracket assemblies to the timber pier cap and concrete pile cap that is supporting the viewing platforms as shown on the Drawings.

6. Provide qualified personnel for design and onsite installation, inspection and record keeping as specified herein.

7. Perform one (1) compression and one (1) tension static load test (i.e., pile load tests) at each viewing platform on pre-production helical anchors as specified herein.

B. Related Work Specified Elsewhere

140.	BRIDGE EXCAVATION
151.2	GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES
995.1	VIEWING PLATFORM STRUCTURE NO. 1
995.2	VIEWING PLATFORM STRUCTURE NO. 2

C. Reference Documents

1. Standards listed by reference, including revisions by issuing authority, form a part of this specification section to the extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title, or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation. In case of conflict, the particular requirements of this specification shall prevail. The latest publication as of the issue of this specification shall govern, unless indicated otherwise.

2. American Society for Testing and Materials (ASTM):

   a. ASTM A29/A29M - Steel Bars, Carbon and Alloy, Hot-Wrought and Cold Finished

   b. ASTM A36/A36M - Structural Steel

   c. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

   d. ASTM A123/A153 - Zinc Coating (Hot Dip) on Iron and Steel Hardware.

   e. ASTM A252 - Welded and Seamless Steel Pipe Piles.

   f. ASTM A320/A320M - Alloy-Steel Bolting Materials for Low Temperature Service

   g. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

   h. ASTM A500 – Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds, and Shapes

   i. ASTM A536 Standard Specifications for Ductile Iron Castings

j. ASTM A572 HSLA Columbium-Vanadium Steels of Structural Quality

k. ASTM A618 Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing.

l. ASTM A656 Hot-Rolled Structural Steel, High-Strength Low-Alloy Plate with Improved Formability

m. ASTM A958 Standard Specification for Steel Castings, Carbon, and Alloy, with Tensile Requirements, Chemical Requirements Similar to Wrought Grades

n. ASTM A1018 Steel, Sheet and Strip, Heavy Thickness Coils, Hot Rolled, Carbon, Structural, High-Strength Low-Alloy, Columbium or Vanadium, and High-Strength Low-Alloy with Improved Formability

o. ASTM D1143 Method of Testing Piles Under Static Axial Compressive Load.

p. ASTM D3689 Method of Testing Individual Piles Under Static Axial Tensile Load.

3. American Welding Society (AWS):

   a. AWS D1.1 Structural Welding Code – Steel

   b. AWS D1.2 Structural Welding Code – Reinforcing Steel

4. ASCE 20-96 Standard Guidelines for the Design and Installation of Pile Foundations

5. Society of Automotive Engineers (SAE) J429 Mechanical and Material Requirements for Externally Threaded Fasteners

6. Geotechnical Engineering Report entitled "Geotechnical Engineering Report, Memorial Drive – Phase III," prepared by Stantec, Inc., dated August XX, 2023".

1.3 DEFINITIONS

A. Contractor: The firm responsible for designing, furnishing, load testing, and installing the helical anchors specified on the Contract Drawings.

B. Coupling: Central steel shaft connection means formed as integral part of the plain extension shaft material. For SS helical anchors, couplings are internal or external sleeves, or hot upset forged sockets.

C. Coupling Bolts: High-strength, structural steel fasteners used to connect helical anchor segments together. Coupling bolts shall be capable of transferring axial load.

D. Helical Extension: Helical anchor component installed immediately following the lead section. This component consists of one or more helical plates welded to a central steel shaft.

E. Helix Plate: Round steel plate formed into a ramped spiral. The helical shape provides the means to install the helical anchor, plus the plate transfers load to soil in end bearing.

F. Installation Torque: The resistance generated by a helical anchor when installed in soil. The installation resistance is a function of the soil type, and the size and shape of the various components of the helical anchor.

G. Lead Section: The first helical anchor foundation component installed into the ground, consisting of single or multiple helix plates welded to a central steel shaft, also referred to as starter section.

H. Plain Extension (Riser): Central steel shaft segment without helix plates. It is installed following the installation of the lead section and helical extension (if used). The segments are connected with integral couplings and bolts. Plain extensions are used to extend the helix plates beyond the specified minimum depth and into competent load bearing soils.

1.4 QUALITY ASSURANCE

A. Due to the special requirements for installation of helical anchors and the requirements for proper performance of the structural system, as a whole, helical anchors and bracket assemblies shall be installed by a specialized helical anchor contractor. The Helical Anchor Contractor shall have a minimum of 7 years of experience in designing and installing helical anchors of the type specified herein, including experience with similar subsurface materials, groundwater conditions, helical anchor sizes and techniques required.

B. The Helical Anchor Contractor shall be trained and certified by the helical anchor manufacturer in the proper methods of design and installation of helical anchors. The Contractor shall provide names of on-site personnel materially involved with the work, including those who carry documented certification from the manufacturer. At a minimum, these personnel shall include foreman, machine operator, and project engineer/manager.

C. The Helical Anchor Contractor shall employ a Registered Professional Engineer in the Commonwealth of Massachusetts to design the helical anchors; load test set-up and instrumentation for the pile load tests; monitor record, and evaluate the test results; and prepare the report of the pile load tests. The Engineer shall have at least five (5) years experience in helical anchor design, installation and pile load test setup, monitoring, and analysis.

D. All helical anchors shall be installed in the presence of a designated representative of the Resident Engineer. The designated representative shall have the right of access to any and all field installation records and test reports.

E. Helical anchor components as specified herein and, on the drawings, shall be manufactured by a facility whose quality systems comply with ISO (International Organization of Standards) 9001 requirements. Certificates of Registration denoting ISO Standards Number shall be submitted to the Resident Engineer for review and acceptance. Acceptance will be at the sole discretion of the Resident Engineer and Owner.

1.5 SUBMITTALS

A. Required submittals include Pre-construction Submittals, Post-construction Submittals, and Close-out Submittals.

1. Pre-Construction Submittals

The Contractor shall prepare and submit to the Resident Engineer, for review and acceptance, working drawings and design calculations for the helical anchors intended for use at least 14 calendar days prior to planned start of construction. All submittals shall be signed and sealed by a Registered Professional Engineer currently licensed in the Commonwealth of Massachusetts.

Pre-construction Submittals shall include:

a. A detailed description of the construction procedures and equipment proposed for installation of the helical anchors. Include description of methods to maintain alignment of the anchors during installation and the required angle for inclined anchors. Procedures shall include a description of mitigating measures to be taken if the torsional strength rating of the central steel shaft and/or installation equipment has been reached prior to achieving the minimum overall length required and if the helical anchor is refused or deflected by a subsurface obstruction. Submittal shall include a description of proposed equipment, methods, and sequence of operations to remove and dispose of, or advance through cobbles and boulders prior to or during installation of helical anchors.

b. Working drawings indicating:

- Helical anchor number, location and pattern by assigned identification number
- Helical anchor design load
- Type and size of central steel shaft for helix segments and riser segments, including transition bars
- Helix configuration (number and diameter of helix plates) on lead segment and extension segment(s), if required
- Minimum effective installation torque
- Minimum overall length
- Inclination of helical anchor
- Cut-off elevation
- Helical anchor bracket assembly to timber pile caps or abutments, including thread bars (if used)

c. Working drawings for all helical anchor components shall include identification of manufacturer’s catalog numbers.

d. Example field log to be used for recording installation details for each helical anchor installation.

e. Mill test reports for the central steel shaft for the materials delivered to the site for record purposes. The ultimate strength, yield strength, % elongation, and chemistry composition shall be provided.

f. Procedures, equipment, locations and set up for pre-production static load testing for the helical anchors. Locations of the load tests shall be selected by the Contractor as accepted by the Resident Engineer. Two load tests will be performed at each viewing platform. The purpose of the tests is to determine the load versus displacement response of the helical anchor and provide an estimation/confirmation of ultimate capacity. Both a tension and a compression load test will be performed on each of the helical anchors to be load tested. The load test proposal shall be in general conformance with ASTM D1143 for compression testing and ASTM D3689 for tension testing. The following minimum information shall be provided for review:

- Type and accuracy of load equipment
- Type and accuracy of load measuring equipment
- Type and accuracy of helical anchor head deflection equipment
- Description of load reaction system, including description of reaction anchors
- Calibration report for complete load test equipment, including hydraulic jack, pump, pressure gage, hoses, and fittings

g. Copies of calibration reports for each torque indicator or torque motor, and all load test equipment to be used on the project. The calibration tests shall have been performed within forty-five (45) working days of the date submitted. Helical anchor installation and testing shall not proceed until the Resident Engineer has received the calibration reports. These calibration reports shall include, but are not limited to, the following information:

- Name of project and Contractor
- Name of testing agency
- Identification (serial number) of device calibrated
- Description of calibrated testing equipment
- Date of calibration
- Calibration data

h. Qualifications of the helical anchor contractor and qualifications of the Contractor's Engineer who will design the helical anchors and design, monitor, evaluate and prepare report for pile load tests. Qualifications shall satisfy the requirements of Section 1.4 of these specifications.

i. ISO9001 certificate or helical anchor manufacturer or complete description of product testing and manufacturing quality assurance programs used to assess and maintain product quality.

j. Work shall not begin until all the submittals have been received and accepted by the Resident Engineer. The Contractor shall allow the Resident Engineer a reasonable time to review, comment, and return the submittal package after a complete set has been received. All costs associated with incomplete or unacceptable submittals shall be the responsibility of the Contractor.

2. Post-Installation Submittals

   a. The Contractor shall provide the Resident Engineer copies of helical anchor installation records within 24 hours after each installation is completed. Formal copies shall be submitted on a weekly basis. As a minimum, data shall include:

      - Name of project and Contractor
      - Name of Contractor's supervisor during installation
      - Date and time of installation
      - Name and model of installation equipment
      - Type of torque indicator used
      - Location of helical anchor by assigned identification number
      - Actual helical anchor type and configuration – including manufacturer's catalogue numbers for lead section (number and size of helix plates), number and type of extension sections, and associated hardware used to make shaft connections and bracket connections to deck
      - Helical anchor installation duration and observations
      - Total length of installed helical anchor
      - Cut-off elevation
      - Inclination of helical anchor
      - Installation torque at one-foot intervals for the final 10 feet
      - Comments pertaining to interruptions, obstructions, or other relevant information
      - Rated load capacities

   b. Submit load test report to the Resident Engineer for review within 2 days following completion of each test. Installation of production helical anchors shall not begin until load test report has been reviewed and accepted by the Resident Engineer. Allow at least three working days for review. Load test reports shall include the following:

      - All relevant test helical pile information specified for production helical anchors specified above, including a scale drawing of test helical anchors showing all relevant construction details and subsurface conditions encountered during installation of the test helical and reaction helical anchors.
      - Steps and duration of load increments

- Description of calibrated testing equipment
- Tabular and graphical summary of load-deformation data including cumulative pile-head movement at each load step.
- Brief memorandum summarizing: type of test (i.e. tension or compression); testing procedures; equipment adjustments required during testing; test results; and recommended allowable design load. Memorandum shall be signed and stamped by the Contractor's engineer.

3. Closeout Submittals

   a. Submit Warranty documents as specified herein

   b. Submit, for Engineer's Acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights the Engineer may have under Contract Document.

1.6 DESIGN REQUIREMENTS

A. Design of the helical anchors shall be based on Allowable Stress Design (ASD) and conform to the following minimum design criteria:

1. Helical anchor manufacturer shall furnish a guarantee for a period of ten (10) years from date of delivery against defects due to manufacturing of helical anchors and bracket assemblies. Helical anchor manufacturer must carry product liability insurance.
2. Helical anchors shall be designed to provide the following minimum allowable design loads:

Load Type	**Load (kips)**
Compression	17
Tension	17

3. Vertical and inclined helical anchors are specified on the Contract Drawings.
4. Anchors shall be designed so that the helices derive support entirely in the natural sand and gravel or glacial till soils underlying fill and organics/buried topsoil (if present). As a minimum, the top helix for all anchors shall extend at least 4 feet below final proposed grade to satisfy frost depth requirements plus an additional length extending into the natural soils to satisfy the requirements of Articles 3.4 and 3.5.
5. Minimum factor of safety shall be 2.0. The design loads shall be confirmed with pile load tests as specified herein.

6. Design and installation of helical anchors shall conform to the manufacturer's recommendations. In the event of a conflict between these specifications and manufacturer's recommendations, the more stringent shall govern.

1.7 PROJECT CONDITIONS

A. The Contractor shall visit the site to review all details of the work and working conditions, to verify dimensions in the field and to advise the Resident Engineer of any discrepancy before performing any work.

B. The Contractor shall verify that all helical anchors may be installed in accordance with all pertinent codes and regulations regarding such items as underground obstructions, right-of-way limitations, utilities, etc. The Contractor shall consult the Contract Drawings and official records of existing utilities, both surface and subsurface, and their connections to be fully informed on all existing conditions and limitations as they apply to this work. The Contractor shall repair or replace any construction induced damage to existing active utilities to the satisfaction of the Resident Engineer and the utility owner at the Contractor's expense.

1.8 ALLOWABLE TOLERANCES

A. Helical anchors and bracket assemblies shall be installed at the locations shown on the Drawings.

1. Centerline of helical anchors shall not be more than 3 inches from indicated plan location.
2. Axial alignment tolerance for inclined piles shall be within -1 to +5° of design alignment, unless otherwise specified on the Drawings.
3. The top elevations of helical anchors shall be within +1/2 inch to –1/2 inches of the design vertical elevation.
4. Bracket assembly placement shall be within 1" in both directions perpendicular to the anchor shaft and ¼" in a direction parallel with the anchor shaft unless otherwise specified.

MATERIALS

2.1 PRODUCTS

A. It is the helical anchor installation Contractor's responsibility to select the appropriate size and type of helical anchors and bracket assemblies to support the loads stated in these specifications. These specifications provide minimum requirements to aid the Contractor in making appropriate materials selections. The size and number of helical blades must be such that the helical anchors achieve the appropriate torque and capacity in the soils at this site. Failure to achieve proper torque and capacity shall result in Contractor replacing helical anchors as appropriate to support the required loads at the Contractor's expense. All installation procedures, materials, and replacements shall be acceptable to the Resident Engineer.

2.2 HELICAL ANCHORS

A. Contractor's design of the helical anchors shall conform to the minimum material requirements stated below:

1. Central steel shaft consisting of lead helical segments, helical extensions, and plain extensions (riser): use hot rolled solid steel bars meeting dimensional and workmanship requirements of ASTM A29. The bar shall be medium carbon steel grade with improved strength due to fine grain size and shall be at least 1.75 inches square and have a minimum yield strength of 50 ksi and a minimum torque strength rating of at least 10,500 ft-lb.
2. Structural steel pipe shall be seamless or straight-seam welded, per ASTM A500 or A513, 3.5 inch O.D. minimum. Wall thickness shall be 0.300 inch (Schedule 80) minimum.
3. Helix bearing plate shall be hot rolled carbon steel sheet, strip or plate formed on matching metal dies to true helical shape and uniform pitch. Bearing plate material shall conform to ASTM A572, ASTM A1019, or ASTM A656 with minimum yield strength of 50 ksi. Plate thickness shall be minimum 3/8 inch.
4. Bolts used to connect the central steel shaft sections together shall be minimum 7/8-inch diameter and shall conform to ASTM A325, ASTM A193 Grade B7, ASTM A320 Grade L7, or SAE J429 Grade 5 or 8.
5. Coupling shall be formed as an integral part of the helical extension segment and riser segment as hot upset forged sockets.
6. Platform vertical and angled bracket assembly plates shall be rated for the design loads specified herein and the strength of the structure they support. The bracket assembly for vertical helical anchors shall be bolted to the riser section to resist tension loading. Thread bars shall be used to form the connection between the riser section and angled brackets for inclined helical anchors. Bolts for the bracket assembly are specified on the Contract Drawings.

2.3 GENERAL

A. Helical anchor shaft connections shall be in-line, straight and rigid and shall have a maximum tolerable slack of 1/16 inch or as otherwise accepted by the Resident Engineer. All helical anchor bolts shall be securely snug tightened.

B. All components of helical anchors shall be hot-dipped galvanized in accordance with ASTM A123 and/or A153, as applicable, after fabrication.

C. The Contractor may be allowed to use materials that are structurally greater than or equal to those specified, based solely on the opinion of the Resident Engineer.

D. Helical anchors shall be designed for a Service Life of 75 years.

E. Any cutting of extension section of central shaft to allow connection to concrete pile cap or wood pier cap shall be painted using galvanized paint prior to making connections to reduce exposure to rust and corrosion to the helical anchor.

2.4 HELICAL ANCHOR LOAD TEST

A. Conform to ASTM D1143 and ASTM D3689 for equipment type, reaction system, load instrumentation, and deflection monitoring.

B. Provide reaction frame capable of safely supporting 125 percent of the maximum test load.

CONSTRUCTION METHODS

3.1 REQUIREMENTS

A. Contractor shall be responsible for selecting installation equipment, tooling, and procedures for installing helical anchors. These specifications provide minimum requirements to aid the contractor in making appropriate selections.

3.2 INSTALLATION EQUIPMENT

A. Contractor shall verify that site conditions will allow for access of proposed equipment and will support equipment for helical anchor installation.

B. Each helical anchor shall be advanced into the ground by application of rotational force using a hydraulic torque converter. Installation equipment shall include a direct means of determining the installation torque being applied to the helical anchor. Percussion drilling methods shall not be permitted.

C. Torque indicator shall be capable of providing continuous measurement of applied torque throughout the installation and shall be capable of providing measurements in increments of at least 500 ft-lbs.

D. Where load capacity testing is required, installation equipment also shall include a means for applying and measuring loads and deflections of helical anchors. Acceptable methods of load testing include a calibrated hydraulic jack or other means acceptable to the Resident Engineer. Current evidence of calibration of Contractor's load testing and torque monitoring equipment shall be provided upon request of the Resident Engineer.

E. Equipment shall be re-calibrated during helical anchor installation, if in the opinion of the Resident Engineer and/or Contractor, reasonable doubt exists as to the accuracy of the torque measurements. Re-calibrations shall be at the cost of the Contractor.

3.3 INSTALLATION EQUIPMENT AND MATERIAL ACCEPTANCE

A. All drive tools and equipment shall be in accordance with the manufacturer's written installation instructions.

B. All helical anchor installation equipment and materials shall be acceptable to the Resident Engineer prior to delivery to the site. Acceptance will be based upon submission of records and data, as discussed in this specification. Once accepted, changes in installation

equipment and materials will not be permitted without additional acceptance and will be considered only after Contractor has submitted any and all information requested by Resident Engineer.

3.4 INSTALLING HELICAL ANCHORS

A. Loads shown in Article 1.6 are allowable design loads. A minimum factor of safety of 2.0 shall be used to determine the required ultimate tensile and compressive capacity of the helical anchors with regard to their interaction with soil. Helical anchor capacity in soil depends on the geometric configuration of the helical blades about the lead section and the subsurface conditions. The torque applied during installation provides an indirect verification of axial capacity. Manufacturer's recommendations should be followed regarding the torque and the tensile/bearing capacity relationship for the particular helical anchor selected. The number and size of blades shall be determined by the Contractor so as to achieve the required torque and tensile/bearing capacity for the soil conditions at the site. However, the ratio of design allowable capacity to the total area of the helical blades shall not exceed the allowable subsurface material bearing capacity.

B. Helical anchors shall be advanced into the ground until the required torque is achieved to accommodate the ultimate tensile and bearing capacity plus an additional distance to ensure proper embedment. For the helical anchors, the embedment length shall be achieved by continuing advancement while maintaining or exceeding the required torque for the last three (3) feet of penetration.

C. Constant normal pressure shall be applied while screwing helical anchors into the ground. The pressure applied shall be sufficient to ensure that, during each revolution, the helical anchor progresses into the ground a distance equal to at least 80% of the blade pitch. Rate of helical anchor rotation shall not exceed 20 revolutions per minute.

D. If the Helical Anchor is refused or deflected by a subsurface obstruction, the installation shall be terminated, and the Helical Anchor removed. The obstruction shall be removed, if feasible, and the Helical Anchor re-installed. If re-installing an anchor in the same location, the top-most helix of the new helical anchor shall be terminated at least three (3) feet beyond the terminating depth of the original helical anchor. If the obstruction cannot be removed, the Helical Anchor shall be installed at an adjacent location(s), subject to review and acceptance of the Resident Engineer.

E. Helical anchors removed due to obstructions that have been permanently twisted during previous attempts to install the anchor shall not be reused without the acceptance of the Resident Engineer. Shaft sections with visibly elongated coupling bolt holes caused by previous installation shall not be reused.

F. Pre-drilling will be necessary at locations where helical anchors are not able to be penetrated through the existing fill and/or into the natural granular strata without difficulty. Helical anchor tip elevations should be at least 3 feet below the pre-drilling bottom elevation.

G. Inclined helical anchors can be positioned perpendicular to the ground to assist in the initial advancement into the soil before the required batter angle is established.

H. All helical anchor components including the shaft and bracket assembly shall be isolated from making a direct electrical contact with any concrete reinforcing bars or other non-galvanized metal objects since these contacts may alter corrosion rates.

3.5 NON-CONFORMING HELICAL ANCHORS

A. Non-conforming helical anchors include anchors that are not installed within tolerances as specified in these specifications, are damaged, are not installed to the required torque, or the helical anchor is not installed in the specified bearing stratum. To mitigate and/or remedy non-conforming helical anchors, the Contractor may be required to provide additional helical anchors or supplement helical anchors to meet specified requirements at no additional cost to the Owner. Mitigating measures shall be submitted for review and acceptance by the Resident Engineer. Re-use of components of helical anchors that had been previously installed and removed shall be at the acceptance by the Resident Engineer.

3.6 FIELD MODIFICATIONS

A. Field welding, if required, shall be in accordance with the "Code for Welding in Building Construction" of the American Welding Society. Welding of galvanized steel can produce toxic gases and should be done in adequate ventilation and with appropriate gas detection, breathing gear, and other safety equipment per OSHA regulations. Modification of manufactured helical anchor shaft, helical blades, bracket assemblies, and shaft connections is prohibited and shall not be performed without approval of product manufacturing company and acceptance by the Resident Engineer.

3.7 QUALITY ASSURANCE OBSERVATION

A. Installation of helical anchors shall be observed by Resident Engineer to verify the length, final installation torque, and load capacity tests. Contractor shall notify Resident Engineer at least 24 hours prior to installation work.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Measurement and payment shall be made based on the bid item number and unit of measurement specified at the beginning of these specifications. Payment will only be made for anchors that are installed in accordance with the requirements of these specifications, the accepted Contractor's design submittal, and accepted as installed anchors by the Engineer. No payment will be made for non-conforming helical anchors.

Helical Piles Type A and Type B Helical Piles will be measured and payment made on a per unit basis of Each pile installed, and shall include all materials, equipment and labor as required for the installation of helical anchors and the mobilization/demobilization of said equipment required to complete the work. The cost of the Contractor's design professional to design the helical anchors and prepare the necessary submittals and respond to comments by the Engineer and the cost of the helical anchor manufacturer's representative is incidental to the items listed in this Section.

Static Load Test: Static load compression and tension testing will be measured on a per unit basis of Each with one unit equal to the equipment, materials, including the sacrificial test anchor, reaction piles and load frame, and labor required for obtaining a successful static load test. No payment shall be made for helical anchors that do not satisfy the specified load test criteria.

ITEM 995.1 VIEWING PLATFORM STRUCTURE NO. 1 LUMP SUM

ITEM 995.2 VIEWING PLATFORM STRUCTURE NO. 2 LUMP SUM

1.1 GENERAL

A. Furnish all labor, materials, tools, equipment and services for the installations of two viewing platforms, as indicated on the plans, and in accordance with provisions of the Contract Documents, including but not limited to the following:

Structural Lumber – For Two Viewing Platforms

The work of this section also includes:

1. Framing with dimension lumber.
2. Wood blocking, and nailers.
3. IPE decking, IPE horizontal railings and top cap, and IPE posts.
4. Cast-in-place reinforced concrete pile caps.
5. Vinyl coated welded wire mesh panels.

1.2 REFERENCES:

A. American Society of Mechanical Engineers (ASME):

1. B18.2.1: Square and Hex Bolts and Screws (Inch Series).
2. B18.6.1: Wood Screws (Inch Series).

B. American Society for Testing and Mater.ials (ASTM):

1. A153: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
2. A307: Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
3. A563: Specification for Carbon and Alloy Steel Nuts.
4. A666: Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
5. B633: Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
6. E488: Standard Test Methods for Strength of Anchors in Concrete Elements.

7. F593: Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

8. F594: Specification for Stainless Steel Nuts.

9. F1667: Specification for Driven Fasteners: Nails, Spikes, and Staples.

C. American Wood Preserver's Association Standard (AWPA):

1. M4: Standard for the Care of Preservative-Treated Wood Products

2. U1: User Specification for Treated Wood

3. T1: Processing and Treatment Standard

1.3 RELATED WORK SPECIFIED ELSEWHERE

945.021	HELICAL PILE AND BRACKET ASSEMBLY, INSTALLED – TYPE A
945.022	HELICAL PILE AND BRACKET ASSEMBLY, INSTALLED – TYPE B
945.03	STATIC LOAD TEST

1.4 DEFINITIONS:

A. Exposed Framing: Framing not concealed by other construction.

B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

C. TIMBER: LUMBER OF 5 INCHES NOMINAL OR GREATER IN LEAST DIMENSION.

D. LUMBER GRADING AGENCIES, AND THE ABBREVIATIONS USED TO REFERENCE THEM, INCLUDE THE FOLLOWING:

1. NeLMA: Northeastern Lumber Manufacturers' Association.

2. NLGA: National Lumber Grades Authority.

3. RIS: Redwood Inspection Service.

4. SPIB: The Southern Pine Inspection Bureau.

5. WCLIB: West Coast Lumber Inspection Bureau.

6. WWPA: Western Wood Products Association.

1.5 SUBMITTALS:

Submit the following shop drawings in accordance with contract requirements. Shop drawings shall include, but are not limited to, the following:

- Structural lumber
- Reinforcing steel specifications
- Concrete mix designs
- Concrete bonding agent – manufacturer's literature
- Grout manufacturer/design mix
- Concrete test results
-

Reinforcing steel shop drawings shall be such detail and completeness that all fabrication and placement at the site can be accomplished without the use of contract drawings for reference. Reinforcing steel shop drawings shall include number of pieces, sizes, and grade of reinforcing steel, accessories, and any other information required for fabrication and placement.

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.

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

    1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.

    2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

    3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

C. Evaluation Reports: For the following, from ICC-ES:

    1. Wood-preservative-treated wood.

    2. Engineered wood products.

    3. Power-driven fasteners.

4. Expansion anchors.

5. Metal framing anchors.

1.6 QUALITY ASSURANCE:

A. Comply with all applicable contract requirements.

B. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

C. Testing of Concrete: All inspection and testing shall be performed by the DCR.

Test Specimens: The Contractor will be required to provide concrete 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. Two cylinders shall be broken after seven days and two cylinders after twenty-eight days.

Slump: Contractor shall allow a slump test 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.

Air Content: The DCR shall make an air content test from each day's pour of concrete and for each fifty cubic yards 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.

In the event the compressive strength of the cylinders, when tested, is below the specified minimum, the Resident Engineer 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 Resident Engineer 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 Resident Engineer at no additional cost to the Owner.

The Contractor shall coordinate the date and location of tests with the Resident Engineer before any concrete work is started.

The following table of minimum cement contents for various minimum 28 days compressive strengths (6” x 12” cylinder) is based on air entrained and water reduced mixtures. The use of an

approved additive other than air entraining and water reducing additives shall not affect the minimum cement content.

The Contractor shall submit to the Engineer, for approval, his proposed concrete supplier, source and type of materials, with current ASTM C-33 aggregate data, and concrete mix designs by an approved laboratory complete with trial mix data. Trial mixtures will be designed and tested at the maximum allowable slump and air content for each designated class of concrete.

Minimum 28 day Compressive Strength	Minimum Cement Pounds/Cu. Yd. Max. Size C.A. Inches			In Place Slump Inches
Lbs./Sq. In.	1 1/2	3/4	3/8	
2000	376	423	470	3-5
2500	423	470	517	3-5
3000	470	517	564	3-5
3500	517	564	611	3-5
4000	564	610	658	3-5
4500	611	658	705	3-5
5000	658	705	752	3-5
Air Content				
% ± 1 ½	5.0	6.0	7.5	

1.7 DELIVERY STORAGE AND HANDLING:

A. Comply with all applicable contract requirements.

B. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

C. 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. 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.

MATERIALS

WOOD PRODUCTS, GENERAL:

Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

Factory mark each piece of lumber with grade stamp of grading agency.

For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.

Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.

Provide dressed lumber, S4S, unless otherwise indicated.

Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

WOOD-PRESERVATIVE-TREATED LUMBER:

Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

Application: Treat all structural lumber unless otherwise indicated.

Wood stringers and pile caps.

Wood nailers, equipment support bases, blocking, stripping, and similar members.

Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.

Pressure Treatment: Shall be a waterborne preservative, alkaline copper quat (ACQ), and shall conform to the requirements of AWPA Standard P5 for ACQ-Type D treatment. Minimum retention of preservatives shall be accordance with AWPA Standard U1 to the

requirements of use category UC4B. The Contractor shall furnish a certificate of compliance prepared by the preservative treating plant, which shall be a certified AWPA facility, warranting the grade of lumber, the quality of preservative used and the net retention of preservative in pounds per cubic foot.

Application: Treat all structural lumber unless otherwise indicated

TIMBER MATERIALS:

General: All timber pier caps, wood sill in contact with concrete, and, stringers shall be Southern Yellow Pine No. 1 and be free from all detrimental defects and dressed four sides.

All southern yellow pine shall be treated with ACQ (Alkaline Copper Quaternary) preservatives and conform to AWPA Standards. Joist Hangers and shall be stainless steel type 316.

Beam Saddles (post base) shall be hot dipped galvanized according to the manufacturer's recommendations.

Beam Saddles shall be stainless steel according to the manufacturer's recommendations.

LUMBER FOR DECKING AND RAILINGS

Lumber for decking, handrails, rail caps, nailers, fascia boards and rail posts shall be IPE ironwood, Tabebuia spp. IPE lumber shall have a typical density of 69 to 75 pounds per cubic foot. Lumber dimensions shown on the plans are nominal. Lumber decking shall be dressed (S4S-E4E) with the edges eased to a radius of 1/8.

The mechanical properties of the IPE lumber shall be verified using US Forest Product Laboratories testing method (2" standard) and shall exceed the values listed below:

Modulus of Elasticity:	2,500,000 pounds per square inch
Modulus of rupture:	22,500 pounds per square inch
Crush Strength:	10,000 pounds per square inch

The lumber for decking shall be air dried to a moisture of no more than 12%. Dimensions shall have a tolerance of plus/minus 0.08" at 12% moisture.

The IPE lumber supplier shall provide proof of membership in the Certified Forest Products Council.

All cutting shall be made with a premium carbide tipped saw blades. High quality drill bits shall be used for predrilling holes for fasteners.

Ends of the lumber shall be sealed within 24 hours after cutting using a clear aqueous wax end sealer appropriate for use with IPE ironwood to reduce end checking.

Lumber for decking shall be in sound condition, free from worm holes, knots, longitudinal heart cracks, soft sap wood, fungus, and deformation (twisting or cupping) that cannot be removed during installation using normal installation method and tools. Natural drying checks to a maximum of 1/8 inch wide will be acceptable.

2.5 COMPOSITE LUMBER

A. Composite (recycled plastic) lumber (plastic lumber) shall contain 100% recycled material with properties for workability similar to natural lumber.

B. The mechanical properties of the composite lumber shall be as follows:

Specific Gravity:	0.91 to 0.95	ASTM D2395
Compression perpendicular to grain:	1740 psi	ASTM D198
Hardness:	1124 pounds	ASTM D143

2.6 STEEL MESH ON RAILING

Vinyl coated welded wire steel mesh panels shall be fastened to the handrails as shown on the plans. The steel mesh panels shall be 1.5”x1.5” square galvanized steel. The vinyl (PVC) coating shall be fusion or extruded bonded.

2.7 MISCELLANEOUS LUMBER:

A. General: Miscellaneous lumber for support or attachment of other construction, including blocking, nailers and other miscellaneous lumber shall be Southern Yellow Pine; SPIB No. 1.

B. Miscellaneous lumber used for attachment of other construction shall be selected and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.8 HARDWARE

A. All brackets, spikes, nails, bolts and related hardware shall be composed of steel and shall be hot-dip galvanized in accordance with ASTM A123 or A153.

B. Unless noted otherwise on the Plans, all bolts shall receive two washers and one nut. Carriage bolts and lag bolts shall receive one washer and one nut. Bolts and nuts shall conform to the requirements of ASTM A307.

C. Unless noted otherwise on the Plans, all nails shall be ring-shank. All nails and spikes shall conform to the requirements of Federal Specification FF-N-105B.

D. All screws for securing decking shall be stainless steel (Type 316) Phillips head deck screws. All staples shall be Monel rustproof and corrosion resistant metal staples.

2.9 PORTLAND CEMENT CONCRETE

A. Portland cement concrete for cast-in-place reinforced concrete pile caps shall conform to Section 901 in the Standard Specifications for 4000 psi, ¾" 610 Cement Concrete.

B. Work of this section includes, but is not necessarily limited to, furnishing and installing the following:

1. Cast-in-place concrete
2. Forms
3. Falsework for forms
4. Form ties
5. Reinforcing steel
6. Anchor threaded rods
7. Preformed filler
8. Cutting and patching
9. Expansion and/or Control Joints
10. Finishing

C. Aggregates:

1. Fine aggregate:

Fine aggregate shall consist of natural sand, manufactured sand, or a combination thereof, conforming to the requirements of ASTM C33, Specifications for "Concrete Aggregates" latest edition. The Fineness Modulus of the fine aggregate shall be 2.80 ± .20 and the percent passing the #200 sieve shall not exceed 2 percent by dry sieving and 3 percent by wet sieving.

2. Coarse aggregate:

Coarse aggregate of washed gravel, crushed gravel, crushed stone or a combination thereof conforming to ASTM C33 Specifications for "Concrete Aggregates" latest edition. Aggregate for Lightweight Concrete shall conform to ASTM C330 Specification for "Lightweight Aggregates for Structural Concrete".

D. Admixtures

Air entraining and water reducing admixtures will be used in all concrete as specified. They shall be used in strict accordance with the manufacturer's recommendations and added at the batch plant. Admixtures shall be a ready-to-use liquid material, and contain no calcium chloride. Super-plasticizers may be added at the plant or job site.

1. Air Entraining Agent

Conforming to ASTM C 260 for Air-Entraining Admixtures for Concrete.

2. Water Reducing Admixture

Conforming to ASTM C 494 Type A for "Chemical Admixtures for Concrete".

All concrete for sidewalks shall have a minimum cement concrete of 564 lbs/cubic yard, contains a water reducing admixture and contains 6% ± 1% entrained air.

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, Epoxy coated.

G. Anchor bolts

New threaded anchor rods for pile cap, conforming to ASTM F1554, Grade 36 and galvanized per ASTM A153, including nuts and washers.

H. Preformed Filler

Preformed filler shall be in accordance with M9.14.0.

I. 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.

J. Tie wire for reinforcement shall be 16 gauge or heavier dielectric coated steel or approved plastic accessories, conforming to the applicable requirements of ASTM A-82.

K. Form Ties and Spreaders

Standard metal form clamp assemble and plastic cone, of type acting as spreaders and leaving no metal with 1 inch of concrete face. Inner tie rod shall be left in concrete when forms are removed. No wire ties or wood spreaders will be permitted. Use ½" x 1" C.T. plastic cones for sinkages.

L. Form Coatings

Non-grain raining 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, "Nox-Crete Form Coating" as manufactured by Nox-Crete Company, or approved equal. Coating containing mineral oils or the non-drying ingredients will not be permitted.

M. Grout

Type A: A high strength, nonshrink cement-based grout pourable for underwater placement which shall be:

"Five Star Structural Concrete Underwater PG" as supplied by Five Star Products, Inc., Fairfield, CT

"Conbextra UW" as supplied by FOSROC Inc., Plainview, NY

or approved equal

Type B: A high-strength non-shrink grout shall be:

"Five Star Grout" as supplied by Five Star Products, Inc., Fairfield, CT
"Conbextra S" as supplied by FOSROC, Inc., Plainview, NY,

or approved equal

Type C: Epoxy grout being a clear two part epoxy resistant to salt water attack and suitable for mixing with stone chips.

or approved equal

N. Bonding Agent

Concrete bonding system shall be an epoxy resin bonding agent for steel and concrete meeting ASTM C-881 Bond Strength Requirements and shall be Armatec 110 as manufactured by SIKA or equivalent.

O. Joint sealant shall be polyurethane-based, one component elastomeric sealant complying with Fed. Spec. TT-S-00230C, Class A, Type 2.

1. Sealant shall be a non-sag, gun grade sealant equal to the following, and as approved by the Engineer.

    a. Vulkem 116, as manufactured by Mameko International, Cleveland, OH
    b. Sikaflex 1-A, as manufactured by Sika Corp., East Hartford, CT
    c. Dynatrol 1, as manufactured by Pecora Corporation

2.10 CONCRETE STRENGTHS AND PROPORTIONS

A. Cast-in-place concrete shall have the following minimum compressive strength at 28 days and shall be proportioned within the following limits in accordance with contract requirements.

Class	Minimum Strength of 28 days	Maximum Size of Aggregate	Minimum Cement Factor
C	4000 psi	¾"	610

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 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 6 percent +/- 1.5 percent.

CONSTRUCTION METHODS

3.1 INSTALLATION, GENERAL:

Set structural lumber to required levels and lines, with members plumb, true to line, cut, and fitted. Fit structural lumber to other construction; scribe and cope as needed for accurate fit.

Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

Use copper naphthenate for items not continuously protected from liquid water.

Securely attach structural lumber work to substrate by anchoring and fastening as indicated, complying with the following:

NES NER-272 for power-driven fasteners.

Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 TIMBER INSTALLATION:

A. General

All timber shall be handled carefully by means of rope slings, care shall be exercised to avoid bruising, penetration of surfaces with tools, or other damage to the outer fibers. Cant hooks or pike poles shall not be used. All fasteners shall be stainless steel including deck screws, joist hangers, and nails.

All material shall be subject to the approval of the Engineer who shall have the option to reject any material that does not comply with the requirements of this Specification.

All construction materials stored at the site shall be stacked above the ground on pallets or similar means until used.

All workmanship shall be high quality. Joints shall be square, tight, and well fastened. All posts shall be set plumb. Bolts shall be tightened to provide a firm connection without crushing the wood or causing excessive deformation (cupping) of the washers. Bolts shall have a maximum of 1 inch of thread beyond the nut.

All waste from cuts shall be removed from the site and properly disposed of.

B. Materials Handling and Preparations

Prior to storage, all cut or damaged surfaces of treated items shall be given two (2) brush coats of ACQ and in such quantity as will fill all shakes and thoroughly penetrate the cut surface.

Proper care shall be exercised in handling and installing of all materials to prevent damage to the finished surfaces.

Timber shall be cut as indicated to permit fitting of piles and other timbers members.

Holes for bolts shall be drilled near in size. In general, holes shall be drilled perpendicular to the face of the timber.

All timber that is to be secured by bolts, spikes, nails, stainless steel screws etc. shall be pre-drilled in significant diameter to allow the fastener to be installed without the straining, splitting or otherwise damaging or potentially damaging the timber.

All timber damaged during the installation shall be immediately removed and replaced with a suitable replacement, at the sole expense of the Contractor.

Field cuts and holes bored into timbers shall receive two coats of ACQ, applied by brush; the second coat shall not be made until the first coat is completely absorbed.

Field cutting over water shall only be performed for final fitting of members and saw dust shall be contained and immediately removed from waterway.

Contractor shall place self-adhered membrane between all horizontal timber to timber interfaces. Membrane shall extend as shown on the plans and shall be approximately 25 mil thickness and consist of rubberized asphalt bonded to a HPDE membrane.

3.3 WOOD SLEEPER, BLOCKING, AND NAILER INSTALLATION:

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

3.4 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect structural lumber from weather. If, despite protection, structural lumber becomes sufficiently wet that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

3.5 CAST-IN-PLACE CONCRETE

A. Falsework for Forms

1. The contractor shall build and maintain necessary falsework for the forms.

B. Construction of Forms

1. General

a. Wood forms shall be constructed of sound material, shall be of the correct shape and dimensions, mortar tight, of sufficient strength, and 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.

2. Embedded Items

a. Provisions shall be made for pipes, sleeves, anchors, inserts, reglets, anchor slots, mailers, waterstops, and other features. No wood other than necessary nailing blocks shall be embedded in concrete. Complete cooperation shall be extended suppliers of embedded items in their installation. Obtain 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. Openings for Items Passing Through Concrete

a. 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.

C. Removing Forms and Falsework

1. Wood forms shall not be removed for at least 72 hours after concrete has been placed.

2. Forms shall not be removed until the concrete has attained sufficient strength to ensure stability.

D. Reinforcing Steel

1. General

Reinforcing steel shall be placed in accordance with the drawings and approved shop drawings and the applicable requirement of the "Codes and Standards" hereinbefore specified. Install reinforcement accurately and secured against movement, particularly under the weight of workmen and the placement of concrete. Welded wire mesh reinforcing shall be in flat sheet form, not in roll form.

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 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 securely tied with tie wire at all splices and at all crossing points and intersections in the positions shown, or as directed. Rebending of bars on the job to accommodate the job to accommodate existing conditions will not be permitted without the written approval of the Resident Engineer. Point ends of wire away from forms.

4. Spacing

   Minimum center to center distance between parallel bars shall be in accordance with the details on the drawings, or, where not shown, the clear spacing shall be 2 times the bar diameter but in no case less than 1-½ inches or less than 1-½ times the maximum size aggregate.

5. Splices shall be in accordance with the following:

   a. Maximum 50% of steel spliced occurring within a splice length.
   b. Top bars as identified on the Drawings shall be 1.4 times values given in 3.D.5.c.
   c. Splice lengths: 40 bar diameters (Min. 12")

6. Protective Concrete Covering

   a. Except where shown otherwise on drawings, the minimum concrete coverage for steel reinforcement shall conform with the applicable revisions of the "Codes and Standards" hereinbefore specified.

7. Dowels and Sleeves

   a. Install expansion dowels and sleeves perpendicular to and across all expansion joints in the concrete paving at two feet (2') on center minimum, or as shown on the Drawings. Core drill existing pavements 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.

E. 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 2.01 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 Resident Engineer at the end of each week.

6. Plant mixed cement concrete shall be the only concrete allowed to be used with all items requiring concrete in this contract. Hand mixing or other types of mixing will not be permitted.

F. 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.

G. Hot Weather Requirements:

1. The maximum temperature of the concrete, when deposited, shall be 90 degrees F. If the weather causes the placing temperature to exceed 80 degrees F., The use of a set retarding mixture shall be used.

2. No concrete shall be deposited when the air temperature is greater than 90 degrees F.

H. 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 to 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 re-handling 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 hereinbefore 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.

7. 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 on (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 not to 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 be deposited in the forms, to a depth of at least one 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.

I. Construction Joints

Construction joints shall be located a maximum of 40 feet apart. If, for any reason, the Contractor feels a change is necessary, he shall prepare a placing plan and submit it to the Owner for approval. 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. Approved keys shall be used at all joints, unless detailed otherwise. Forms shall be retightened before placing of concrete is continued. There shall be an interval of at least 48 hours between adjacent pours.

J. Expansion Joints

Expansion joints shall be located a maximum of 25' on center or as shown on contract drawings or as directed by Resident Engineer. The joint shall include a joint filler, a bond breaker, dowers and sleeves, and joint sealant and installed as indicated on contract drawings.

K. Patching

Immediately after stripping forms, patch minor defects, form-tie holes, honeycombed areas, etc., before concrete is thoroughly dry. Repair gravel pockets by cutting out to solid surface, form key, and thoroughly wet before placing patching mortar consisting of 1 part cement to 2 parts fine sand; compact into place and neatly finish. Honeycombed areas or gravel pockets which, in the Owner's opinion are too large and unsatisfactory for mortar patching as described above, shall be cut out to solid surface, keyed, and packed solids with matching concrete to produce firm bond and surface.

1. The Contractor shall do all the cutting as required by himself or other trades. All such work shall be of the minimum size required. No excessive cutting will be permitted, nor shall any structural members or reinforcement be cut.

2. The Contractor shall do all patching after work by other trades has been installed, where required, using Portland Cement Mortar 1:2 mix.

L. 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.

4. Allow no slabs to become dry at any time until curing operations are complete. In general, slabs shall be cured with non-staining curing paper, hosing or fog spray; vertical surfaces shall be curing with Burlap or fog spray or an approved curing compound. Protect fresh concrete from drying winds, rain, damage, or spoiling. Curing paper shall be lapped 4 inches minimum at joints and sealed with waterproof tape.

M. Concrete Finishes

1. Unexposed Surfaces

   a. All unexposed surfaces shall have any form finish, at the Contractor's option.

2. Wearing Surface Finish

   a. The wear surface shall receive a monolithic steel trowel finish. Surfaces shall be finished with a screed, float or steel trowel. Trowel shall be vigorously used at an angle under pressure by the finisher until troweling gives evidence of shine or gloss as required to make a smooth, hard, dense, impervious surface, free of defects. Finishers shall work from knee boards laid flat upon the surface. Mechanical troweling machines may be used if the desired finish and level tolerances can be obtained by their use, but finishing shall be by hand troweling.
   b. Finish texture and control joint for pavement shall be as indicated on plans, or in the applicable specification section, or as directed by Resident Engineer.

3. Addition of Material

   a. The addition of cement, sand, water, or mortar to slab surfaces while finishing concrete is strictly prohibited.

N. 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.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 995.1 Viewing Platform Structure No. 1 and Item 995.2 Viewing Platform Structure No. 2 will be measured as complete Lump Sum units, under each respective item number, and no separate measurement will be made.

Payment for Item 995.1 and Item 995.2 will be at the contract unit price per Lump Sum, under each respective item number, installed and accepted by the Engineer which prices shall include, cast in place reinforced concrete pile cap, formwork, reinforcement, timber framing, IPE decking and railings, composite lumber, wire mesh screens, labor, tools and equipment necessary for furnishing and erecting the two viewing platforms as detailed on the plans and any other items considered incidental to complete the work as specified herein. All helical piles and testing shall be paid under Items 945.021, 945.022, and 945.03, respectively.

APPENDIX A

Memorial Drive Tree Inventory

Memorial Drive Phase III - Existing Tree Inventory

Updated 6.8.21, 2.1.22, 8.18.22, 4.2.24, 3.14.25

Eliot Bridge to Anderson Bridge

ID No. *from survey*	**Species**	**DBH inches**	**Health Condition** *0=Dead, 1=Poor, 2=Fair, 3=Good*	**Comments** *(condition, disease, construction concerns)*
0000	Cherry	22	1	Remove, poor condition
0001	Cherry	16	2	Prune if needed
0002	Norway Maple	20	3	Prune if needed
0004	Maple	14	2	Large wound, prune if needed
0008	Cherry	24	1	Remove, poor condition, excessive sucker growth, trunk rot
0009	Cherry	14	1	Remove, poor condition, mimimal branching on large trunk
0011	London Plane	2	0	Transplant and prune if needed
0012	Tulip Tree	4	3	Prune if needed
0013	London Plane	3	3	Transplant and prune if needed
0014	Tulip Tree	4	2	Remove due to wound at base which could be issue in future.
0015	London Plane	3	2	Prune if needed
0016	Oak	4	3	Prune if needed
0017	Maple	40	3	Prune if needed
0019	London Plane	18	3	Prune
0020	London Plane	18	3	Prune
0021	London Plane	30	1	Stunted growth, could stay, between existing road and path, prune if needed
0022	London Plane	30	2	Stunted growth, between existing road and path, decay on road side, could stay but remove if possible, prune if needed
0023	London Plane	3	3	Prune if needed
0024	London Plane	3	3	Prune if needed
0025	Cherry	12	2	Prune if needed
0026	Tulip Tree	3	3	Prune if needed

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Updated 6.8.21, 2.1.22, 8.18.22, 4.2.24, 3.14.25

Eliot Bridge to Anderson Bridge

ID No. *from survey*	**Species**	**DBH inches**	**Health Condition** *0=Dead, 1=Poor, 2=Fair, 3=Good*	**Comments** *(condition, disease, construction concerns)*
0027	Tulip Tree	6	3	Prune if needed
0028	Tulip Tree	4	3	Prune if needed
0029	London Plane	42	3	Prune if needed
0030	Cherry			Remove, in way of path
0031	Cherry			
6416	Cherry		2	Remove to protect Eliot Bridge foundation
6417	Crabapple		3	Prune
6418	London Plane		3	Prune
6419	Pine		3	Prune
6420	London Plane		3	Prune
6421	London Plane		3	Prune
6422	London Plane		3	Prune
6423	Unknown			Prune if needed
6424	Unknown			Prune if needed
6425	Unknown		0	Prune if needed, DEAD 12/18/24
6426	Unknown		0	Prune if needed, DEAD 12/18/24
6427	Unknown			Prune if needed
6428	Unknown			Prune if needed
6429	Unknown			Prune if needed
6430	Unknown			Prune if needed
6431	Unknown			Prune if needed

Memorial Drive Phase III - Existing Tree Inventory

Updated 6.8.21, 2.1.22, 8.18.22, 4.2.24, 3.14.25

Eliot Bridge to Anderson Bridge

ID No. *from survey*	**Species**	**DBH inches**	**Health Condition** *0=Dead, 1=Poor, 2=Fair, 3=Good*	**Comments** *(condition, disease, construction concerns)*
6432	London Plane		3	Prune
6433	London Plane		3	Prune
6434	Cherry	10	1	Remove, not a hazard, poor condition.
6435	Cherry	8	1	Remove, not a hazard, poor condition.
6436	Norway Maple		3	Nice shade tree, Prune. NEED TO CONFIRM IF STILL HERE
6437	Cherry	14	1	Remove, not a hazard, poor condition.
6443	Cherry			Prune if needed
6446	Unknown			Prune if needed
6447	Unknown			Prune if needed
6448	Unknown			Prune if needed
6449	Unknown			Prune if needed
6450	Ash	30	3	Prune if needed
6451	London Plane	18	2	Prune dead limbs
6452	Ash	24	3	Prune if needed
6453	Maple	24	3	Prune if needed
6454	Maple	18	3	Prune if needed
6455	London Plane	16	2	Prune if needed
6456	London Plane	28		Prune if needed
6457	London Plane	42		Prune if needed
6458	London Plane	23		Prune if needed
6459	London Plane	25		Prune if needed

ID No. *from survey*	**Species**	**DBH inches**	**Health Condition** *0=Dead, 1=Poor, 2=Fair, 3=Good*	**Comments** *(condition, disease, construction concerns)*
6460	London Plane	26		Prune if needed
6461	London Plane	32		Prune if needed
6462	London Plane	28		Prune if needed
6463	London Plane	27		Prune if needed
6464	London Plane	25		Prune if needed
6465	London Plane	28		Prune if needed
6466	London Plane	22		Prune if needed
6467	Tree of Heaven	17		Prune if needed
6471	Tree of Heaven	22		Prune if needed
6472	Tree of Heaven	16		Prune if needed
6473	Tree of Heaven	16		Prune if needed
6474	Tree of Heaven	15		Prune if needed
6475	Tree of Heaven	23		Prune if needed
6476	Tree of Heaven	22		Prune if needed
6477	Norway Maple	30		Prune if needed
6478	London Plane	30		Prune if needed
6479	London Plane	39		Prune if needed
6480	London Plane	41		Prune if needed
6481	London Plane	43		Prune if needed
6482	London Plane	28		Prune if needed
6483	London Plane	24		Prune if needed

Memorial Drive Phase III - Existing Tree Inventory

Updated 6.8.21, 2.1.22, 8.18.22, 4.2.24, 3.14.25

Eliot Bridge to Anderson Bridge

ID No. *from survey*	**Species**	**DBH inches**	**Health Condition** *0=Dead, 1=Poor, 2=Fair, 3=Good*	**Comments** *(condition, disease, construction concerns)*
6484	London Plane	46		Prune if needed
6485	London Plane	43		Prune if needed
6486	London Plane	48		Prune if needed
6487	London Plane	49		Prune if needed
6488	London Plane	51		Prune if needed
6489	London Plane	49		Prune if needed
6490	London Plane	49		Prune if needed
6491	London Plane	48		Prune if needed
6492	London Plane	46		Prune if needed
6493	London Plane	48		Prune if needed
6494	London Plane	48		Prune if needed
6495	London Plane	51		Prune if needed
6496	London Plane	54	1	RECOMMENDED FOR REMOVAL BY ARBORIST, on N side of Mem Drive, decay at base in center, over hanging res area/church, needs heavy pruning/weight removal (may risk structural integrity)
6497	London Plane	46		Prune if needed
6498	London Plane	40		Prune if needed
6499	London Plane	43		Prune if needed
6500	London Plane	34		Prune if needed
6522	London Plane	26	3	Needs pruning
6523	London Plane	31	3	Dead branch, needs pruning

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Eliot Bridge to Anderson Bridge

ID No. *from survey*	**Species**	**DBH inches**	**Health Condition** *0=Dead, 1=Poor, 2=Fair, 3=Good*	**Comments** *(condition, disease, construction concerns)*
6524	London Plane	11	3	Prune
6525	London Plane	11	3	Prune
6526	London Plane	13	3	Prune
6527	London Plane	13	3	Prune
6528	London Plane	10	3	Prune
6529	London Plane	10	3	Prune
6530	London Plane	11	3	Prune
6531	London Plane	11	3	Prune
6532	London Plane	12	3	Prune
6533	London Plane	13	3	Prune
6534	London Plane	9	3	Prune
6535	London Plane	7	3	Prune
6536	London Plane	29	2	Prune
6537	London Plane	15	3	Prune
6538	London Plane	9	3	Prune
6540	London Plane	7	1	Prune
6541	London Plane	9	2	Prune
6542	London Plane	10	2	Prune
6544	London Plane	17	1	RECOMMENDED FOR REMOVAL BY ARBORIST, Girdling roots, cavities, decay on trunk on road side, in the way of traffice signal, dead at top
6545	London Plane	20	1	RECOMMENDED FOR REMOVAL BY ARBORIST, Mushroom growth, decay, tops dying, sprouting indicates poor conditions
6546	London Plane	46		Prune if needed
6547	London Plane	44		Prune if needed
6548	London Plane	45		Prune if needed

Memorial Drive Phase III - Existing Tree Inventory

Updated 6.8.21, 2.1.22, 8.18.22, 4.2.24, 3.14.25

Eliot Bridge to Anderson Bridge

ID No. *from survey*	**Species**	**DBH inches**	**Health Condition** *0=Dead, 1=Poor, 2=Fair, 3=Good*	**Comments** *(condition, disease, construction concerns)*
6549	London Plane	48		Prune if needed
6550	London Plane	28	3	Prune
6551	London Plane	35	3	Prune
6552	London Plane	32	3	Prune
6553	London Plane	34	1	RECOMMENDED FOR REMOVAL BY ARBORIST, Internal decay, structural defects, mechanical damage at base
6554	London Plane	32	2	Remove to permit construction of paths.
6555	London Plane	31	1	RECOMMENDED FOR REMOVAL BY ARBORIST, decay through middle, split
6556	London Plane	33	2	Remove to permit construction of paths.
6557	London Plane	34		Prune
6558	London Plane	30		Prune
6559	London Plane	33		Prune
6560	London Plane	36		Prune
6561	London Plane	39		Prune
6562	London Plane	48		Prune
6563	London Plane	41		Prune
6564	London Plane	33	2	Prune
6566	London Plane	38	3	Prune
6601	London Plane	32		Prune if needed
6602	London Plane	33		Prune if needed
6603	London Plane	34		Prune if needed
6604	London Plane	37		Prune if needed

Memorial Drive Phase III - Existing Tree Inventory

Updated 6.8.21, 2.1.22, 8.18.22, 4.2.24, 3.14.25

Eliot Bridge to Anderson Bridge

ID No. *from survey*	**Species**	**DBH inches**	**Health Condition** *0=Dead, 1=Poor, 2=Fair, 3=Good*	**Comments** *(condition, disease, construction concerns)*
6605	London Plane	36		Prune if needed
6606	London Plane	36		Prune if needed
6607	London Plane	48		Prune if needed
6608	London Plane	53		Prune if needed
6609	London Plane	43		Prune if needed
6610	London Plane	46		Prune if needed
6611	London Plane	47		Prune if needed
6612	London Plane	17		Prune if needed
6613	London Plane	23		Prune if needed

APPENDIX B

1986 DCR/MDC Graphic Standards for Directional Signs

MetroParkways

Directional Sign
Typical Elevation

A2-7

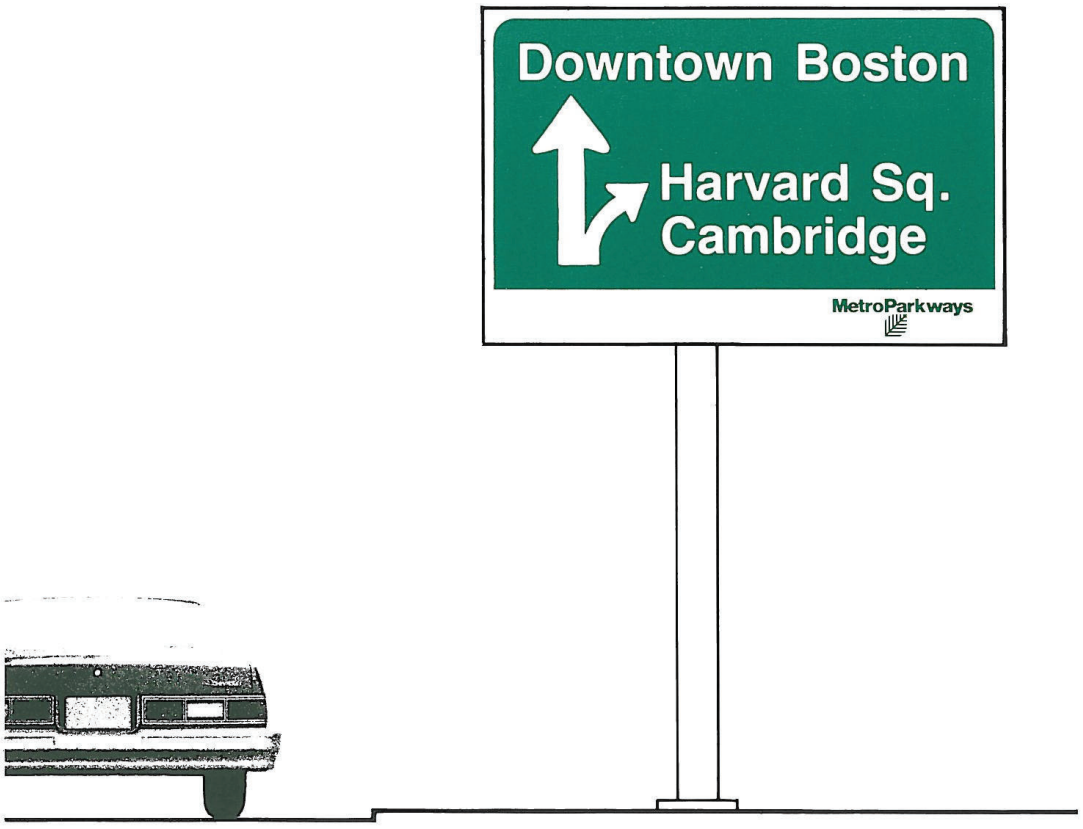
Below is a typical directional sign for MetroParkways. For layout specifications see pages A2-7.1 through A2-7.7. For structural details see pages A2-15.1 through A2-15.6.

For explanation of parkway and intersection types, and general design guidelines, refer to pages A2-2 through A2-6.

Colors: White reflective letters on standard reflective green background. Green reflective MetroParkways logotype on white reflective background,

Typography: Sign message Helvetica Medium, upper and lower case. MetroParkways artwork provided in Appendix. When route numbers appear on signs, refer to the chart on page A2-14.

For arrow specifications, refer to pages A1-4 and A1-5.



MetroParkways

Directional Sign Layout
Intersection, Multi-direction

A2-7.3

Use the layout specifications below for multi-direction signs located at simple intersections.

For typical directional sign elevation, see Page A2-7.

For layout of sign border and MetroParkways band, refer to Pages A2-7.7 and A2-7.8

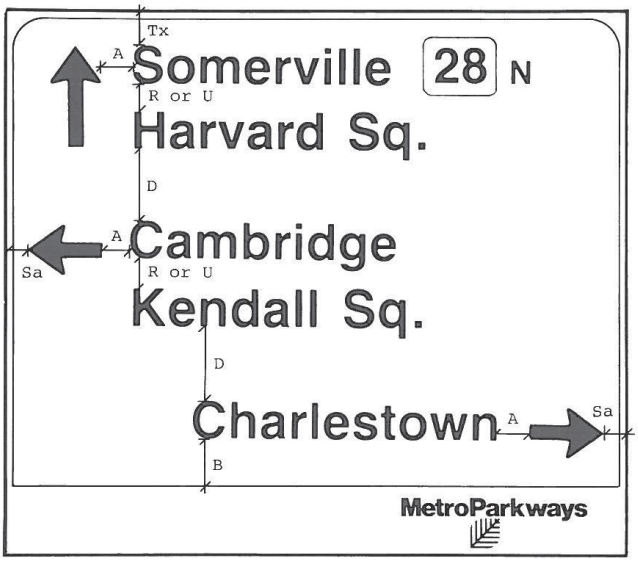
For structural detail and material specifications, refer to pages A2-15, and A2-15.1 through A2-15.3, A2-15.6, A2-15.7.

Typography:Helvetica Medium MetroParkways artwork provided in Appendix.

For Letter Widths and Letter Spacing charts refer to Appendix pages D1-5 through D1-8.

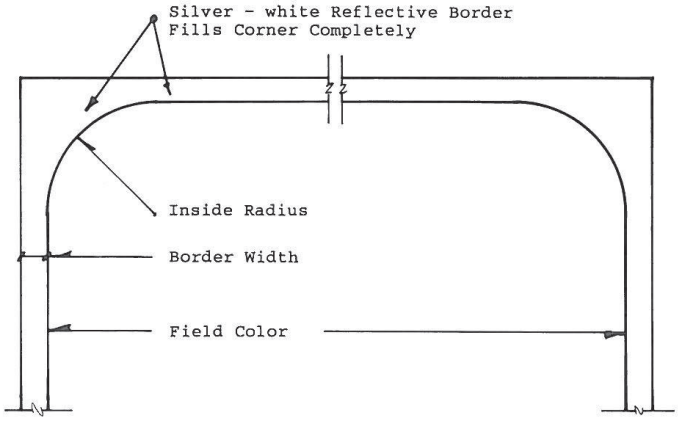
Refer to chart on page A2-14 for dimensions of route numbers.

For arrow specifications, refer to pages A1-4 and A1-5.



Cap Ht.	Sa	Tx	B	A	D	R	U
4"	3"-6"	4"-7"	4"-7"	4"	8"	2"	4"
6"	4"-7"	5"-8"	5"-8"	5"	12"	2.5"	5"
8"	5"-8"	6"-9"	6"-9"	6"	16"	3"	6"
10"	6"-9"	7"-10"	7"-10"	7"	20"	5"	8.5"

MetroParkways **Directional Sign Layout** **A2-7.8**
Sign Border



Margin Detail

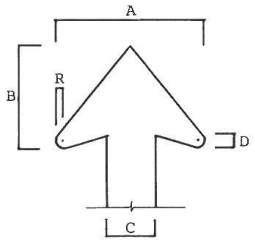
Letter Height	10"	8"	6"	4"
Border Width	1.5"	1.25"	1.0"	1.0"
Inside Radius at Corner	6"	1/8 Vertical Sign Dimension		
		5" Min	4" Min	3" Min
		6" Max	6" Max	6" Max

Please note that for 8", 6", 4" letters, the inside radius is equal to 1/8 the vertical dimension within the minimum and maximum sizes shown in the chart above.

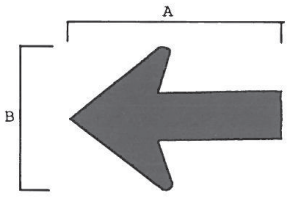
MetroParkways **Single Arrow** **A1-4**

The arrow used for Metro-Parkways is of similar shape and dimensions as the standard MUTCD arrow. The arrow shaft is of uniform width, not tapered.

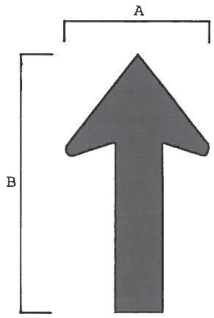
A standard set of arrow forms showing curves and angles of shaft and size of arrowhead are shown below. These should be used on all parkway signs for visual consistency and legibility.



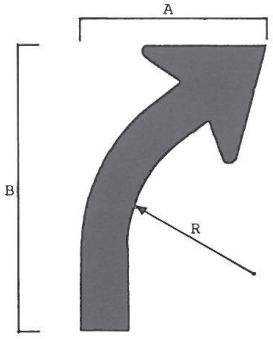
Cap Ht.	A	B	C	D	R
4"	6"	4 7/32"	2"	1/2"	5/16"
6"	9"	6 5/16"	3"	3/4"	15/32"
8"	12"	8 7/16"	4"	1 1/32"	5/8"
10"	15"	10 1/2"	5"	1 1/4"	1/2"



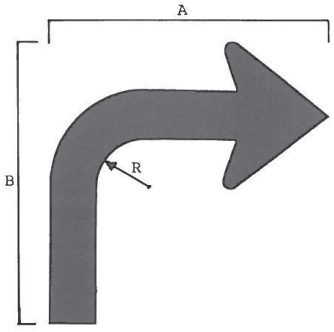
Cap Ht.	A	B
4"	8.75"	6"
6"	13.25"	9"
8"	17.5"	12"
10"	22"	15"



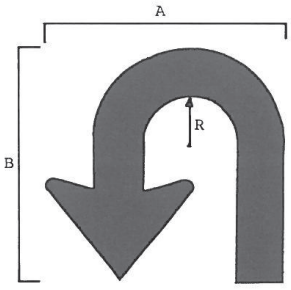
Cap Ht.	A	B
4"	6"	11"
6"	9"	16.5"
8"	12"	22"
10"	15"	27.5"



Cap Ht.	A	B	R
4"	7.75"	12.0"	5.5"
6"	11.75"	17.75"	8.5"
8"	15.75"	23.75"	11.25"
10"	20"	30"	14"



Cap Ht.	A	B	R
4"	11.75"	11.75"	2"
6"	17.75"		3"
8"	23.5"	23.5"	4"
10"	29.5"	29.5"	5"



Cap Ht.	A	B	R
4"	10"	10"	2"
6"	15"	15"	2.75"
8"	20"	20"	3.75"
10"	25"	25"	4.75"

Introduction

The pages that follow contain the specifications and drawings for MetroParkways signs. These specifications and drawings should be used together with the layouts shown earlier in this section to form a full description of each sign type.

Specifications

Directional Signs	A2-15
DPW Directional Signs	A2-15a
Gateway Signs	A2-15b
Gateway, Entering and Leaving Signs	A2-15c
Parkway Trailblazer	A2-15c
Street Name Signs	A2-15e

MetroParkways
Directional Signs

A. General

1. The Directional Signs are based on the MDC Charles River Parkway sign system and the drawings and specifications prepared for that system.

2. The directional sign supports shall be designed in conformity with the AASHTO publication "Specifications for Design and Construction of Structural Supports for Highway Signs."

B. Materials

1. Structural Steel

- All structural steel materials, workmanship and details shall conform to the latest edition of the AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings".

- Structural steel tubes shall conform to specification ASTM - A500, Grade B.

- Structural steel shapes and plates shall conform ASTM-A36.

- Bolts, Nuts and Washers used for anchoring sign structures shall conform to ASTM-A572 with a minimum yield strength of 50,000 p.s.i. High tension bolts, where specified, shall conform to ASTM-A325. All bolts, nuts and washers shall be galvanized in accordance with ASTM-A153. Structural steel shall be galvanized in accordance with ASTM-A123.

- Welding materials and practices shall conform to the requirements of the latest edition of the American Welding Society code. All connections shall be welded to conform to specification ASTM-A233, E60 or E70 series.

2. Sign Panels

- The sign panels shall be of standard profile and shall be fabricated of extruded Aluminum ASTM-B221, Alloy 6063-T6, shall be 12" wide and of bolted joint design. Only one 6" panel shall be used where the overall height of the sign requires one panel less than 12". 12" sections shall be 2.687 lb. per ft. and 6" sections 1.105 lb. per ft.

- The sign panels shall conform to Mass. DPW "Standard Specifications for Highways and Bridges" Section 828, latest revision.

- Edge trim shall be standard extruded edge trim -- .276 lb. per ft. Edge trim shall be painted white to match sign border.

- Bolts, rivets, lock nuts and washers shall be stainless steel, type 304 or 305.

3. Graphics

- All messages shall be cut from white reflective sheeting mounted on aluminum sheet and applied as individual characters to the sign panels with rivets.

- Route markers (shields) shall be silkscreened on white reflective sheeting and applied as individual characters to the sign panels with rivets.

- The MetroParkways logo shall be cut from green reflective sheeting and applied directly to the sign face. The logo will be reproduced from the artwork included in this manual.

- Messages, arrows and Route Markers up to and including 12" in height shall be .040" aluminum; those over 12" in height shall be .064" aluminum. Aluminum sheet shall conform to ASTM-B209, Alloy 3003, H14.

- The Helvetica typeface for messages shall conform to samples shown in the sign manual and shall be of photo-typeset quality. All graphics shall be neatly cut with crisp edges.

4. Fabrication Date

- White numerals, 1" in height, designating the year and month of fabrication and size of sign shall be affixed to the bottom left corner of the rear of all ground-mounted signs.

- White numerals, 1 1/2" in height, shall be affixed at the bottom left hand corner of the face of each overhead sign panel.

- Black numerals shall be used in place of white numerals where the background they are affixed to is white or aluminum.

5. Reflective Sheeting

- Reflective sheeting shall conform with Federal Highway Administration standard FP-79 Table IV (engineer grade) or Table V (high intensity). The sheeting shall include a pre-coated pressure sensitive adhesive backing (class 1).

- Reflective sheeting shall conform to Mass. DPW "Standard Specifications for Highways and Bridge" Section 828, latest edition.

- Reflective sheeting shall be applied to properly treated base panels with mechanical equipment in a manner specified by the sheeting manufacturer.

- Sign faces, comprised of two or more panels of reflective sheeting shall be carefully matched for color at the time of sign fabrication to provide uniform appearance and brilliance both day and night.

C. Finishes

1. Color Galv Finish

- All sign support structures shall be hot dip galvanized and color coated by the galvanizer in his plant. The high-build vinyl coating shall be Color-Galv by Duncan Galvanizing, Everett, MA or equal. Color shall be dark green #34108 or grey #2441. The galvanizer shall provide a 10 year product warranty.

2. Paint

- The sign support structures may also be painted with green or grey semi-gloss alkyd enamel as directed by the MDC representative colors shall conform to Federal Specification 595a.

D. Concrete Footings

1. Specifications for concrete shall conform to the Mass DPW specification Section M4, Class D (alternate designation), As outlined in the supplement specifications dated June 1985.

2. Portland cement shall conform to specification ASTM-C150, Type II. The air-entraining agent shall conform to ASTM-C260. All concrete shall have a compressive strength of at least 3,000 p.s.i. at 28 days.

MetroParkways
DPW Directional Signs

A. General

1. The signs are the same as the Mass. DPW D6 signs except that the plywood sign panels vary in both height and width rather than being a single dimension - 5'X5'. The panel may also be placed off-center on the sign post as shown in Elevation B, Page A2-15.8

2. DPW Directional sign materials and sign supports shall conform to DPW publication "Standard Drawings for Signs and Supports", latest revision, DPW "Standard Specifications for Highways and Bridges", latest revision, and AASHTO publication "Specifications for Design and Construction of Structural Supports for Highway Signs."

B. Materials

1. Structural Steel:

- The steel post shall be seamless steel pipe and shall conform to ASTM - A53.

- Structural steel shapes and plates shall conform to ASTM-A36.

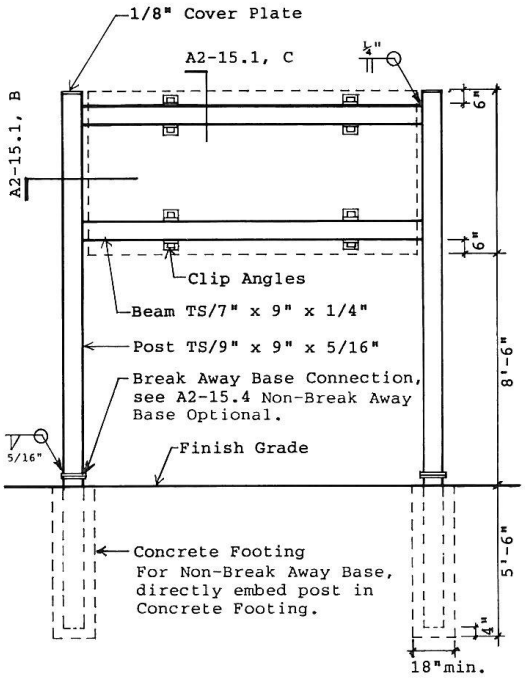
- All high strength bolts, nuts and washers shall conform to ASTM-A325. All other bolts shall conform to ASTM-A307 Class A.

- All steel hardware shall be galvanized as per ASTM - A307.

- Structural steel shall be galvanized as per ASTM - A123.

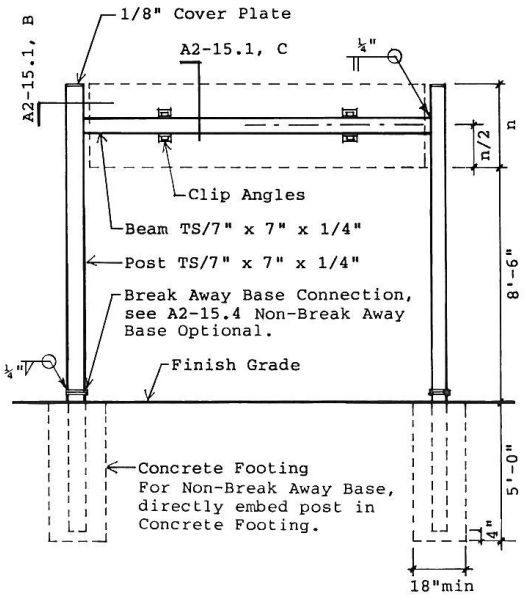
- Welding materials and practices shall conform to the requirements of the latest edition of the Welding Society Code. All connections shall be welded to conform to specifications ASTM - A233, E60 or E70 series.

MetroParkways | **Sign Structures and Material Specifications** | **A2-15.2**
Directional Sign — Elevations



A ELEVATION

Scale: 3/16" = 1'0"



B ELEVATION

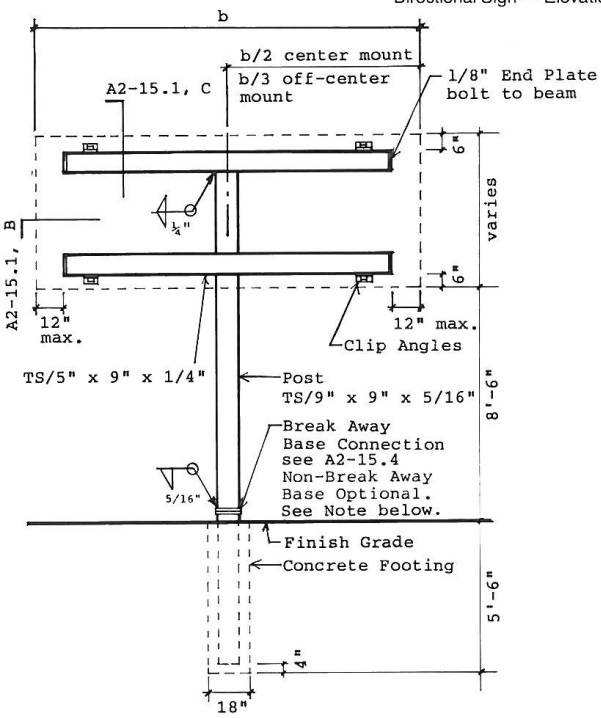
Scale: 3/16" = 1'0"

For Graphic Layout Specifications, see pages A2-7 through A2-7.8

	No. of Poles	No. of Cross Members	Size of Pole
70 sq. ft. and over	2	2	TS 9X9
12 ft. wide and over - 5 ft. high and over	2	2	TS 9X9
12 ft. wide and over - under 5 ft. high	2	1	TS 7X7
Under 70 sq. ft. 5 ft. high and over	1	2	TS 9X9
Under 12 ft. wide, under 5 ft. high - 25 sq. ft. and over	1	1	TS 8X8
under 25 sq. ft.			TS 4X4 or 6X6 depending on pole length

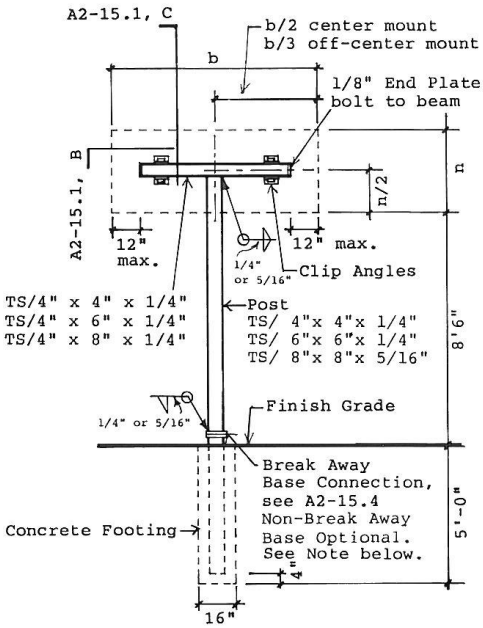
MetroParkways **Sign Structures and Material Specifications** **A2-15.3**

Directional Sign — Elevations



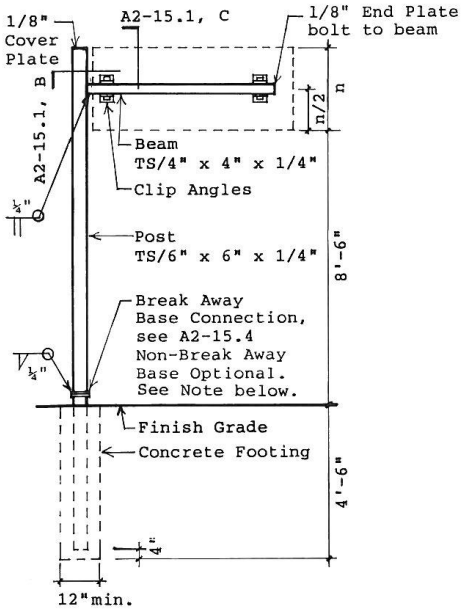
A ELEVATION

Scale: 3/16" = 1'0"



B ELEVATION

Scale: 3/16" = 1'0"



C ELEVATION

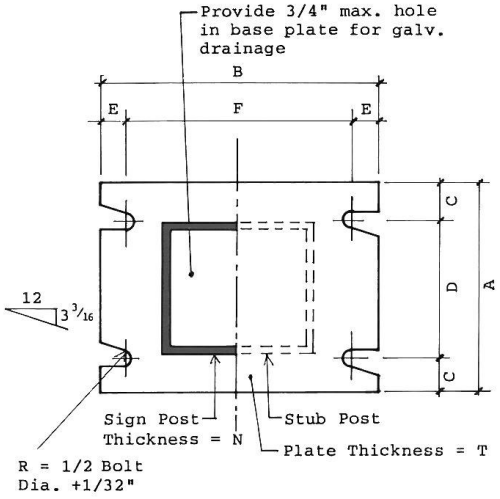
Scale: 3/16" = 1'0"

For Graphic Layout Specifications, see pages A2-7 through A2-7.8

Note:
Cover Plates welded as per page A2-15.1, Section C

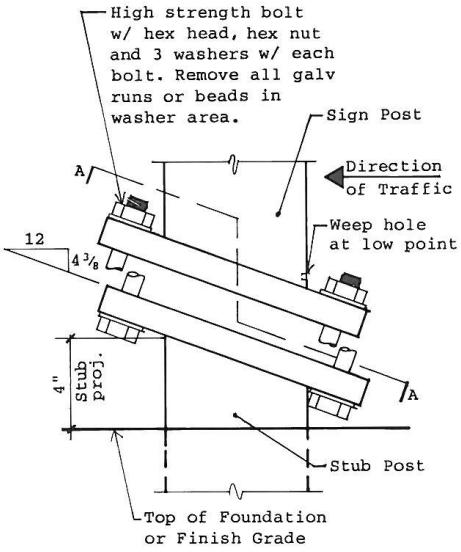
Note:
For Non-Break Away Base, directly embed post in footing as shown in the drawings.

MetroParkways **Sign Structures and Material Specifications** **A2-15.4**
Directional Signs — Breakaway Details



A SECTION

Note:
Section A is for installation on right shoulder. Plate slot bevels are opposite hand from that shown for installation on left shoulder.

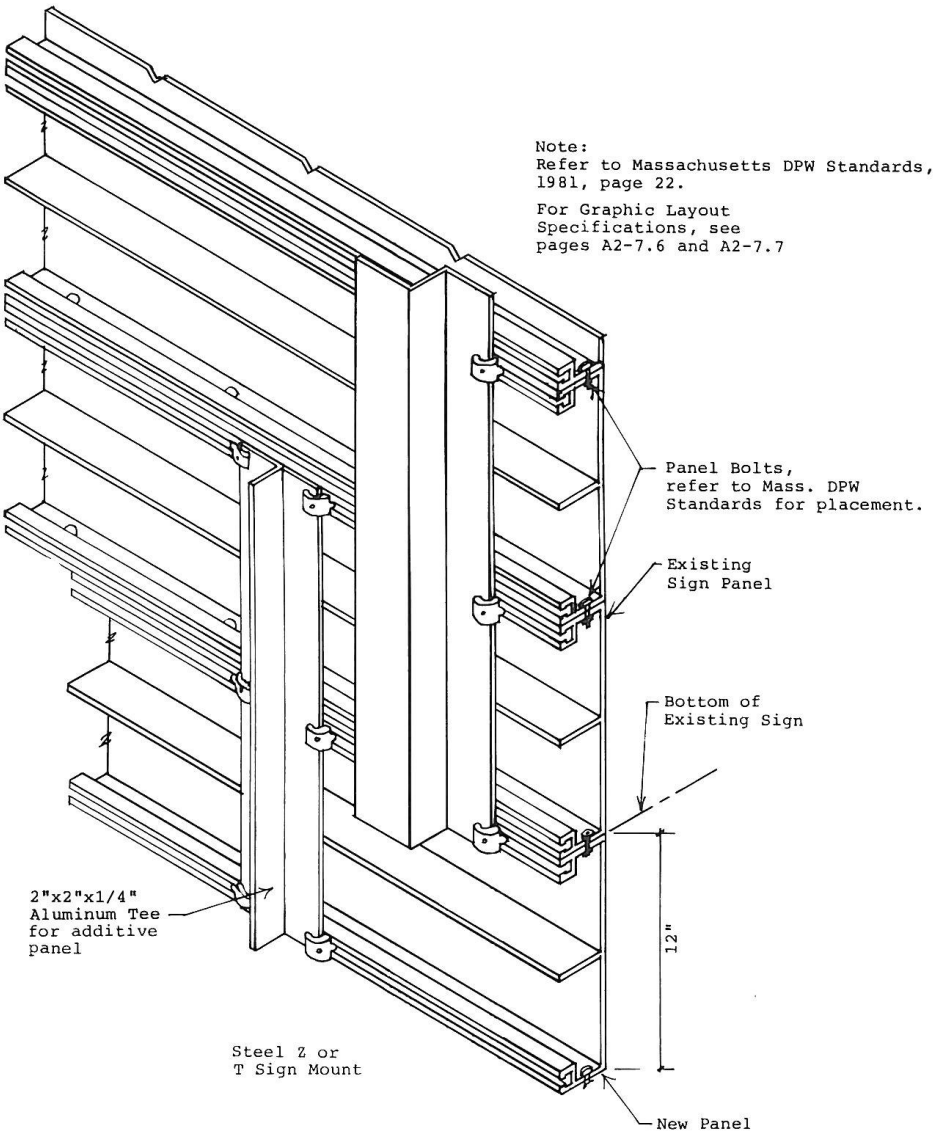


B ELEVATION

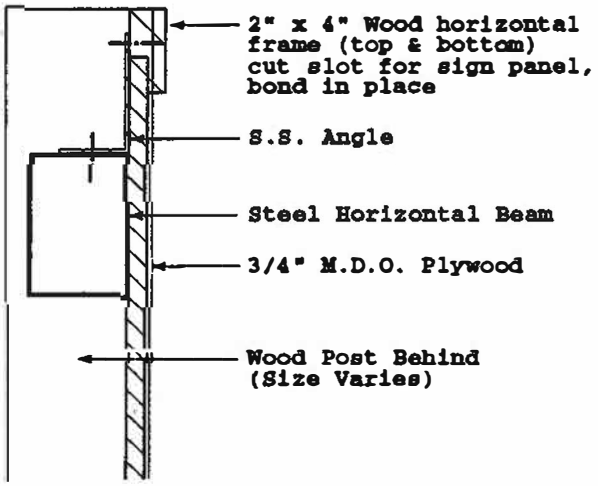
Note:
For Non-Break Away Base, directly embed post in footing as shown in the drawings.

BASE PLATE DIMENSION CHART

Sign Post Size	Bolt Size	Torque	A	B	C	D	E	F	T	N
TS4X4X¼	½"X2¾"W/ 1½"Thread	200#	5"	8"	1⅛"	2¾"	¾"	6½"	⅝"	¼"
TS6X6X¼	⅝"X3¼"W/ 1¾" Thread	450#	7"	10"	1⅛"	4¾"	¾"	8½"	¾"	¼"
TS7X7X¼	⅝"X3¼" W/ 1¾" Thread	450#	8"	11"	1⅛"	5¾"	¾"	9½"	¾"	¼"
TS8X8X5/16	¾"X4"W/ 1⅞"Thread	750#	9"	12½"	1¼"	6½"	⅞"	10¾"	1"	5/16"
TS9X9X5/16	¾"X4"W/ 1⅞"Thread	750#	10"	13½"	1¼"	7½"	⅞"	11¾"	1"	5/16"

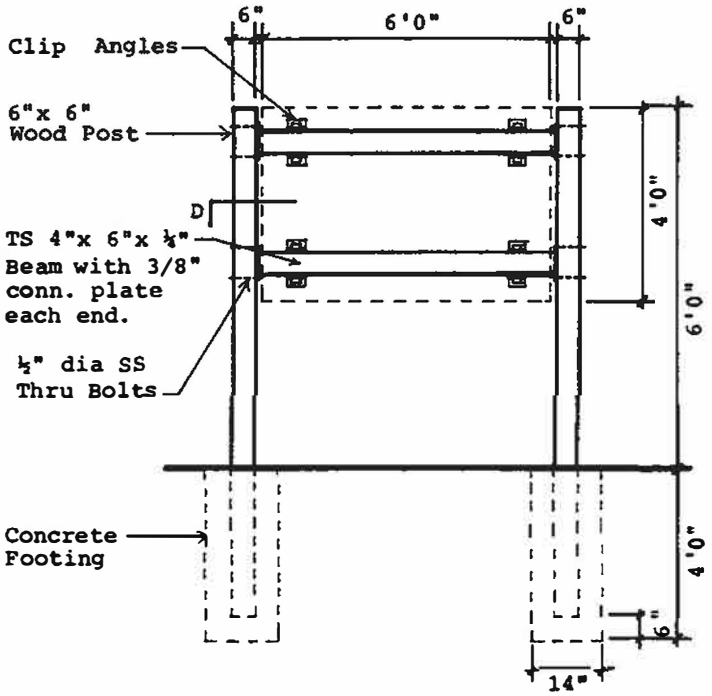


B ISOMETRIC VIEW
Not to Scale



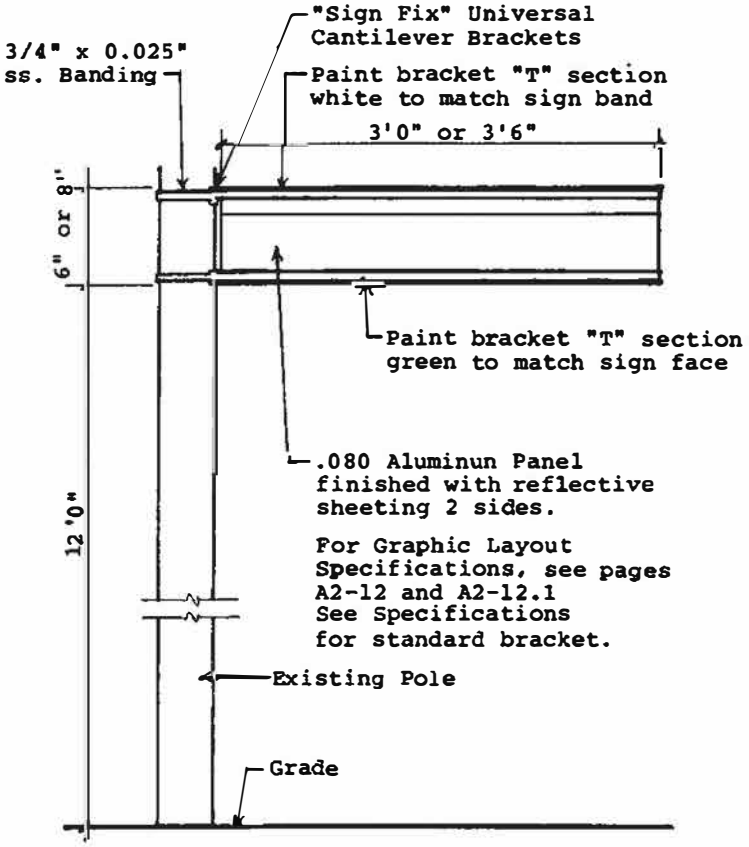
A VERTICAL SECTION - RETROFIT

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



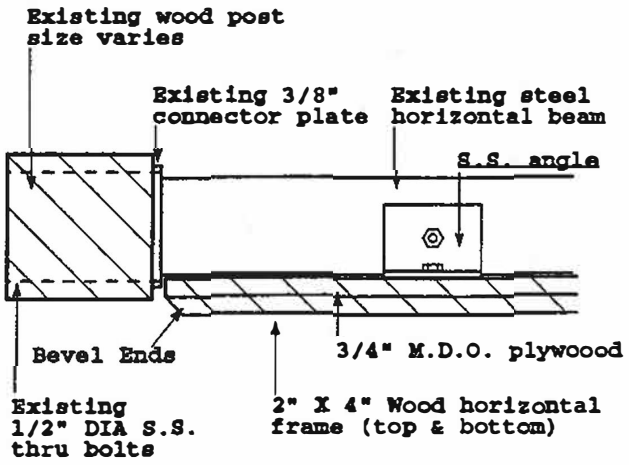
B ELEVATION, GATEWAY RETROFIT

Scale: 1/4" = 1'-0"



C ELEVATION STREET NAME SIGN

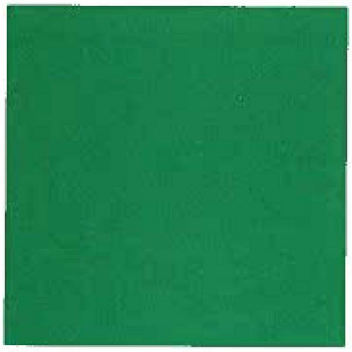
Scale: ½"= 1'0"



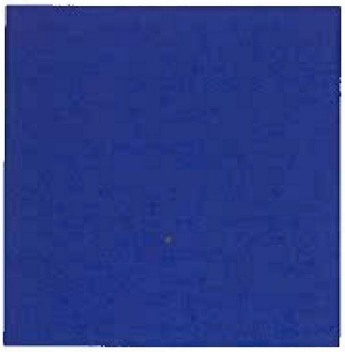
D HORIZONTAL SECTION - RETROFIT

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

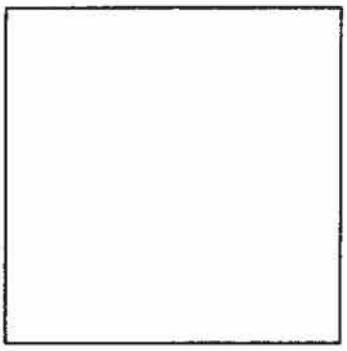
Green and white are the official "corporate" colors for the Parkway Signs and should be used consistently. Blue is used exclusively for the parkway trailblazer slat signs. Only the colors specified below are acceptable. Please follow the Pantone Matching System (PMS) color specifications, materials and acceptable manufacturer list found below and repeated in the material specifications for each sign type.



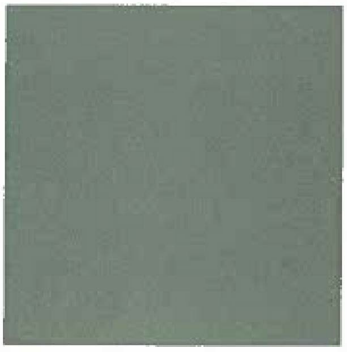
PMS 348 Green
Reflective Sheeting:
FHWA PR Color #4
Highway Green
Paint:
Federal Standard 595a
Color #14090 (matte)



PMS 072 Blue
Reflective Sheeting:
FHWA PR Color #3
Highway Blue
Paint:
Federal Standard 595a
Color #15056 (gloss)



PMS White
Reflective Sheeting:
FHWA White
Paint:
Federal Standard 595a
Color #27875



PMS 423 Grey
Reflective Sheeting:
Custom Color Silkscreened
on white sheeting
Paint:
Federal Standard 595a
Color #26280
For Sign Support Only

Appendix

Lettering Guide
Normal Letterspacing For
Helvetica Regular, Medium and Bold

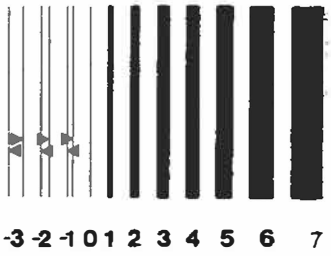
The table below is provided as a guide for inter-letter spacing. The letters indicated in the column to the left of the chart contain the characters which have already been positioned. The unit distance between the fixed character and the subsequent one is found opposite the fixed character and under the column heading in which the next character is listed.

The graduated unit scale indicating both negative and positive spacing, -3 to 7, found above the chart, provides the actual distance between characters for 1" lettering. The scale may be photostatically reduced or enlarged so that the unit height corresponds with the desired letter height. The graduated units will thus provide the actual spacing distance for any letter size.

Positive spacing is the distance between the extreme right hand edge of the initial character to the extreme left hand edge of the subsequent character. An exception to this rule is the lower case "a" where spacing is measured from the straight back of the character rather than its serif.

Negative spacing is the overlap distance between two characters as when a "T" is followed by an "a".

Word spacing is to be the equivalent of the width of a lower case "v".



	acde goqs 12	bhijkl	mnpru	vwy 356890	ft 7	x	z 4
adghijlmnqu	5	6	6	1	3	2	5
bceops	2	5	5	0	0	0	2
vwyr	0	2	2	2	2	1	1
ftz 2356890	2	3	5	2	1	1	2
kx_	0	2	2	0	1	1	1
GHIJMNU 1	6	7	7	4	4	3	5
BCDOQRS	2	6	6	3	2	2	3
VW	-1	2	1	0	0	0	0
KX	-1	2	2	-2	-2	2	2
A	0	2	2	-3	-2	2	2
E	3	6	6	1	1	2	4
F 4	0	2	2	2	0	0	2
L	2	3	3	-2	0	2	4
P 7	0	5	5	0	2	0	-2
T	-3	3	0	-2	0	-2	0
Y	-3	2	-1	-1	-1	-1	-1
Z	2	3	2	0	0	1	2