

Cambridge, Massachusetts
Broadway

SPECIAL PROVISIONS
PROJECT NO. 605604
BROADWAY IMPROVEMENT PROJECT
CAMBRIDGE, MA
MAY 2011

SCOPE OF WORK

The work under this Contract consists of furnishing all necessary labor, materials and equipment required for intersection improvements along Broadway from Third Street to Ames Street (Kendall Square) in the City of Cambridge, Massachusetts. The work includes cold plane and hot mix asphalt overlay, new cement concrete sidewalks, new granite curb, drainage improvements, sign upgrades, new pavement markings, new landscaping and other miscellaneous items of work.

All work done under this contract shall be in conformance with the, Massachusetts Highway Department Standard Specifications for Highways and Bridges, dated 1988, 2006 Massachusetts Highway Department Project Development and Design Guide dated February 25, 2010. The Standard Special Provisions, the 2010 Construction Standards and the Supplemental Drawings dated April 2003 the 2009 Manual on Uniform Traffic Control Devices, with Massachusetts Amendments, the 1990 Standard Drawings for Signs and Supports. The 1968 Standard Drawings for Traffic Signals and Highway Lighting, the latest edition of American Standard of Nursery Stock, the Plans detail sheets the Special Provisions and all amendments will govern.

WORK SCHEDULE

Work on this project is restricted to a normal eight-hour day, five-day week, with the Contractor and all Subcontractors working on the same shift.

No work shall be done on this contract on Saturday, Sunday, a State or Federal holiday or on the day before or the day after a long weekend that involves a holiday without prior approval by the Engineer.

PUBLIC SAFETY AND CONVENIENCE (Supplementing Subsection 7.09)

The Contractor shall provide necessary access for fire apparatus and other emergency vehicles through the work zones to abutting properties at all times.

Sweeping and cleaning of surfaces beyond the limits of the project to clean up material caused by spillage or vehicular tracking during the various phases of the work shall be considered as incidental to the work being performed under the Contract and there will be no additional compensation.

NOTICE TO OWNERS OF UTILITIES (Supplementing Subsection 7.13)

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Before commencing work on service connections, the Contractor shall be responsible for contacting the Electric Company servicing the area to obtain construction requirements, standards, and to give adequate notice of commencement of work. The Contractor's attention is further directed to the requirements of Work in the Immediate Vicinity of Certain Underground Structures and Poles herein included in these Special Provisions.

The following are the names of owners and representatives of the principal utilities affected. The accuracy of this list is not guaranteed by the Department:

City Hall
795 Massachusetts Avenue
Cambridge, MA 02139

David P. Maher, Mayor
(617)-349-4321

Department of Public Works
147 Hampshire Street
Cambridge, MA 02139

Jim Wilcox, Director of Engineering
(617)-349-4800

Police Department

(617)-349-3300

Fire Department

(617)-349-4990

UTILITY COMPANIES

NStar Gas
One NSTAR Way, SUM SE 310
Westwood, MA 02090

Steven Owens
(781) 441-8709

NStar Electric
One NSTAR Way, SUM SE 310
Westwood, MA 02090

Steven Owens
(781) 441-8709

Verizon
1166 Shawmut Avenue
New Bedford, MA 02746

Karen Nunes
(508)-991-3522

Cambridge Water Department
250 Fresh Pond Parkway
Cambridge, MA 02746

Mark Gallagher
(617)-349-4770

MWRA
2 Griffin Way
Chelsea, MA 02150

Ralph Francesconi
(617)-305-5827

Cambridge Sewer Department
147 Hampshire Street
Cambridge, MA 02139

William Dwyer
617-349-4800

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Comcast
676 Island Pond Road
Manchester, NH 03109

Jean MacLaren
603-695-1461

NStar Communications
One NStar Way, NE 220
Westwood, MA 02090

Andrew Balta
781-441-3492

AT&T / TCG, c/o Siena Engineering
50 Mall Road – Suite 203
Burlington, MA 01803

David Edgar
781-221-8400

To be contacted for the Pre-construction meeting:

Marie Rose
Director of Project Management
MassDOT
10 Park Plaza, Room 6311
Boston, MA 02116

Katherine F. Watkins, P.E.
Supervising Engineer
Department of Public Works
147 Hampshire Street
Cambridge, MA 02139
Tel: 617-349-4751

Laurence F. Keegan, P.E.
Project Manager
Weston & Sampson
100 Foxborough Boulevard, Suite 250
Foxborough, MA 02035
Tel: (508)-698-3034

For Resident Engineers Reference:

David Shedd
Project Manager
MassDOT
10 Park Plaza
Boston, MA 02116
Tel: (617)-973-7265

The Contractor shall make his own investigation to assure that no damage to existing structures, drainage lines, traffic signal conduits, and other utilities will occur as a result of his operations.

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The Contractor shall notify "Mass. DIG SAFE" and procure a DIG SAFE number of each location prior to disturbing ground in any way.

"DIG-SAFE" Call Center: Telephone 1-800-344-7233

PROTECTION OF UTILITIES AND PROPERTY (Supplementing Subsection 7.13)

The Contractor, in constructing or installing facilities alongside or near sanitary sewers, storm drains, water or gas pipes, electric or telephone conduits, poles, sidewalks, walls, vaults or other structures shall, at his expense, sustain them securely in place, cooperating with the officers and agents of the various utility companies and municipal departments which control them, so that the services of these structures shall be maintained. The Contractor shall also be responsible for the repair or replacement, at his own expense, of any damage to such structures caused by his acts or neglect, and shall leave them in the same condition as they existed prior to commencement of the work. In case of damage to utilities, the Contractor shall promptly notify the utility owner and shall, if requested by the Engineer, furnish labor and equipment to work temporarily under the utility owner's direction in providing access to the utility. Pipes or other structures damaged by the operation of the Contractor may be repaired by the Department or by the utility owner that suffers the loss. The cost of such repairs shall be borne by the Contractor, without compensation therefore.

If, as the work progresses, it is found that any of the utility structures are so placed as to render it impracticable, in the judgment of the Engineer, to do the work called for under this Contract, the Contractor shall protect and maintain the services in such utilities and structures and the Engineer will, as soon thereafter as reasonable, cause the position of the utilities to be changed or take such other actions deemed suitable and proper.

If live service connections are to be interrupted by excavations of any kind, the Contractor shall not break the service until new services are provided. Abandoned services shall be plugged off or otherwise made secure.

Full compensation for furnishing all labor, materials, tools, equipment and incidentals for doing all the work involved in protecting or repairing property as specified in this section, shall be considered included in the prices paid for the various Contract items of work and no additional compensation will be allowed therefore.

WORK IN THE IMMEDIATE VICINITY OF CERTAIN UNDERGROUND STRUCTURES AND UTILITY POLES

Before starting work at existing manholes, the Contractor shall test for gas and blow out the manholes. This shall be considered incidental to the project.

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SCHEDULE OF OPERATIONS (Supplementing Subsection 8.02)

Work hours shall be 7:00 a.m. through 4:00 p.m. Monday through Friday only (except as noted below). No weekend or holiday work shall be allowed except during emergencies.

One travel lane in each direction on Broadway, Ames Street and Third Street shall be maintained at all times.

No work shall occur on City holidays or the Thursday or Friday of Harvard Graduation. A list of the City holidays will be supplied by the city of Cambridge upon awarding of the contract.

PROVISIONS FOR TRAVEL AND PROSECUTION OF THE WORK (Supplementing Subsection 8.03)

Before starting any work under this Contract, the Contractor shall prepare, and submit to the Engineer for approval, a plan (based on the Contract traffic management plans) that indicates the traffic routing proposed by the Contractor during the various stages and time periods of the work and the temporary barricades, signs, drums and other traffic control devices to be employed during each stage and time period of the work to maintain traffic and access to abutting properties.

Particular care shall be taken to establish and maintain methods and procedures that will not create unnecessary or unusual hazards to public safety. Traffic control devices required only during working hour operations shall be removed at the end of each working day.

Signs having messages that are irrelevant to normal traffic conditions shall be removed or properly covered at the end of each work period. Signs shall be kept clean at all times and legends shall be distinctive and unmarred.

DISPOSAL OF SURPLUS MATERIALS

All existing and other materials not required or needed for use on the project, and not required to be removed and stacked, shall become the property of the Contractor and shall be removed from the site during the construction period and legally disposed of. No separate payment will be made for this work, but all costs in connection therewith shall be included in the prices bid for various Contract items.

DRAINAGE

The Contractor shall maintain the drainage system in the project areas to provide continuous drainage of the roadway and construction area.

All drainage castings in new pavement areas shall be installed at base or binder course grade, as directed by the Engineer, and reset to proposed finish surface grade prior to placement of the pavement surface course.

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All pipes and structures installed as part of this Contract shall be left in a clean and operable condition at the completion of the work.

All existing pipes to be abandoned shall be plugged with brick masonry not less than 8 inches in thickness in conformance with the Standard Specifications, Section 201.62.

No separate payment will be made for the maintenance or cleaning of the existing drainage system or for plugging or unplugging of pipes, but all costs in connection therewith shall be included in the unit prices bid for the various Contract items.

DRAINAGE STRUCTURES

Where new pipe is shown on the drawings to be connected into an existing drainage structure to remain, the existing structure shall be first cleaned to remove all mud, debris and other material. The existing structure wall shall be carefully and neatly cored using mechanical means to provide the minimum size opening required for the insertion of the new pipe. The proposed pipe end shall be set or cut off flush with the inside face of the existing structure wall and the remaining space around the pipe completely filled with cement grout for the full thickness of the structure wall.

Existing shaped inverts shall be reconstructed as necessary to provide a smooth and uniform flow channel from the new pipe through the existing structure.

No separate payment will be made for the cost of connecting new pipes into existing structures, cleaning and necessary alterations of existing structures, but all costs in connection therewith shall be included in the unit prices bid for the various pipe items.

MATERIALS AND EQUIPMENT REMOVED AND STACKED

All materials scheduled to be removed and stacked shall be delivered to the DPW maintenance facility or storage yard located at 147 Hampshire Street Cambridge, MA 02139. If the Engineer determines that any part of the stacked materials is unsuitable for re-use, or if the City decides to abandon part or all of such materials, said materials shall become the property of the Contractor and he shall dispose of them outside and away from the limits of the project, without additional compensation.

PROPERTY ACCESS

The Contractor shall provide and maintain access at all times to all properties abutting the work. Final pavement installation on the public ways shall be performed after all other work is finished. The Contractor may be required to install temporary measures (i.e. wood planking) across excavated areas of sidewalk to allow safe access to buildings and/or storefronts. Such measures will require approval from the City of Cambridge and the Engineer prior to installation.

CONCRETE FOUNDATIONS

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Concrete foundations of items to be removed, if not interfering with the proposed construction, may be abandoned in place with written acceptance of the Engineer. Foundations left in place under the roadway surface shall be removed to a depth of three feet (3') below the finished grade; all other foundations left in place shall be removed to a depth of six inches (6") below the finished grade. The top six inches (6") shall be restored to match the existing grade with materials similar in kind to the adjacent materials.

PAVEMENT MARKINGS

All pavement markings on public ways shall be epoxy and meet existing pavement markings at the limit of work. All pavement markings within the limit of work but outside of the limit of full depth reconstruction shall be removed completely.

TREE REMOVAL

Existing trees shown on the plans or directed by the Engineer to be removed that are smaller than 9 inches in diameter shall be considered incidental to the project. The Contractor shall coordinate with the City of Cambridge Tree Warden prior to marking or removal of any trees within the project limits and will not mark or remove any tree within the project limits without approval from the City of Cambridge or MassDOT.

ENVIRONMENTAL PERMITTING

Environmental permits have not been obtained, as no work (either temporary or permanent) is proposed to occur in water or wetland resource areas. If Contractor erection, demolition, storage, or other procedures require work to occur in or otherwise impact water or wetland resource areas, the Contractor is advised that no associated work can occur until all required environmental permits have been obtained. The Contractor must notify the District #6 Highway Director and Resident Engineer in writing at least 60 days prior to desired commencement of the proposed activity. All environmental submittals, including any contact with Local, State, or Federal environmental agencies, must be coordinated through the District #6 Environmental Engineer. The Contractor is expected to fully cooperate with requests for information and provide same in a timely manner. The Contractor is further advised that MassDOT will not entertain a delay claim due to the time required to obtain the environmental permits. As a supplement to Section 7.00 of the Standard Specifications, the Contractor is reminded that no debris of any type shall be allowed to enter water or wetland resource areas, either temporarily or permanently.

BOUNDS

The Contractor shall exercise due care when working around all bounds which are to remain. Should any damage to a bound result from the actions of the Contractor, it shall be replaced and/or realigned by the Contractor as directed by the Engineer. No further compensation will be due the Contractor for the materials and labor required to reestablish the bound in its proper orientation. All bounds, including new bounds as shown on the plans, and bounds replaced or realigned shall be installed by a Land Surveyor registered in the Commonwealth of Massachusetts.

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Bounds shown on the plans to be removed shall be carefully removed and delivered and stacked at the City DPW maintenance facility or storage yard located at 147 Hampshire Street Cambridge, MA 02139 unless otherwise directed. The cost of this work shall be considered incidental to the project.

EXISTING BRICK WALKS

The Contractor will be required to reset or relay existing brick walks. This work will be considered incidental to the project and will include all materials, equipment, tools and labor to complete the work including new bricks as shown on the plans or as directed by the Engineer.

CONTAMINATED SOILS

The Contractor shall be made aware that information on record indicates the possibility that soil within the project limits has been contaminated. Any contaminated soil will have to be removed and disposed of properly as per these specifications.

SHOP DRAWINGS

This shall supplement the appropriate sections of the Standard Specification. When the contractor is submitting any shop drawings, s/he is instructed that any traffic management submittals conform to MUTCD standards, latest edition.

<u>ITEM 102.51</u>	<u>INDIVIDUAL TREE PROTECTION</u>	<u>EACH</u>
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GENERAL

The purpose of this item is to prevent damage to branches, stems and root systems of existing individual trees to remain and to ensure their survival. Provisions under this item include steps to minimize soil and root disturbance and to construct protection measures for trees close to construction areas.

The work under this item shall conform to the relevant provisions of Sections 101 and 771 and the following:

Examination of Conditions

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.

Prior to any construction activities, the Contractor and Arborist shall walk the site with the Engineer and City Tree Warden to identify which trees will require protection and to determine

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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.

Incidental to the cost of these items, the Contractor shall retain the services of a certified arborist, who shall make recommendations as to the specific appropriate treatment of trees within or near the work zone.

SUBMITTALS

Incidental to this item, the Contractor shall provide to the Engineer one (1) copy each of the 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.

Prior to start of work, the Contractor shall submit to the Engineer the name and certification number of the Massachusetts Certified Arborist referenced herein. Cost for Certified Arborist for all activities pertaining to this Item shall be incidental to this item.

MATERIALS

Fence and temporary fence posts shall be subject to the approval of the Engineer.

Fencing for individual plants shall be polyethylene fencing or chain link fence (new or used), as specified under Item 657.51, Temporary Tree Protective Fence contained herein.

Staking for individual tree protection fencing shall be steel posts or 2x4 inch stock as directed and approved by the Engineer.

Wood chips shall conform to provisions of Wood Chip Mulch under Materials Section M6.04.3.

Trunk protection shall be 2x4 inch cladding, at least 8 feet in length, clad together with wire. Trunk protection shall include burlap.

Incidental to these items, the Contractor shall provide water for maintaining plants in the construction area that will have exposed root systems for any period during construction.

CONSTRUCTION METHODS

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. Where

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these activities will occur within 10 Feet of the canopy of trees, the Contractor shall provide Individual Tree Protection as specified herein.

Tree Fencing and Armoring

For individual tree protection, the 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 and place wood chips to a depth of 6 inches on the ground to protect the root systems. The Contractor shall wrap the area of the trunk of the tree with burlap prior to armoring with 2x4 inch cladding. Cladding for tree trunks shall extend from the base of the tree to at least 8 feet from the base.

Where excavation within canopy is unavoidable, the Contractor shall use equipment and methods that shall minimize damage to the tree roots, per recommendations of the Certified Arborist. Such methods may require root pruning prior to, as well as during, any excavation activities.

All fencing, trunk protection, branch protection, and woodchips shall be maintained throughout the duration of the contract. Protective fencing shall be repaired and woodchip mulch replaced as necessary during the duration of the contract at no additional cost.

Cutting and Pruning

Some pruning of roots and branches may be a necessary part of construction. Pruning will be performed on the same side of the tree that roots have been severed.

The Contractor shall retain the services of a Massachusetts State Certified Arborist to oversee any cutting of limbs, stem or roots of existing trees. All cuts shall be clean and executed with an approved tool. Under no circumstances shall excavation in the tree protection area be made with mechanical equipment that might damage the existing root systems.

Any tree root area exposed by construction shall be covered and watered immediately. Exposed tree roots shall be protected by dampened burlap at all times until they can be covered with soil.

Watering

Water each tree within the construction area where work is in progress twice per week until the surrounding soil of each tree is saturated for the duration of construction activities.

Removal of Protection

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 disposed off site by the Contractor at no additional cost.

Tree Damage

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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.

BASIS OF PAYMENT

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 protected and paid for under ITEM 102.51, Individual Tree Protection.

Item payment 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.

Compensation for Individual Tree Protection will be paid for at the contract unit price PER EACH under Item 102.51. This shall include full compensation for all labor, equipment, materials, and incidentals for the satisfactory completion of the work, including the services of a certified arborist, water and fertilizer, and the subsequent removal and satisfactory disposal of the protective materials upon completion of the contract.

Where construction disturbance, such as grading activities, will occur within the limits of the canopy of groups of trees, these trees shall be protected and paid for under ITEM 657.51, TEMPORARY TREE PROTECTIVE FENCE.

Cost of wood chips, as required, shall be incidental to these items.

<u>ITEM 120.1</u>	<u>UNCLASSIFIED EXCAVATION</u>	<u>CUBIC YARD</u>
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Work under this item shall conform to Section 100 of the Standard Specification and the following:

Unclassified Excavation shall include the removal of tree pits, fences, drain pipe, brick walk, and any other items to be removed not covered under other items of work.

<u>ITEM 146.</u>	<u>DRAINAGE STRUCTURE REMOVED</u>	<u>EACH</u>
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The work under this item shall conform to the relevant provisions of Section 140 of the Standard Specifications and the following:

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The removal of accumulated dirt, sediment, refuse, and other debris from drainage structures and drainage pipes or culverts shall be measured for payment under Item 187.32 Removal And Disposal of Drainage System Sediments.

Castings shall be removed only immediately preceding the work and shall be replaced immediately after the cleaning of the structure unless removal of said structure is imminent.

The Contractor is made aware that this work may require machine and hand methods.

Drainage Structure Removed and shall include all labor, tools, equipment, and materials required to do the work as described above, as shown on the plans and as directed by the Engineer.

<u>ITEM 154.99</u>	<u>BIORETENTION SOIL</u>	<u>CUBIC YARD</u>
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The work under these items shall conform to the relevant provisions of Section 150 of the Standard Specifications and the following:

All work under this item shall be for the installation of bioretention soil including furnishing all materials, labor and equipment to construct individual stormwater planters as shown on the plans or as directed by the Engineer.

The contractor shall submit the following items in accordance with the Standard Specifications:

Submit the qualifications of the independent geotechnical testing laboratory performing soil testing and inspection services during earthwork operations. The geotechnical testing laboratory must demonstrate to the Engineer's satisfaction, based on evaluation of laboratory submitted criteria conforming to ASTM D3740, that it has the experience and capability to conduct required field and laboratory geotechnical testing. In addition, the laboratory shall be supervised by a geotechnical engineer who is a Registered Professional Engineer in the Commonwealth of Massachusetts.

Submit the methodology for handling and mixing the Bioretention Soil Mix.

The Contractor shall control the grading in the areas surrounding all excavations so that the surface of the ground will be properly sloped to prevent water from running into the excavated area. Where required, temporary ditches shall be provided for drainage. Upon completion of the work and when directed, all areas shall be restored by the Contractor in a satisfactory manner and as directed.

Materials

Bioretention Soil Mix (BSM) shall consist of a homogeneous mixture (by volume) of 50% Coarse Sand, 25% Topsoil, and 25% wood chips. The BSM shall be a uniform mix, free of stones, stumps, roots or deleterious materials. No other materials or substances shall be mixed with the BSM.

The BSM shall conform to the following:

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- A. **Bioretention Soil Mix (BSM)** shall consist of a homogeneous mixture (by volume) of 50% Coarse Sand, 25% Topsoil, and 25% wood chips. The BSM shall be a uniform mix, free of stones, stumps, roots or deleterious materials. No other materials or substances shall be mixed with the BSM.

The BSM shall conform to the following:

Parameter	Limit	Test Method
pH	5.5 – 7.5	ASTM D4972
Magnesium	> 32 ppm	
Phosphorous (as Phosphate P ₂ O ₅)	< 69 ppm	
Potassium (K ₂ O)	> 78 ppm	
Soluble Salts	< 500 ppm	

- B. Coarse Sand: Coarse sand shall consist of clean inert, hard, durable grains of quartz or other hard durable rock, free from clay, organics, surface coatings or other deleterious material. Coarse sand shall conform to the following gradation:

SIEVE SIZE	NOMINAL PERCENT PASSING BY WEIGHT
½-inch	100
3/8-inch	100
No. 4	80-100
No. 16	50-85
No. 50	5-30
No. 100	0-10
No. 200	0-5

Common fill shall be soil containing no stone greater than 2/3 loose lift thickness. The materials shall be free of trash, ice, snow, tree stumps, roots and other organic and deleterious materials. Common fill shall not contain more than 30 percent by weight of soil material passing the number 200 sieve. It shall be of such a nature and character that it can be compacted to the specified densities in a reasonable length of time. Topsoil and subsoil shall not be considered common fill.

Common fill used as general backfill, daily cover, or final cover shall have a maximum particle size of 3 inches. Nesting of larger particles within common fill layers shall be prevented.

Woodchips used as mixture in BSM shall be from hardwood trees and consist of 2-inch maximum particle size and provide a uniform texture free from sawdust, foreign materials, twigs, leaves and

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any artificially introduced chemical compounds. Wood chips shall have been stockpiled outside for at least six months prior to uses.

Hardwood Mulch used as a filter medium shall consist of the wood from hardwood trees which has been milled and screened to a maximum 4 in. particle size and provide a uniform texture free from sawdust, foreign materials, and any artificially introduced chemical compounds that would be detrimental to plant or animal life.

Immediately prior to placing the underdrain and the BSM, the bottom of the Bioretention facility shall be roto-tilled to depths between 3 and 6 inches.

Should the pH fall outside the acceptable range, the Contractor may, upon approval of the Engineer, modify the BSM with lime (to raise) or iron sulfate plus sulfur (to lower). The lime or iron sulfate shall be mixed uniformly into the BSM prior to placement.

Should the magnesium content of the BSM be lower than the specified amount, it may be modified with magnesium sulfate, which shall be mixed uniformly into the BSM prior to placement.

Should the potassium content of the BSM be lower than the specified amount, it may be modified with potash, which shall be mixed uniformly into the BSM prior to placement.

All testing of the pH of the BSM shall be considered incidental to item 150.99 Bioretention Soil.

Stockpiles shall be neatly trimmed and graded to provide drainage from surfaces and to prevent depressions where water may become impounded. Stockpiles shall be protected and shall not be disturbed.

Backfill Material Selection: Unless otherwise specified or directed, material used for filling and backfilling shall meet the requirements of common fill as above and approved by the Engineer.

1. The BSM shall be placed in horizontal twelve-inch loose lifts to the elevations shown on the drawings. The BSM shall be compacted by saturating the entire area of the bioretention facility after each lift of BSM is placed until water flows from the underdrain. The water for saturation shall be applied by spraying or sprinkling. Saturation of each lift shall be performed in the presence of the Engineer.
2. If the BSM becomes contaminated during the construction of the bioretention facility, the contaminated BSM shall be removed and replaced at no additional cost to the Owner.
9. Final elevations of the BSM shall be performed after a 24-hour settling period. Final elevations shall be within two-inches of the elevations shown on the Drawings.
10. Heavy equipment shall not be used within the perimeter of the bioretention facility before, during or after the placement of BSM.

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11. See Section 700 of the Standard Specifications for planting specifications. Once the plants are in place, the entire bioretention facility shall be mulched to a uniform thickness of 3 inches. Well aged (minimum age of 6 months) shredded hardwood bark mulch is the only acceptable mulch.

After backfilling, the Contractor shall maintain the surfaces of backfill areas in good condition so as to present a smooth surface at all times level with adjacent surfaces. Any subsequent settling over backfilled areas shall be repaired by the Contractor immediately, in a manner satisfactory to the Engineer, and such maintenance shall be provided by the Contractor for the life of this Contract, at no additional expense to the Owner.

The finished subgrade of the fills and filled excavations upon which topsoil is to be placed, shall not be disturbed by traffic of other operations and shall be maintained in a satisfactory condition until the finished courses are placed. The storage or stockpiling of materials on finished subgrade will not be permitted.

Uniformly smooth grading of all areas to be graded, as indicated and as directed, including excavated and filled sections, embankments and adjacent transition areas, and all areas disturbed as a result of the Contractor's operations, shall be accomplished. The finished surfaces shall be reasonably smooth, compacted and free from surface irregularities.

BIORETENTION SOIL MIX MANUFACTURE AND STOCKPILING:

The components for the Bioretention Soil Mixture (BSM) shall be stored and stockpiled at a location within the Project Area to be provided by the Owner.

Upon acceptance by the Engineer the BSM shall be manufactured in accordance to the procedure submitted and accepted by the Engineer.

The BSM shall be stored in a designated stockpile at the site. Only BSM from this designated stockpile shall be used in the Bioretention Cells (Rain Gardens).

BASIS OF PAYMENT

Payment under this item shall be by the cubic yard of material as installed.

<u>ITEM 180.11</u>	<u>HEALTH AND SAFETY PLAN</u>	<u>LUMP SUM</u>
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It is the Contractor's ultimate responsibility to ensure the health and safety of all the Contractor's employees and subcontracting personnel, the Engineer and his representatives, and the public from any on-site chemical contamination.

A Health & Safety Plan (HASP) shall be prepared by a Certified Industrial Hygienist or other experienced individual with the appropriate training required by OSHA to prepare such a plan, and it shall include the components required by OSHA 29 CFR 1910.120(b). The preparer's name and work experience shall be included as part of the Health and Safety Plan submittal. The HASP must

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be stamped by a Certified Industrial Hygienist certifying that it complies with all applicable laws, regulations, standards and guidelines, and that it provides a degree of protection and training appropriate for implementation on the project during the execution of this contract.

The HASP shall be designed to identify, evaluate, and control health and safety hazards associated with the work on this project and provide for emergency response if needed. The HASP 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. Health and safety procedures provided by the Contractor shall comply with all the appropriate regulations that address employee working conditions (e.g. OSHA, RCRA, CERCLA). In addition, guidelines of NIOSH, OSHA, USCG, EPA, etc., shall be followed. Equipment used for the purpose of health and safety shall be approved and meet pertinent standards and specifications of the appropriate regulatory agencies.

A copy of the Health and Safety Plan 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 Department, Contractor and subcontractors. The employee's signature on the Health and Safety Plan shall be deemed prima facie evidence that the employee has read and understands the plan. A copy of the plan with signatures shall be submitted to the Engineer at the conclusion of the Contract, or at the Engineer's request. Signature sheets shall be submitted monthly, or at the request of the Engineer.

BASIS OF PAYMENT

The work to be done under this Item shall be paid at the Contract Lump Sum Price under Item 180.1 for the development and preparation of the HASP by a qualified individual.

ITEM 180.2 IMPLEMENTATION OF HEALTH AND SAFETY PLAN HOUR

For all construction activities which require handling or exposure to potentially hazardous materials, the Health and Safety Plan shall specify an on-site Safety Officer. The Site Health and Safety Officer duties shall include, but are not limited to: implementation of the site Health and Safety Plan, training, evaluating risks, safety oversight, determining levels of personnel protection required, and performing any required monitoring at the site. A Daily Log shall be kept by the on-site Safety Officer and provided weekly to the Engineer. This log shall be used to record a description of the weather conditions, levels of personnel protection being employed, monitoring data and any other information relevant to on-site safety conditions. The Site Health and Safety officer shall sign and date the Daily Log.

In the event that subsurface contamination is discovered during construction, the Site Safety Officer shall be present to oversee all handling, storage, sampling, and transport of such contaminated materials.

The level of protection, relative to respiratory and dermal hazards, required to ensure the health and safety of on-Site personnel will be stipulated in the Health and Safety Plan and will be subject to modification by the on-site Safety Officer based on changing site and weather conditions and the following factors: type of operation or activity, chemical compounds identified on-site,

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concentration of the chemicals, physical state of the hazardous materials, potential duration of exposure to hazardous materials, dexterity required to perform work, decontamination procedures, necessary personnel and equipment, and type of equipment to be utilized.

The Contractor shall be required to provide appropriate personnel protective equipment for anyone who is working in an area either containing or suspected of containing a hazardous environment. This work will include both individuals physically working in these areas and those directing the work of same. Contingencies for upgrading the level of protection for on-site workers will be identified in the Health and Safety Plan and the contractor shall have the necessary materials/equipment on hand to implement the level of protection upgrade in a timely manner. Payment for this level of upgraded protection shall be paid for under Item 180.2.

BASIS OF PAYMENT

Implementation of the Health and Safety Plan will be paid at the contract bid price per hour of implementing the plan and shall include the cost of enforcement by an on-site Safety Officer. Personnel protective clothing and equipment below Level "C" shall be considered incidental to the project and shall be a cost borne by the contractor.

ITEM 180.3 PERSONNEL PROTECTION LEVEL C UPGRADE HOURS

The Contractor shall provide to all workers disposable, protective clothing appropriate to the hazard level of the work. The protective equipment and its use shall be in strict compliance with the Health and Safety Plan (Item 180.1), and all appropriate regulations that address employee working conditions.

BASIS OF PAYMENT

Payment for Item 180.3 will be at the contract unit price, per, per man, required in level 'C' personnel protection.

ITEM 180.4 MONITORING / HANDLING AND CUBIC YARD **STOCKPILING OF CONTAMINATED SOILS**

The On-Site Safety Officer or Environmental Consultant shall be responsible for evaluating soil with non-natural discoloration, petroleum or chemical odor, the 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 contaminated with oil or hazardous materials. Soil suspected of gasoline contamination shall be field tested using the jar headspace procedures according to Department of Environmental Protection Bureau of Waste Site Cleanup Interim Policy #WSC-94-400 (Remedial Waste Management Policy for Petroleum Contaminated Soil) and the Bureau of Waste Prevention Policy #COMM-97-001 (Reuse and Disposal of Contaminated Soil and Massachusetts Landfills). The Engineer shall be contacted immediately when any results indicate contamination requiring soil removal or when contamination not detectable by on-site instrumentation is suspected.

The Contractor shall be required to supply all personnel and materials necessary to comply with this section and to support the anticipated levels of protection and monitoring described above.

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Within limited areas of the project site, it is likely that excavated soils may be contaminated. Where possible, all soils originally in contact with groundwater will be replaced in the same trench up to the existing groundwater level. All soils determined to be contaminated by metals or petroleum products, through the monitoring/evaluation program will be stockpiled for disposal in accordance with all Massachusetts Department of Environmental Protection statutes, policies, and regulations.

The Environmental Consultant/Contractor shall be responsible for identifying a disposal/recycling facility and obtaining all permits, approvals, Bill of Lading, etc. prior to the removal of the contaminated soil from the site. Any soils contaminated with hazardous materials that are not of petroleum origin shall be handled on a case-by-case basis. The contractor shall obtain at least three bids for the handling and disposal of any contaminated material. All manifest, bills of lading, etc. will be the responsibility of the Contractor with copies provided to the Department. The Contractor is also responsible for hiring an Licensed Site Professional (LSP), as needed, for oversight and Bills of Lading, etc.

METHOD OF MEASUREMENT

Measurement shall be made by the volume, in cubic yards, of contaminated material monitored, handled and/or stockpiled as described under Item 180.4.

BASIS OF PAYMENT

Work under this Item shall be paid at the Contractor bid price, per cubic yard, which payment shall be considered compensation for all labor, tools, equipment and materials needed to do the work as described above.

<u>ITEM 180.5</u>	<u>LICENSED SITE PROFESSIONAL</u>	<u>HOUR</u>
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A Licensed Site Professional will be required to provide the services necessary to comply with the requirements of the Massachusetts Contingency Plan (MCP), 310 CMR 40.000, with respect to the scope of work for this Contract. These services will include, but are not limited to, sampling and analysis of potentially contaminated media, preparation of IRA, URAM and RAM Plans, status reports, transmittal forms, release notification forms, completion statements and related documents required pursuant to the MCP. The LSP will be responsible for obtaining all permits related to the characterization, treatment, and disposal of contaminated media. The LSP will provide oversight of handling, stockpiling, re-use, treatment and disposal of contaminated media, including preparation of Bills of Lading, Manifests, and related shipping documents. Environmental technicians, including but not limited to personnel conducting field monitoring and sampling, data interpretation and support services directly related to MCP compliance, are also included in this Item.

The name and qualifications of the Licensed Site Professional (LSP) will be submitted to the Engineer for review and approval at least two weeks prior to initial site activities. The LSP shall have significant experience in the oversight of MCP activities at active construction sites. The LSP will coordinate all activities with MassDOT and the Massachusetts Department of Environmental Protection through the Engineer or his/her designee.

The LSP will be responsible for adequately characterizing contaminated media to insure that it meets the requirements of the MCP and, in the case of contaminated media to be disposed of off-

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site, to insure that it meets the acceptance criteria set forth by the disposal facility. The LSP will be responsible for adequately characterizing subsurface conditions prior to backfill in areas where contaminated soils / sediments are excavated. The cost of laboratory analyses conducted in accordance with the sampling and assessment requirements for compliance with the MCP will be paid for within the unit bid price for Item 180.6 – Monitoring/ Handling and Stockpiling of Contaminated Soils, Item 180.6 – Soil Tests, and Item 181.1 – Disposal of Contaminated Soil.

Work under this Item shall be paid at the Contractor bid price per hour of service provided to perform the work as described above. The bid price shall reflect the cost of the LSP and any environmental technicians providing the services described above.

ITEM 180.6 MISCELLANEOUS SOIL TESTING EACH

The work under this item shall conform to all relevant provisions of the Standard Specifications, the Special Provisions and the following:

The Engineer may, from time to time, direct the Contractor to obtain soil samples from various locations within the project area and to perform laboratory analyses on those soil samples to assess reuse or disposal options.

Sampling and Analysis

The Contractor shall collect discrete soil sample(s) from locations within individual soil piles or specific land area identified by the Engineer. The soil samples shall be collected at a depth specified by the Engineer. The samples shall be delivered to a Massachusetts certified laboratory using proper chain-of-custody documentation for the analysis of Resource Conservation and Recovery Act (RCRA) 8 metals, polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, polyaromatic hydrocarbons (PAHs) and total petroleum hydrocarbons (TPH). Subsequent testing, depending upon initial results, may be required for Toxicity Characteristic Leaching Procedure (TCLP) analyses (Method 1311) for metals.

Data Evaluation and Report

The Contractor shall review and summarize the laboratory data from the soil sampling analyses. The data will be compared to Massachusetts Contingency Plan (MCP) soil standards and acceptance criteria for soil recycling and landfill disposal facilities. A letter report shall be delivered to the Engineer outlining the soil sampling methods, laboratory analyses results and proposed options for reuse or disposal of the soil.

METHOD OF MEASUREMENT

Miscellaneous Soil Testing shall be measured by each round of samples collected, tested and reported to the Engineer. A round of samples shall include a total of three samples.

ITEM 181.1 DISPOSAL OF CONTAMINATED SOILS TON

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The contractor shall be responsible for the proper disposal or recycling of contaminated soils. The proper methods of disposal and recycling of contaminated soils shall comply with the methods described under Item 180.4 and in accordance with all Massachusetts Department of Environmental Protection and Environmental Protection Agency statutes, policies, and regulations. The following are disposal options for contaminated soils. MassDOT prefers methods involving recycling options.

DIRECTLY LANDFILLED HAZARDOUS WASTE
TREATED AND LANDFILLED HAZARDOUS WASTE
INCINERATED HAZARDOUS WASTE DISPOSAL OF SPECIAL WASTE SOIL
PETROLEUM CONTAMINATED SOIL RECYCLED AT ASPHALT BATCH FACILITY
USED AS DAILY COVER AT A LINED LANDFILL

METHOD OF MEASUREMENT

Measurement shall be made by the weight, in tons, of contaminated material removed from the site and delivered to an approved landfill, disposal facility, or recycling facility, and includes any costs for approvals, permits, testing, transportation and disposal.

BASIS OF PAYMENT

The work under the appropriate method shall be paid at the contractor's unit bid price, per ton, which payment shall be considered full compensation for all labor, tools, equipment, permits, shipping papers and materials required to do the work as described above.

<u>ITEM 187.32</u>	<u>REMOVAL AND DISPOSAL</u>	<u>CUBIC YARD</u>
<u>OF DRAINAGE SYSTEM SEDIMENTS</u>		

The work shall consist of the removal of accumulated dirt, sediment, refuse, and other debris from drainage structures and drainage pipes or culverts as directed by the Engineer.

The material removed from the drainage system or structure shall be transported immediately to the place of disposal in machines or trucks that will not spill the material along the roadway. Any material that spills onto the roadway from delivery trucks shall be removed at the Contractor's expense.

A hydraulic lift truck should be used during drainage system cleaning operations so that after sufficient material is loaded onto the truck, the truck can then be elevated so any free flowing liquid may drain back into the drainage structure. Material must arrive at the disposal facility sufficiently dry to pass the "Paint Filter Liquids" test (or no liquid drips from it when a handful is taken and squeezed).

All material removed from the drainage system shall be properly handled and disposed of by the Contractor, and this must be accomplished in accordance with all DEP regulations, policies and guidance. The Contractor is solely responsible for the proper handling and disposal of the material. The Contractor is reminded that drainage system cleanings are classified as a solid waste by the

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MDEP and may be disposed of at any landfill that is permitted by MDEP to accept solid waste. However, materials containing free flowing liquids are prohibited from being accepted at landfills.

It is anticipated that a majority (if not all) of sediments extracted from drainage systems on this project will be taken to a landfill, the Contractor should be aware that most landfills will require testing and analysis of this material prior to acceptance for disposal at their facility. In the event that test results indicate the presence of contaminants that cannot be disposed at landfills, the Contractor shall be responsible for all costs associated with adhering to special regulations regarding disposal of hazardous waste.

Removal and Disposal of Drainage System Sediments will be measured for payment at the contract price per cubic yard, which price shall include all labor, tools, equipment, approvals, permits, testing and transportation of material removed from existing drainage systems as shown on the plans or as directed by the Engineer.

ITEM 201.99	HDPE CATCH BASIN	EACH
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The work under this item shall conform to the relevant provisions of Section 200 of the Standard Specifications and the following:

The contractor shall provide all material, labor, tools, equipment and transportation to complete this item.

Drainage structures shall be installed in the quantities and locations identified on the Contract Drawings. Work shall also include the installation and connection of all required storm drainage pipe outlets and inlets. This shall be considered incidental to the item.

HDPE drainage structures shall be of the inline drain type as indicated on the contract drawings and referenced within the contract specification. Ductile iron grates for each of these fittings are to be used. These HDPE catch basins shall be manufactured from PVC pipe stock. The drainage pipe connection stubs shall be manufactured from PVC pipe stock and formed to provide a watertight connection with the specified pipe system. The joint tightness shall conform to ASTM D3212 for joints or drain and sewer plastic pipe using flexible elastomeric seals. The pipe bell spigot shall be joined to the inline drain body by use of the swage mechanical joint. The pipe stock used to manufacture the inline drain body and pipe bell spigot of the surface drainage inlets shall meet the mechanical property requirements for fabricated fittings as described by ASTM D3034, Standard for Sewer PVC Pipe and Fittings; ASTM F1336, Standard for PVC Gasketed Sewer Fittings.

The grates furnished for all surface drainage inlets shall be ductile iron. Metal used in the manufacture of the castings shall conform to ASTM A536 grade 70-50-05 for ductile iron.

Measurement

HDPE Catch Basins shall be measured for payment per each installed.

Payment

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Payment for Item 201.99 HDPE Catch Basins will be by the each as measured on the plan. The contractor shall provide all grates, excavation, backfill, material, labor, tools, equipment and transportation to complete this item.

ITEM 222.2 FRAME AND GRATE (OR COVER) MUNICIPAL STANDARD EACH

The work under this item shall conform to the relevant provisions of Section 200 of the Standard Specifications and the following:

Frame and Grate (or Cover) Municipal Standard will be measured by the each.

Payment for Item 222.2 Frame and Grate (or Cover) Municipal Standard will be by the each as shown on the plans or as directed by the Engineer.

**ITEM 223.1 FRAME AND GRATE (OR COVER) EACH
REMOVED AND STACKED**

The work under this item shall conform to the relevant provisions of Section 201 of the Standard Specifications and the following:

Frame and Grate (Or Cover) Removed and Stacked will be measured for payment by the each.

Payment for Item 223.1 Frame and Grate (Or Cover) Removed and Stacked will be by the each as shown on the plans or as directed by the Engineer.

ITEM 225.52 TRAP AND HOOD MUNICIPAL STANDARD EACH

The work under this item shall conform to the relevant provisions of Section 200 of the Standard Specifications and the following:

The Trap and Hood Municipal Standard shall be the “Eliminator” by Ground Water Rescue, INC. of Quincy MA or approved equal.

Trap and Hood Municipal Standard will be measured for payment by the each.

**ITEM 250.06 6 INCH POLYVINYL CHLORIDE SANITARY FEET
SEWER PIPE**

The work under this item shall conform to the relevant provisions of Section 230 of the Standard Specifications and the following:

This section covers the furnishing, handling, hauling, laying, jointing, testing, and disinfecting of all polyvinyl chloride (PVC) pipe, fittings, and appurtenant work as indicated on the drawings and as specified herein.

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All pipe and fittings shall be inspected and tested at the factory as required by the standard specifications to which the material is manufactured. The Contractor shall furnish in duplicate to the Engineer sworn certificates of such tests.

In addition, the City of Cambridge reserves the right to have any or all pipe, fittings, and special castings inspected and/or tested by an independent service at either the manufacturer's plant or elsewhere. Such inspection and/or tests shall be at the Contractor's expense.

A. The following standards form a part of this specification as referenced:

American Society for Testing and Materials (ASTM)

ASTM D1784 Specification for Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPVC) Compounds

ASTM D2241 Specification for Polyvinyl Chloride (PVC) Pressure-Rated Pipe (SDR-Series)

ASTM D2321 Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe

ASTM D3139 Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

ASTM F477 Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

PRODUCTS

PVC pressure pipe from 1 1/2-inch through 3-inch shall be designed and manufactured in accordance with ASTM D2241; 4-inch through 12-inch to AWWA C900; and 14-inch through 36-inch to AWWA C905, using materials which conform to ASTM D1784.

Unless otherwise indicated or specified, PVC pressure pipe from 1 1/2-inch through 3-inch shall be pressure class [160 (SDR 26)] [200 (SDR 21)] and from 4-inch through 12-inch shall be pressure class [100 (DR25)] [150 (DR18)].

Pipe shall be homogeneous throughout; free from voids, cracks, inclusions, and other defects; as uniform as commercially practicable in color, density, and other physical properties.

Pipe surfaces shall be free from nicks, scratches, and other blemishes. The joining surfaces of pipe spigots and of integral-bell and sleeve-reinforced bell sockets shall be free from gouges and other imperfections that might cause leakage at joints.

JOINTS:

Push-on joints for PVC pressure pipe shall conform to ASTM D3139 and F477.

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Where so indicated, pipe and fittings shall be furnished with approved thrust restraining appurtenances to keep the piping from pulling apart under pressure.

FITTINGS:

PVC fittings shall be used for pipe sizes 1-1/2-inch through 3-inch.

PVC fittings, conforming to AWWA C907 shall be used for pipe sizes 4-inch through 8-inch.

Pressure classification of fittings shall be at least equal to that of the pipe with which they are used.

Gaskets shall be of a composition suitable for exposure to the liquid within the pipe.

EXECUTION

INSPECTION BEFORE INSTALLATION:

Pipes and fittings shall be subjected to a careful inspection and a hammer test just before being laid or installed.

HANDLING AND CUTTING:

Every care shall be taken in handling and laying pipe and fittings to avoid damaging the pipe, and scratching or marring surfaces.

Any fitting or pipe showing a crack or which has received a severe blow that may have caused an incipient fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work site.

In any pipe showing a distinct crack and in which it is believed there is no incipient fracture beyond the limits of the visible crack, the cracked portions, if so approved, may be cut off by and at the expense of the Contractor before the pipe is laid so that the pipe used will be perfectly sound. The cut shall be made in the sound barrel at a point at least 12 inches from the visible limits of the crack.

All cutting of pipe shall be done with a machine suitable for cutting PVC pipes. Cut ends shall be beveled when recommended by the pipe manufacturer.

INSTALLATION:

PIPE AND FITTINGS:

No defective pipe or fittings shall be laid or placed in the piping, and any piece discovered to be defective after having been laid or placed shall be removed and replaced by a sound and satisfactory piece.

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Each pipe and fitting shall be cleared of all debris, dirt, etc., before being laid and shall be kept clean until accepted in the complete work.

Pipe and fittings shall be laid accurately to the lines and grades indicated on the drawings or as required. Care shall be taken to ensure good alignment both horizontally and vertically.

In buried pipelines, each pipe shall have firm bearing along its entire length.

If the pipe is to be installed in a curvilinear configuration using pipe bending, or pipe must have slight changes in direction using joint deflection, the Contractor is to follow the installation guide provided by the manufacturer. Under no circumstances shall the pipe be curved or the joints offset more than the maximum limits provided by the manufacturer.

Pipe shall be installed underground in a manner that will ensure that external loads will not subsequently cause a decrease of more than 5 percent in the vertical cross-section dimension (deflection). When installing the pipes, they shall be rotated 180 degrees so that the upper quadrant of the pipe that was exposed to direct sunlight will not be backfilled upon.

At all times when pipe laying is not actually in progress, the open ends of pipe shall be closed by temporary water-tight plugs or by other approved means. If water is in the trench when work is resumed, the plug shall not be removed until all danger of water entering the pipe has passed.

BASIS OF PAYMENT

The work under is item shall be paid at the contractor's unit bid price, per linear foot, which payment shall be considered full compensation for all labor, tools, equipment, permits, shipping papers and materials required to do the work as described above.

<u>ITEM 269.06</u>	<u>6 INCH SLOT PERFORATED CORRIGATED</u>	<u>FEET</u>
	<u>PLASTIC PIPE (SUBDRAIN)</u>	

The work under this item shall conform to the relevant provisions of Section 230 of the Standard Specifications and the following:

This section includes furnishing all material, labor and equipment and installing polyethylene drainage pipe and fittings with synthetic protective wrap, as shown on the drawings and as specified herein.

The following standards form a part of these specifications as referenced:

American Society for Testing and Materials (ASTM)

ASTM D 1557	Standard Test Methods for Moisture-Density Relations of Soils and Soil - Aggregate Mixtures Using 10-lb. Rammer and 18-inch Drop.
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ASTM	D 2321	Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.
ASTM	F405	Standard Specification for Corrugated Polyethylene Pipe and Fittings.
ASTM	F667	Standard Specification for Large Diameter Corrugated Polyethylene Pipe and Fittings.

American Association of State Highway and Transportation Officials (AASHTO).

AASHTO	M252	Corrugated Polyethylene Drainage Tubing.
AASHTO	M294	Corrugated Polyethylene Pipe, 12 to 36 inch diameter.

DELIVERY, STORAGE AND HANDLING:

Pipe shall be packaged to withstand shipment without damage and handled carefully on arrival at job site. Pipe shall be stored so that it is not exposed to sunlight.

PRODUCTS

This Section applies to high density polyethylene corrugated pipe with an integrally formed smooth interior. It is applicable to nominal sizes 4 through 36 inch diameter.

The nominal size for the pipe and fittings is based on the nominal inside diameter of the pipe.

The pipe and fittings shall be free of foreign inclusions and visible defects. Fittings may be either molded or fabricated. Fittings supplied by manufacturers other than the supplier of the pipe shall not be permitted without the approval of the Engineer. The ends of the pipe shall be cut squarely and cleanly so as not to adversely affect joining.

When perforated pipe is specified, the perforations shall be cleanly cut so as not to restrict the inflow/outflow of water and uniformly spaced along the length and circumference of the pipe. Dimensions of the perforations shall be as stated in AASHTO M252.

Joints shall be made with split couplings, corrugated to engage the pipe corrugations, and shall engage a minimum of 4 corrugations, 2 on each side of the pipe joint. Where required by the Engineer, a neoprene gasket shall be utilized with the coupling to provide a soil-tight joint.

Pipe sizes 4 through 10 inch shall conform to AASHTO M252.

Pipe sizes 4 through 6 inch shall conform to ASTM F405. SYNTHETIC PROTECTIVE WRAP:

Provide a synthetic protective piping wrap that will admit fine silt and clay and retain sands and coarse silts.

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The synthetic protective wrap shall have the following characteristics:

1. Non-toxic, non-irritating.
2. Inert in soil.
3. Non-biodegradable.
4. Resist alkalis and acids.
5. Not affected by freezing or thawing.
6. Air permeability shall be a minimum of 500 cubic feet per minute per square foot.

INSTALLATION:

The pipe shall be installed as shown on the drawings and in accordance with the requirements of ASTM D2321.

Installation of pipe and protective wrap shall be per the manufacturer's recommendations as approved by the Engineer.

If protective wrap is not scheduled for immediate installation, the Contractor shall protect the pipe from sunlight ultra violet rays.

Backfill shall be as shown on plans.

Backfill material shall be compacted to 95 percent of maximum density according to ASTM D 1557.

BASIS OF PAYMENT

The work under is item shall be paid at the contractor's unit bid price, per linear foot, which payment shall be considered full compensation for all gravel, backfill, labor, tools, equipment, permits, shipping papers and materials required to do the work as described above.

<u>ITEM 376.</u>	<u>HYDRANT</u>	<u>EACH</u>
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<u>ITEM 376.3</u>	<u>HYDRANT – REMOVED AND STACKED</u>	<u>EACH</u>
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The work under these items shall conform to the relevant provisions of Section 300 of the Standard Specifications and the following:

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The work shall include the furnishing and installation of all materials required to replace the existing hydrants where shown on the plans or as directed by the Engineer. The work shall also include the capping the end of existing iron pipe once the existing hydrant and connection pipe from valve (to remain) is removed.

Approval of Materials

The Contractor shall submit the names of the material suppliers to the Engineer for approval prior to ordering any materials.

Pipe and Fittings

Pipe shall be ductile iron, Class 52, conforming to ANSI A21.50 and ANSI A21.51.

Fittings shall be ductile iron, Class 250 minimum, conforming to applicable ANSI, NEWWA, and AWWA specifications.

Pipe and fittings shall have a cement mortar lining and bituminous seal coat on the inside and a coal tar enamel coat on the outside in accordance with ANSI A21.4 (AWWA C104) and ANSI A21.6 (AWWA C106), as amended, except that the cement mortar lining shall be 1/8-inch in thickness for pipe 2 inches to 12 inches in diameter.

Pipe shall be either the rubber-ring type push-on joint pipe.

Rubber gaskets for push-on joints shall conform to ANSI A21.11.

Pipe shall be supplied in lengths not exceeding 20 feet. Each pipe and fitting shall have the initials of the manufacturer's name and the year cast stamped or cast into the metal.

Hydrants

Hydrants shall be as manufactured by Kennedy - The Guardian; American Darling Corp. - Model B-62-B; or U.S. Pipe and Foundry Co. - The Metropolitan; or approved equal. The hydrant shall conform to the "Standard" Specifications for Fire Hydrants for Ordinary Water Works Service," AWWA C502 and the following:

Hydrants shall be according to manufacturer's standard pattern of standard size and shall have one 4-1/2-inch pumper nozzle and two 2-1/2-inch hose nozzles.

Hydrant inlet connections shall have mechanical joints for 6-inch ductile iron pipes.

Hydrant valve opening shall have an area at least equal to the area of a 5-1/4-inch diameter circle and be obstructed only by the valve rod. Each hydrant shall be able to deliver 500 gallons per minute through its two 2-1/2-inch hose nozzles when opened together with a loss of not more than 2 psi in the hydrant.

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Each hydrant shall be designed for installation in a trench that will provide 5 feet of cover. Hydrant extension shall be as manufactured by the company furnishing the hydrants and of a style appropriate for the hydrants as furnished.

Hydrants shall be hydrostatically tested as specified in AWWA C502.

All nozzle threads shall be American National Standard.

Hydrant operating nut shall be AWWA Standard pentagonal type measuring 2-1/2 inches point to flat.

Hydrants shall be equipped with "O" ring packing.

Each nozzle cap shall be provided with a Buna N rubber washer.

Hydrants shall be so arranged that the direction of outlets may be turned 90 degrees without interference with the drip mechanism and without the mechanism obstructing the discharge from any outlet.

A bronze or rustproof steel nut and check nut shall be provided to hold the main hydrant valve on its stem.

Hydrants shall open by turning an operating nut to left (counterclockwise) and must be marked with an arrow and word "OPEN" to indicate the direction to turn stem to open hydrant.

All iron work to be set below ground shall be thoroughly cleaned and painted with two coats of asphalt varnish specified in AWWA C502, and iron work to be exposed above ground shall be shop painted with two coats of paint of quality and color conforming to the present Town standard.

Each hydrant shall be designed such that the hydrant valve closes with line pressure preventing loss of water and consequent flooding in the event of traffic damage.

Each hydrant shall be furnished with a steel chair holder, double steel hose cap chain, steel pumper cap chain and any other hooks or appurtenances required for proper use.

Pipe Installation

The Contractor shall make all necessary arrangements with the City of Cambridge Water and Fire Department for the necessary shutdown or bypass of service.

The City of Cambridge Water Department may establish the time of shutdown to be within the normal daily low demand period.

Care shall be taken in loading, transporting, and unloading to prevent injury to the pipes or coatings. Pipe and fittings shall not be dropped. All pipe or fittings shall be examined before laying and no piece shall be installed which is found to be defective. Any damage to the pipe

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coatings shall be repaired as directed by the Engineer. Any pipe found to be defective, before or after laying, shall be satisfactorily removed and replaced with sound pipe at no additional cost to the Owner.

All pipe and fittings shall be installed in conformance with AWWA Standard Specifications C600, except as otherwise provided herein. All pipe and fittings shall be sound and clean before laying and shall be laid on a shaped bedding providing uniform, firm support over the entire length of each section barrel. **BLOCKING WILL NOT BE PERMITTED.** The select bedding material shall be placed and tamped along the sides of the pipe to complete the bedding.

Pipe shall be laid with good alignment and at a uniform 5-foot depth to top of pipe below proposed grade except where extra depth is required to clear other utilities and to connect to existing pipes, valves or fittings. Joint deflection shall not exceed that recommended by the manufacturer. Additional fittings shall be furnished and installed as required to cross existing utilities. Solid sleeves shall be used only where approved by the Engineer.

When pipe laying is stopped for any length of time, including short periods, the open ends of the pipe and fittings shall be closed with a watertight plug or cap.

Necessary pipe cutting shall be accomplished by power saw and shall leave a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be used with a push-on bell shall be beveled to conform to the manufactured spigot end. Cement lining shall be undamaged.

Push-on joints shall be made in strict accordance with the manufacturer's instructions. The rubber gasket shall be inserted in the groove of the bell end of the pipe, the joint surfaces cleaned and lubricated. The plain end of the pipe to be entered shall then be inserted in alignment with the bell of the pipe to which it is to be joined and pushed home with a jack or by other means. After jointing the pipe, a metal feeler shall be used to make certain that the rubber gasket is correctly located.

Hydrants

Hydrants shall be set at the locations shown on the drawings, or as directed by the Engineer, and bedded on a firm foundation. A drainage pit 2 feet 6 inches in diameter shall be filled with 3/4-inch crushed stone and satisfactorily compacted. Additional stone shall be brought up and around 6 inches over the drain ports. Each hydrant shall be set in true vertical alignment and properly braced. A concrete thrust block shall be placed between the back of the hydrant inlet and undisturbed soil at the end of the trench. Felt roofing paper shall be placed around hydrant elbow before placing concrete. Care shall be taken to insure that concrete does not plug the drain ports. Hydrant paint shall be touched up as required after installation.

Concrete Thrust Blocks

Concrete thrust blocks shall be installed at all tees, bends, plugs, caps, tapping sleeves and other locations as directed by the Engineer in accordance with the dimensions and details shown on the plans.

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The back of thrust blocks shall be placed against undisturbed earth and the sides shall be formed. Felt roofing paper shall be placed to protect pipe joints. Concrete shall not be placed over bolts or nuts, or in a manner, which prevents the removal of joints.

Concrete shall be Class C (3,000 psi, 1-1/2 in., 470 lb.) or better.

Concrete shall be considered incidental to the item.

Testing

The Contractor shall provide all necessary equipment and conduct hydrostatic pressure and leakage tests on the new water system installed under the Contract in conformance with AWWA 600, the regulations of the Massachusetts State Board of Health and the following:

The water system shall be subjected to a hydrostatic pressure of 200 psi and this pressure shall be maintained for at least one hour. The leakage test shall be conducted at a pressure of 150 psi and this pressure shall be maintained for at least two hours.

Permitted leakage shall conform to AWWA C600. Leaks exceeding this standard shall be located and all defective pipe, fittings, pipe joints, valves and other material removed and replaced with new material to correct the leak, as directed by the Engineer, at no additional cost to the Owner.

All testing shall be done in a manner, which prevents the entrance of contaminated water or pollutants into the existing water system.

Disinfection

After completion of testing, and any necessary leak repairs, the new water system shall be chlorinated in conformance with AWWA C601. The procedure and location of chlorination and sampling points shall be approved by the Engineer before beginning disinfection.

Immediately prior to disinfection, the system shall be flushed at the maximum velocity can be developed, but not less than 2.5 feet per second. All flushing shall be done in the presence of the Engineer and wastewater shall be directed into the drainage system.

Chlorine shall be introduced into the system in a dosage which provides a minimum concentration of 50 parts per million of available chlorine. The chlorine solution shall remain in the system for at least 24 hours and the residual chlorine concentration in any portion of the system after this period shall not be less than 25 parts per million.

During disinfection, all valves and hydrants shall be operated to insure that all appurtenances are disinfected.

Following disinfection, the chlorine solution shall be flushed from the system and the system refilled. The Town will take samples and tests for bacteriologic quality and the absence of coliform

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organisms. The Contractor will be required to rechlorinate, if necessary, and the lines shall not be placed in service until the requirements of the City and State Board of Health are met.

Measurement and Payment

Item 370.4, 376 and 376.3 will be measured and paid for at the respective Contract unit price per each, complete in place, which price shall include all labor, material, equipment and incidental costs required to complete the work.

No separate payment will be made for excavation, new ductile iron pipe, concrete thrust blocks, gravel borrow and crushed stone bedding, backfill, insulation, testing and disinfection, but all costs in connection therewith shall be included in the unit prices bid for the respective items including fittings.

No separate payment will be made for the removal, transporting and stacking of existing salvaged materials including existing ductile or cast iron pipe, but all costs in connection therewith shall be included in the unit prices bid for the respective items.

<u>ITEM 415.</u>	<u>PAVEMENT MICROMILLING</u>	<u>SQUARE YARD</u>
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Item 415 – Pavement Micromilling shall conform to the same requirements for Section 130 Pavement Milling within Section 450.

Description

415.20 General.

This work shall consist of micromilling and removal of existing Hot Mix Asphalt (HMA) pavement courses from the project by the Contractor. Micromilling shall be performed in conformity with the approved QC Plan. The Contractor shall present and discuss in sufficient detail the Quality Control information and activities related to milling at the Construction Quality Meeting required under Section 450. Unless otherwise specified, the milled material shall become the property of the Contractor.

Construction Procedures

415.60 General.

All construction procedures under Pavement Micromilling shall also conform to any of the following relevant provisions of Pavement Milling:

Milling Equipment Requirements.

The milling equipment shall be self-propelled with sufficient power, traction, and stability to remove the existing HMA pavement to the specified depth and cross-slope. The milling machine

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shall be capable of operating at a minimum speed of 10 feet (3 meters) per minute, designed so that the operator can at all times observe the milling operation without leaving the control area of the machine, and equipped with the following:

- (a) A built in automatic grade control system that can control the longitudinal profile and the transverse cross-slope to produce the specified results.
- (b) Longitudinal controls capable of operating from any longitudinal grade reference, including string line, 30 foot (10 meter) ski minimum, 30 foot (10 meter) mobile string line minimum, or a matching shoe.
- (c) The transverse controls shall have an automatic system for controlling cross-slope at a given rate.
- (d) Cutting heads able to provide a minimum 6 foot (2 meter) cutting width and a 0 to 4 inch (0 to 100 mm) deep cut in one pass. The teeth on the revolving cutting drum must be continually maintained and shall be replaced as warranted to provide a uniform pavement texture.
- (e) An integral pickup and conveying device to immediately remove milled material from the roadway and discharge the millings into a truck, all in one operation.
- (f) All necessary safety devices such as reflectors, headlights, taillights, flashing lights and back up signals so as to operate safely in both day and night.
- (g) A means of effectively limiting the amount of dust escaping from the milling and removal operation in accordance with local, State, and Federal air pollution control laws and regulations.

When milling smaller areas or areas where it is impractical to use the above described equipment, the use of a smaller or lesser-equipped milling machine may be permitted when approved by the Engineer.

Sweeper Equipment Requirements.

The Contractor shall provide a sufficient number of mechanical sweepers to ensure that the milled surface is free of millings and debris at the end of each day's milling operations. Each sweeper shall be equipped with a water tank, spray assembly to control dust, a pick-up broom, a dual gutter broom, and a dirt hopper. The sweepers shall be capable of removing millings and loose debris from the textured pavement.

Milling Operations.

The milling operations shall be scheduled to minimize the duration and placement of traffic on the milled surface. The milling operations shall not proceed more than 3 miles ahead of the paving operations. Under no circumstances shall the milled surface be left exposed to traffic for a period

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exceeding seven days. The Engineer may allow the Contractor to adjust the above limitations on milling production when necessary.

The Contractor shall coordinate milling and paving operations to minimize the exposure of milled surfaces to traffic. The Contractor shall ensure that milled surfaces are overlaid in a timely manner to avoid damage to the pavement structure. Any damage to the pavement structure resulting from extended exposure of the milled surface to traffic shall be repaired as directed by the Engineer at the Contractor's expense.

The existing pavement shall be removed to the average depth shown on the plans, in a manner that will restore the pavement surface to a uniform cross-section and longitudinal profile. The longitudinal profile of the milled surface shall be established using a 30 foot (10 meter) mobile ski, mobile string line, or stationary string line. The cross-slope of the milled surface shall be established by a second sensing device or by an automatic cross-slope control mechanism. The Contractor will be responsible for providing all grades necessary to remove the material to the proper line, grade, cross section, superelevation, and transitions shown on the plans or as directed by the Engineer. The requirement for automatic grade or slope controls may be waived by the Engineer in locations warranted by the situation, including intersections and closely confined areas.

The Engineer may adjust the average milling depth specified on the plans by $\pm 3/4"$ ($\pm 20\text{mm}$) during each milling pass at no additional payment to minimize delamination of the underlying pavement course or to otherwise provide a more stable surface. If delamination or exposure of concrete occurs when milling a HMA pavement course from an underlying Portland Cement Concrete (PCC) pavement, the Contractor shall cease milling operations and consult the Engineer to determine whether to reduce the milling depth or make other adjustments to the operation.

Protection of Inlets and Utilities.

Throughout the milling operation, protection shall be provided around existing catch basin inlets, manholes, utility valve boxes, and any similar structures. Any damage to such structures as a result of the milling operation is the Contractor's responsibility and shall be repaired at the Contractor's expense. To prevent the infiltration of milled material into the storm sewer system the Contractor shall take special care to prevent the milled material from falling into the inlet openings or inlet grates. Any milled material that falls into inlet openings or inlet grates shall be removed at the Contractor's expense.

Vertical Faces.

All permanent limits of the milled area shall be sawcut or otherwise neatly cut by mechanical means to provide a clean and sound vertical face. No vertical faces, transverse or longitudinal, shall be left exposed to traffic. If any vertical face is formed in an area exposed to traffic a temporary paved transition with a maximum 12:1 slope shall be established. If the milling machine is used to temporarily transition the milled pavement surface to the existing pavement surface, the temporary transition shall be constructed at a maximum 12:1 slope.

Opening to Traffic.

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Prior to opening a milled area to traffic, the milled surface shall be thoroughly swept with a mechanical sweeper to remove all remaining millings and dust. This operation shall be conducted in a manner so as to minimize the potential for creation of a traffic hazard and to comply with local, State, and Federal air pollution control laws and regulations. Any damage to vehicular traffic as a result of milled material becoming airborne is the responsibility of the Contractor and shall be repaired at the Contractor's expense. Temporary pavement markings shall be placed in accordance with the provisions of Subsection 850.64.

Milled Surface Inspection.

The milled surface shall provide a satisfactory riding surface with a uniform textured appearance. The milled surface shall be free from gouges, excessive longitudinal grooves and ridges, oil film, and other imperfections that are a result of defective equipment, non-uniform milling teeth, improper use of equipment, or otherwise poor workmanship. Any unsatisfactory surfaces produced shall be corrected by remilling at the Contractor's expense and to the satisfaction of the Engineer.

The Contractor shall perform Quality Control inspection of all work items addressed as specified in the table below. Inspection activities during milling of HMA pavement may be performed by qualified Production personnel (e.g. Skilled Laborers, Foremen, Superintendents). However, the Contractor's QC personnel shall have overall responsibility for QC inspection. The Contractor shall not rely on the results of Department Acceptance inspection for Quality Control purposes. The Engineer shall be provided the opportunity to monitor and witness all QC inspection.

The milled surface of each travel lane shall be divided into longitudinal Sublots of 500 feet (150 meters). The Contractor shall perform a minimum of one random QC measurement within each Sublot with a 10 foot (3 meter) straightedge in the transverse direction across the milled surface. Additional selective QC measurements within each Sublot will be performed as deemed necessary by the QC personnel. All QC inspection results shall be recorded on NETTCP Inspection Report Forms. The Engineer will also randomly inspect a minimum of 25% of the Sublots. The Contractor shall perform surface texture measurements with a 10 foot (3 meter) straightedge in the transverse direction across the milled surface. The milled surface shall have a texture such that the variation from the edge of the straightedge to the top of ridges between any two ridge contact points shall not exceed 1/8 inch (3 mm). The difference in height from the top of any ridge to the bottom of the groove adjacent to that ridge shall not exceed 1/16" (1.6 mm). Any point in the surface not meeting these requirements shall be corrected as directed by the Engineer at the Contractor's expense.

In isolated areas where surface delamination between existing HMA layers or a surface delamination of HMA on Portland Cement Concrete causes a non-uniform texture to occur, the straightedge surface measurement requirements stated in the preceding paragraph may be waived, subject to the approval of the Engineer.

Minimum QC Inspection of Milling Operations

Inspection Component	Items Inspected	Minimum Inspection	Point of Inspection	Inspection Method
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		Frequency		
Equipment	As specified in QC Plan	Per QC Plan	Per QC Plan	Per QC Plan
Environmental Conditions	Protection of Inlets & Utilities	Per QC Plan	Existing Surface	Visual Check
	Removal of Millings & Dust	Per QC Plan	Milled Surface	Visual Check
Workmanship	Milling Depth	Per QC Plan	Milled Surface	Check Measurement
	Cross-Slope & Profile	Per QC Plan	Milled Surface	Check Measurement
	Milled Surface Texture	Per QC Plan	Milled Surface	Visual Check
	Milled Surface Roughness	Once per 500 feet(150 meters) per milled lane	Milled Surface per Subsection 410.67	10 foot (3 meter) standard straightedge
	Sawcut Limit Vertical Face	Per QC Plan	Sawcut Limits	Visual Check

415.61 Micromilling Equipment Requirements.

The micromilling machine shall be equipped with a drum specifically designed to provide the surface specified below.

415.62 Control Strip.

The Contractor shall micromill a control strip. The control strip shall be 500 feet minimum in length with a uniformly textured surface and cross slope, as approved by the Engineer.

The micromilled surface of the control strip shall provide a satisfactory riding surface with a uniform textured appearance. The micromilled surface shall be free from gouges, excessive longitudinal grooves and ridges, oil film, and other imperfections that are a result of defective equipment, non-uniform milling teeth, improper use of equipment, or otherwise poor workmanship. Any unsatisfactory surfaces produced in the control strip shall be corrected by additional micromilling at the Contractor's expense and to the satisfaction of the Engineer.

The micromilled pavement surface shall have a transverse pattern of 0.2 – 0.3 inch center to center of each strike area. The Contractor shall perform surface texture measurements with a 10 foot (3 meter) straightedge in the transverse direction across the milled surface. The milled surface shall have a texture such that the variation from the edge of the straightedge to the top of ridges between any two ridge contact points shall not exceed 1/8 inch (3 mm). The difference in height from the top of any ridge to the bottom of the groove adjacent to that ridge shall not exceed 1/16" (1.6 mm). Any point in the surface not meeting these requirements shall be corrected as directed by the Engineer at the Contractor's expense.

415.67 Micromilled Surface Inspection.

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The Contractor shall perform Quality Control inspection of all work items addressed under Section 415. The Contractor shall not rely on the results of Department Acceptance inspection for Quality Control purposes.

The micromilled surface shall meet the requirements of 415.62.

Compensation

415.80 Method of Measurement.

Micromilling - Micromilling will be measured for payment by the number of square yards (square meters) of area from which the milling of existing HMA pavement has been completed and the work accepted. No area deductions will be made for minor unmilled areas such as catch basin inlets, manholes, utility boxes and any similar utility structures.

415.81 Basis of Payment.

Micromilling - Micromilling, removal and disposal of existing HMA pavement will be paid for at the contract unit price per square yard (square meter). This price shall include all equipment, tools, labor, and materials incidental thereto. No additional payments will be made for multiple passes with the milling machine to remove the existing HMA surface to the grade specified.

No separate payments will be made for: performing handwork removal of existing pavement and providing protection around catch basin inlets, manholes, utility valve boxes and any similar structures; repairing surface defects as a result of the Contractor's negligence; providing protection to underground utilities from the vibration of the milling operation; sawcutting micromilled limits; installing and removing any temporary transition; removing and disposing of millings; furnishing a sweeper and sweeping after milling. The costs for these items shall be included in the contract unit price for Pay Item 415., Pavement Micromilling.

415.82 Payment Items.

415.	Pavement Micromilling	Square Yard
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<u>ITEM 450.9</u>	<u>CONTRACTOR QUALITY CONTROL</u>	<u>TON</u>
<u>ITEM 451.</u>	<u>HOT MIX ASPHALT FOR PATCHING</u>	<u>TON</u>
<u>ITEM 452.</u>	<u>ASPHALT EMULSION FOR TACK COAT</u>	<u>GAL</u>
<u>ITEM 453.</u>	<u>HOT MIX ASPHALT JOINT SEALANT</u>	<u>FEET</u>
<u>ITEM 455.23</u>	<u>SUPERPAVE SURFACE COURSE 12.5 (SSC-12.5)</u>	<u>TON</u>

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Section 450 and 455 to be inserted by the Construction Contract Section

<u>ITEM 482.3</u>	<u>SAWING ASPHALT PAVEMENT</u>	<u>FEET</u>
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The work under this item shall conform to the relevant provisions of Section 120 of the Standard Specifications and the following:

The work shall include the sawing of existing asphalt pavement where shown on the plans, and as directed by the Engineer.

Equipment used to sawcut the existing pavement shall be approved by the Engineer prior to commencing work.

The existing pavement shall be sawcut through its full depth, or to the elevation of the abutting proposed pavement subgrade, whichever is lesser, at all joints between existing and proposed pavements, and at all utility trenches through existing pavement to remain, to provide a uniform, vertical surface for the proposed pavement joint with the existing pavement. Sawcut edges that become broken, ragged or undermined as a result of the Contractor's operations shall be re-cut prior to the placement of abutting proposed pavement at no additional cost to the Owner. Sawcut surfaces in hot mix asphalt shall be sprayed or painted with a uniform, thin coat of RS-1 asphalt emulsion immediately before placement of bituminous concrete material against the surfaces.

Sawing Asphalt Pavement will be measured for payment by the foot on the pavement surface complete in place. Sawing Asphalt Pavement will be paid for at the Contract unit price per foot, which price shall include all labor, materials, equipment, and incidental costs required to complete the work including asphalt emulsion.

<u>ITEM 590.</u>	<u>CURB REMOVED AND STACKED</u>	<u>FEET</u>
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The work under these items shall conform to the relevant provisions of Section 501 of the Standard Specifications and the following:

All curb designated to be removed and stacked shall be delivered to the DPW maintenance facility or storage yard located at 147 Hampshire Street Cambridge, MA 02139. The work shall include the removal and stacking of existing granite curb not reused during construction as shown on the plans and as directed by the Engineer.

Curb Removed And Stacked will be measured and paid for at the Contract unit price per linear foot, which price shall include all labor, materials, equipment and incidental costs required to complete the work. Item 504 and 504.1 respectively shall include the cost of sawcutting either the existing pavement or binder course in order to install the new curb and is not included under Item 482.3 Sawing Asphalt Pavement.

<u>ITEM 657.51</u>	<u>TEMPORARY TREE PROTECTIVE FENCE</u>	<u>FEET</u>
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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. Where these activities will occur within 10 feet of the canopy of trees or where directed by the Engineer, the Contractor shall provide Individual Tree Protection, Item 102.51.

Temporary Tree Protection Fence shall be brightly colored Polypropylene barricade or wooden snow fencing for tree protection or safety fencing as shown on the Contract drawings or as directed by the Engineer. Fencing shall be a minimum of 4 feet high and supported by steel or hardwood stakes spaced at a maximum of 8 feet on center or by other means acceptable to the Engineer.

To the extent possible, fencing shall be installed at the limit of tree canopy and shall be staked and maintained vertical for the length of the contract.

Some pruning of roots and branches may be a necessary part of construction. Pruning will be performed on the same side of the tree that roots have been severed.

The Contractor shall retain the services of a Massachusetts State Certified Arborist to oversee any cutting of limbs, stem or roots of existing trees. All cuts shall be clean and executed with an approved tool. Under no circumstances shall excavation in the tree protection area be made with mechanical equipment that might damage the existing root systems.

After all other construction activities are complete, but prior to final seeding, temporary fencing shall be removed and disposed off site by the Contractor at no additional cost.

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.

Fencing shall be paid at the contract unit price per foot. Said price shall include full compensation for all labor, tools, materials and equipment necessary for the installation and maintenance of the fencing.

ITEM 701.1 CEMENT CONCRETE SIDEWALK AT DRIVEWAYS SQUARE YARD

ITEM 701.2 CEMENT CONCRETE WHEELCHAIR RAMP SQUARE YARD

The work under this item shall conform to the relevant provisions of Section 476 of the Standard Specifications and the following:

The Contractor shall install detectable warning panels on all proposed cement concrete wheelchair ramps as shown on the plans according to Standard Drawing No. M/E 107.6.5R or as directed by the Engineer.

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Payment for Item 701.1 Cement Concrete Sidewalk At Driveways will include a detectable warning panel at the driveway. Payment for Item 701.2 Cement Concrete Wheelchair Ramp will include a detectable warning panel, complete in place.

<u>ITEM 706.</u>	<u>BRICK WALK</u>	<u>SQUARE YARD</u>
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The work under this item shall conform to the relevant provisions of Section 700 of the Standard Specifications and the following:

GENERAL

The Contractor shall furnish all labor, materials, equipment and transportation required to complete all improvements involving the placement and finished installation of brick pavers according to the line and grade as shown on the plans, as directed by the Engineer and to these special provisions.

Prior to ordering any materials, the Contractor shall submit representative samples to Weston & Sampson and/or the City of Cambridge for selection and approval. The Contractor shall not order materials until Weston & Sampson, the City of Cambridge and/or the Engineer has approved these materials.

The Contractor may be required to submit up to three (3) samples of each required paver color, blend or type in order to represent the full range of color variation that can be expected in the finished work.

SUBMITTALS

The Contractor shall submit shop drawings of all materials required of this section. The Contractor shall obtain approval of shop drawings prior to proceeding with ordering and installation of materials.

Shop drawings and manufacturer's cut drawings shall include dimensions, sizes and thickness of members, details of construction, details of installation, relation to adjoining work, description of manufactured items, accessories and all other pertinent data for approval.

Notwithstanding any prior acceptance of materials given prior to delivery, acceptance and approval for all work will be based upon the conditions at completion of installation.

It is the responsibility of the Contractor to exercise all necessary precautions to properly protect materials. Where damage occurs the items will be rejected.

Deliver packaged materials in manufacturer's unopened containers or bundles, fully identified with name, brand, type, weight and analysis. Store packaged materials in such a manner as to prevent damage or intrusion of foreign matter. Damaged or fractional packages shall be rejected.

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Pavers shall be packaged by strapping to manufacturer's standard as delivered on pallets. Pavers damaged in any manner will be rejected and shall be replaced with new material at no additional cost to MassDOT or the City.

Store all pavers on raised platforms or pallets in such a manner as to prevent damage or intrusion of foreign matter. Storage piles or stacks shall be located to avoid or be protected from heavy and unnecessary traffic. Materials shall be stored under an approved roof or covered with waterproof tarpaulins, at all times, except when men are working and using the materials.

After completion of all work, all debris, rubbish, and surplus materials shall be removed from the site. The site shall be left clean, presentable, and to the satisfaction of Weston & Sampson or the City.

The following standards, specifications and tests of technical societies, organizations and governmental bodies apply:

AASHTO - American Association of State Highway and Transportation Officials (tests or specifications).

ASTM - American Society for Testing and Materials.

MATERIALS

Brick Pavers shall conform to section M4.05.4 of the Standard Specification. The contractor is responsible to coordinate sample colors and styles of the brick with the City of Cambridge prior to installation. If the original sample is not approved, the Contractor shall provide additional samples, as required, at no additional cost to the owner until an approved sample is obtained.

Bedding and Joint Sand

The bedding and joint sand shall be clean, washed natural or manufactured concrete sand conforming to the table below. Sand shall be non-plastic and free from deleterious or foreign matter.

Grading Requirements for Bedding Sand

ASTM C 33

Sieve Size	Percent Passing
3/8 in.	100
No. 4	95 to 100
No. 8	85 to 100
No. 16	50 to 85
No. 30	25 to 60
No. 50	10 to 30
No. 100	2 to 10

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Grading Requirements for Joint Sand

ASTM C 144

Sieve Size	Natural Sand Percent Passing	Manufacturing Sand Percent Passing
No. 4	100	100
No. 8	95 to 100	95 to 100
No. 16	70 to 100	70 to 100
No. 30	40 to 75	40 to 100
No. 50	10 to 35	20 to 40
No. 100	2 to 15	10 to 25
No. 200	0	0 to 10

CONSTRUCTION METHODS

Sand Setting Bed

After installation of the concrete base with weeps to the appropriate grades, place sand setting bed to achieve the compacted depth of two (2) inches after the pavers are vibrated into place at the specified finish grades.

Brick Pavers

The Contractor shall set new pavers in a pattern on a sand setting bed installed over a hot mix asphalt base in accordance with these specifications and in close conformity with the lines and grades shown on the plans and as directed by the Engineer.

All pavers shall be set with zero clearance and the specified pattern alignment must be maintained. Adjust paver rows so that full pavers can be used to the greatest extent possible. Under any condition, no less than 1/3 of a full size paver will be permitted. All adjustment of pavers to the patterning will be performed with a special hydraulic guillotine cutter.

Adjust any surface variations at this time and reinstall those areas so affected and re-vibrate.

Sweep sand over surface of pavers to fill any voids and mechanically vibrate a second time. Reapply sand for jointing as necessary to ensure adequate filling has been achieved. Methodology for compaction of pavers and vibration of sand for joints shall be as approved by the Engineer and shall be performed in such a manner that caused no harm to finished surfaces.

All areas on which water stands or which are found to be excessively uneven shall be promptly brought to the correct grade and line.

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No pavers shall be laid in inclement weather or when the temperature is thirty-six degrees F (36°F), and dropping, nor shall any work be done on rising temperatures until the temperature reaches thirty-two degrees F (32°F), and subgrade is free of frost.

The final surface elevation shall be adjusted so that when the pavers are placed, the top surface of the pavers will be at the required finished grade.

Installation shall be by a contractor and crew with at least five years experience in placing concrete pavers on projects of similar size and scope.

Protect concrete pavers and accessory materials during shipment, storage, and construction against staining and damage.

Cover sands with waterproof covering to prevent exposure to rainfall or removal by wind. Secure the covering in place.

Coordinate delivery and paving schedule to minimize interference with normal use of buildings adjacent to paving.

Do not install sand or pavers during heavy rain or snowfall. Do not install sand or pavers over frozen base materials. Do not place pavers over frozen sand.

ADAAG limits abrupt vertical changes in surfaces of an accessible route to 1/4 inch or less. If retaining paragraph below for use on an accessible route, verify that pavers selected can comply with requirements.

After a substantial area of pavers have been placed, the pavers shall be vibrated into the sand using a low amplitude, high frequency plate vibrator capable of applying a minimum force of 4000-5000 ft-lb.

All work to within 3 feet of the laying face shall be left fully compacted with sand-filled joints at the end of each day.

Excess sand shall be swept off of the pavement when the job is complete.

The final surface elevations shall not deviate more than 3/8 inches under a 10 feet long straightedge.

The surface elevation of pavers shall be 1/8 inch to 1/4 inch above adjacent drainage inlets, concrete collars or channels.

Quality Control

After removal of excess sand, check final elevations for conformance to the drawings.

Remove pavers that are loose, chipped, broken, stained or otherwise damaged, with fresh units and re-set units that do not match adjoining units. Provide new units to match adjoining units and

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install in same manner as original units with same joint treatment to eliminate evidence of replacement.

Clean exposed surfaces with potable water and stiff fiber brushes until all dirt, stains, efflorescence, asphalt, and other blemishes are removed. Use cleaner and procedures recommended by paver manufacturer. Test small sample areas for acceptance of cleaning procedures. Do not use wire brushes, metal scrapers or acids. Protect adjacent surfaces from damage during cleaning and operations.

After cleaning, examine work and repair unacceptable conditions and correct as required.

After installation and cleaning, protect work from damage during subsequent construction activities until work is accepted.

MANUFACTURES

Morin Brick Co.
130 Morin Brick Rd
Auburn, ME 04210
(207) 784-9375

Stiles Hart Brick Co.
127 Cook Street,
Bridgewater,
(508) 697-6928

MA

Endicott Tile LLC,
P.O. Box 645,
Fairbury, NE USA 68352,
402-729-3323
FAX 402-729-5804

Or approved equal.

MEASUREMENT AND PAYMENT

Brick Pavers shall be paid for at the contract unit price per square yard. The quantity of brick pavers shall be the number of square yards measured parallel to the horizontal surface of the ground. The payment per square yard of concrete pavers shall include excavation, removal and proper off site disposal of excess excavated material, grading and compaction, hot mix asphalt base, sand bed, brick pavers, joint sand where required and all work, equipment, and materials required to provide a complete paver system.

<u>ITEM 707.1</u>	<u>PARK BENCH</u>	<u>EACH</u>
<u>ITEM 707.11</u>	<u>PARK SEAT</u>	<u>EACH</u>

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The work under this item shall conform to the relevant provisions of the Standard Specifications and the following.

GENERAL

The work under this Section consists of the furnishing and installation of park benches as shown on the drawings and as specified herein, complete with all assembly and anchoring hardware, preparation of site and footings.

SUBMITTALS

Submit final shop drawings of all equipment as it is to be constructed if at variance with enclosed drawings.

Applicable requirements of accepted Standards and Codes shall apply to the work of this section and shall be so labeled or listed:

ASTM - American Society for Testing and Materials

MATERIALS

All metal shall be steel or cast iron as furnished by the manufacturer:

M. E. O'Brien & Sons, Inc.
93 West Street
P.O. Box 650
Medfield, MA 02052-0650
Phone: 508-359-4200
Toll Free: 800-835-0056

or

Victor Stanley, Inc.
P.O. Drawer 330
Dunkirk, Maryland 20754 USA
Toll Free: (800) 368-2573 (USA & Canada)
Tel: (301) 855-8300
Fax: (410) 257-7579

or

Keystone Ridge Designs
670 Mercer Road, Butler, PA 16001
Phone: 1-800-284-8208
Fax: 724-284-1253

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Or approved equal.

All structural shapes shall then be hot dip galvanized conforming to ASTM-A-123 and A-153.

All structural shapes shall receive black power coating, baked on polyester and shall be surface mounted.

All anchor devices shall be 5/8" expansion bolts drilled into pavements and footings to a minimum total depth of 8" below finished grades.

All footings shall be excavated in accordance with other sections of the specifications. The cement concrete for foundations shall conform to 4000 psi Cement Concrete, per Materials Section M4 of the standard specifications. All footings shall be to the depths stated, or as directed by the Engineer to fit pavement requirements.

After all fabrication operations are complete, each support weldment will have all burrs and sharp edges removed by grinding so as to be hand smooth. All welds will be chipped, thus removing all slag and spatter, and sanded or ground smooth. Each unit will then be completely washed with an approved solvent to remove any grease or foreign matter.

CONSTRUCTION METHODS

Contractor shall excavate footings to the dimensions indicated on the contract drawings. Refer to Standard Specification, Section 901 - Cast-In-Place Concrete. This shall be considered incidental to the item.

Contractor shall secure metal supports to footings as recommended by the manufacturer, utilizing cast-in-place foundations and expansion bolts.

Apply an epoxy or peen all surface bolts and nuts to prevent removal by vandals.
Guarantee all furnishings and installation free from defects in materials and workmanship for one (1) year from final acceptance.

BASIS OF PAYMENT

Park Benches shall be paid for at the contract unit price per each. The payment per each of benches shall include excavation, removal and proper off site disposal of excess excavated material, grading and compaction, concrete footing, steel reinforcement, bench and all work, equipment, and materials required to provide a complete bench in place.

<u>ITEM 707.35</u>	<u>TREE CELL</u>	<u>SQUARE FOOT</u>
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SUMMARY

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Furnishing and installing Tree Cell system, including: geotextile, geogrids, aggregates, sub base material, backfill, drainage system, root barrier, compost, and the installation of planting soil.

DEFINITIONS

Aggregate Sub Base (below Cell frame): Aggregate material between the bottom of the Tree Cell frame and the compacted subgrade below, designed to distribute loads from the frame to the subgrade.

Aggregate Base Course (above Cell deck): Aggregate material between the paving and the top of the Tree Cell deck below designed to distribute loads across the top of the deck.

Aggregate Setting Bed – For Pavers (above Cell deck): Aggregate material between the aggregate base course and unit surface pavers, designed to act as a setting bed for the pavers.

Backfill: The earth used to replace or the act of replacing earth in an excavation beside the Tree Cell frames to the excavation extents.

Bridging Slab: Bridging slabs are to be used in locations where spacing larger than 3 inches (75 mm) is necessary between Tree Cell frames.

Compost: Organic material subjected to composting processes

Finish Grade: Elevation of finished surface of planting soil or paving.

Geogrid: Net-shaped synthetic polymer-coated fibers that provide a stabilizing force within soil structure as the fill interlocks with the grid.

Geotextile: A geosynthetic fabric, applied to either the soil surface or between materials, providing filtration, separation, or stabilization properties.

Irrigation: Trees planted in the Tree Cell system must receive adequate water to ensure survival of the living system during periods of drier weather. Harvest of natural rainwater or supplemental water must be a part of the system, either through pressurized or non-pressurized systems, within the soil of the Tree Cell system.

Planting Soil: Soil as defined in Division 2 Section 32 94 56, Planting Soil for Tree Cells, intended to fill the frames and other planting spaces.

Root Barrier: Plastic root diversion device.

Root package: The earthen package containing the root system of the tree as shipped from the nursery.

Tree Cells: Plastic structural cellular system with posts, beams and decks designed to be filled with planting soil for tree rooting and support of vehicle loaded pavements. The soil within the cells may also be used as part of rainwater filtering, retention and detention systems.

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Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill.

Strongback: Modified Tree Cell frame designed to be attached to top of Tree Cells for stability while installing planting soil and backfill.

Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

Tree: A perennial woody plant with one or several trunks and a distinct crown and intended to become large enough to shade people and or vehicles.

Zip Tie: A tensioning device or tool used tie similar or different materials together with a specific degree of tension.

SUBMITTALS

For bulk materials, including soils and aggregates, Include analysis of the materials by a recognized laboratory made that demonstrates that the material meets the specification requirements.

Tree Cell manufacturer's letter of review and approval of the project, plans, details and specifications for compliance with product installation requirements.

Soil Installation Mock Up:

Prior to the installation of Tree Cells, construct a mock up of the complete installation at the site.

The installation of the mock up shall be in the presence of the landscape architect.

The mock up shall be a minimum of 100 square feet in area and include the complete Tree Cell system installation with sub base compaction, drainage installation, base course aggregate and geotextile as required, geogrids, backfill, planting soil with compaction, decks, top geotextile and all necessary accessories.

The mock up area may remain as part of the installed work at the end of the project provided that it remains in good condition and meets all the conditions of the specifications.

Compaction testing results: Submit results of all compaction testing required by the specifications including the bulk density test of the mock up and installed soil to the landscape architect for approval.

Qualification Data: Submit documentation of the qualifications of the Tree Cell installer sufficient to demonstrate that the installer meets the requirements of paragraph "Quality Assurance".

SEQUENCING AND SCHEDULING

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General: Prior to the start of Work, prepare a detailed schedule of the work for coordination with other trades.

Schedule all utility installations prior to beginning work in this section.

Where possible, schedule the installation of Tree Cells after the area is no longer required for use by other trades and work. Protect installed Tree Cells from damage in the event that work must occur over or adjacent to the completed Tree Cells.

QUALITY ASSURANCE

Installer Qualifications: Tree Cells and related products shall be installed by a qualified installer whose work has resulted in successful installation of planting soils and planter drainage systems, underground piping, chambers and vault structures.

Submit list of completed projects of similar scope and scale to the Owner, demonstrating capabilities and experience.

The installer and the field supervisor shall have a minimum of five years successful experience with construction of similar scope in dense urban areas.

Installer's Field Supervision: Installer is required to maintain an experienced full-time supervisor on Project site when work is in progress. This person shall be identified during the Pre-installation Conference, with appropriate contact information provided, as necessary. The same supervisor shall be utilized throughout the Project, unless a substitution is submitted to and approved in writing by the Owner.

DELIVERY, STORAGE, AND HANDLING

Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, if applicable. Protect materials from deterioration during delivery and while on the project site.

Bulk Materials:

Do not deliver or place backfill, soils and soil amendments in frozen, wet, or muddy conditions.

Provide protection including tarps, plastic and or matting between all bulk materials and any finished surfaces sufficient to protect the finish material.

Provide erosion-control measures to prevent erosion or displacement of bulk materials and discharge of soil-bearing water runoff or airborne dust to adjacent properties, water conveyance systems, and walkways. Provide additional sediment control to retain excavated material, backfill, soil amendments and planting mix within the project limits as needed.

Tree Cells: Protect Tree Cells from damage during delivery, storage and handling.

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Store under tarp to protect from sunlight when time from delivery to installation exceeds one week. Storage should occur on smooth surfaces, free from dirt, mud and debris

Handling is to be performed with equipment appropriate to the size (height) of Cells and site conditions, and may include, hand, handcart, forklifts, extension lifts, or small cranes, with care given to minimize damage to Tree Cell frames, decks and adjacent Tree Cells.

PROJECT CONDITIONS

Verification of Existing Conditions and Protection of New or Existing Improvements: Before proceeding with work in this section, the Installer shall carefully check and verify all dimensions, quantities, and grade elevations, and inform the landscape architect immediately of any discrepancies.

Carefully examine the civil, record, and survey drawings to become familiar with the existing underground conditions before digging. Verify the location of all aboveground and underground utility lines, infrastructure, other improvements, and existing trees, shrubs, and plants to remain including their root system, and take proper precautions as necessary to avoid damage to such improvements and plants.

In the event of conflict between existing and new improvements notify the landscape architect in writing and obtain written confirmation of any changes to the work prior to proceeding.

When new or previously existing utility lines are encountered during the course of excavation, notify the landscape architect in writing and make recommendations as to remedial action. Proceed with work in that area only upon approval of appropriate remedial action. Coordinate all work with the appropriate utility contractors, utility company or responsible public works agency.

Weather Limitations: Do not proceed with work when subgrades, soils and planting soils are in a wet, muddy or frozen condition.

Protect partially completed Tree Cell installation against damage from other construction traffic with highly visible construction tape, fencing, or other means until construction is complete. Prevent all non-installation related construction traffic over the completed Tree Cell installation; allowing only loads less than the design loads.

PROTECTION

Protect open excavations and partially completed Tree Cell installation from access and damage when work is in progress, and following completion with highly visible construction tape, fencing, or other means until all construction is complete.

WARRANTY

Tree Cell manufacturer's product warranty shall apply. Submit manufacturer's product warranty.

PROJECT WORK

Coordinate installation with all other work that may impact the completion of the work.

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PRODUCTS

TREE CELLS

Fiberglass-reinforced polypropylene structures including frames and decks designed to support sidewalk loads and designed to be filled with soil for the purpose of growing tree roots, and rainwater filtering, detention and retention.

Tree Cell Frames: 400 mm x 600 mm x 1200 mm (16 inches x 24 inches x 48 inches).

Tree Cell Deck: 5 cm x 600 mm x 1200 mm (2 inches x 24 inches x 48 inches). Deck to include manufactured installed galvanized steel tubes.

Tree Cell Strongback: 400 mm x 600 mm x 150 mm (24 inches x 48 inches x 6 inches) modified

Tree Cell Frame units designed to stiffen and align the frames as planting soil and backfill material is placed. Strongbacks are to be removed prior to placing decks. They are to be reused as the work progresses.

Tree Cell Deck Screws: Manufacturer's supplied stainless steel screws to attach decks to frames.
Manufacturer: DeepRoot Partners, L.P. (Deep Root); 530 Washington Street, San Francisco, CA 94111; 415.781.9700; 800.458.7668; fax 415.781.0191 or approved equal

PLANTING SOIL

The Planting Soil for installation within the Tree Cell shall conform to M1.06.1 Processed Planting Material. This planting soil shall be considered incidental to the item.

ANCHORING SPIKES

10" (250 mm) long X 19/64" (8 mm) diameter, spiral, galvanized timber spikes. Utilize 4 spikes in each frame on the first layer of Tree Cells to anchor the frames to the aggregate sub base.

INSPECTION RISER AND CAP

Inspection riser shall consist of a rigid, schedule 40 non-perforated PVC pipe, 4 inches in diameter. Cut slots in the bottom to allow water access for inspection risers that extend to the sub base aggregate.

Cap shall be PVC solid threaded cleanout or removable inlet grate designed to fit standard PVC schedule 40 pipe-fittings.

GEOGRID

Geogrid shall be woven polyester fabric with PVC coating, Uni-axial or biaxial geogrid, inert to biological degradation, resistant to naturally occurring chemicals, alkalis, acids.

Tensile strength at ultimate: 1850 lbs/ft (27.0 kN/m) minimum by ASTM D6637 test method

Creep reduced strength : 1000 lbs/ft (14.6 kN/m) minimum by ASTM D5262 test method

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Long term allowable design load: 950 lbs/ft (13.9 kN/m) minimum by GRI GG-4 test method

Grid aperture size (MD): 0.8 inch (20 mm) minimum

Grid aperture size (CD): 1.28 inch (32 mm) maximum

Roll size: 6' (1.8m) width is preferred, up to 18' (5.4m)

Products meeting this specification:

Miragrid 2XT as manufactured by Ten Cate Nicolon, Norcross, GA, (Distributed by Geosynthetic Systems in Ontario)

BX1500 Biaxial Geogrid as manufactured by Tensar International, Atlanta, GA, Fortrac 35 Geogrid as manufactured by Huesker, Charlotte, NC,

SF 20 Biaxial Geogrid, as manufactured by Synteen, Lancaster, SC,

Stratagrid SG 150, by Strata, Cumming, GA,

GEOTEXTILE

Geotextile shall be nonwoven polypropylene fibers, inert to biological degradation and resistant of naturally occurring chemicals, alkalis and acids.

Grab tensile strength: 200 lbs (900 N) minimum (*ASTM D 4632 test method*)

Elongation: 50% maximum (*ASTM D 4632 test method*)

Trapezoid tear strength: 80 lbs (350 N) minimum (*ASTM D 4533 test method*)

Mullen burst strength: 350 psi (2400 kPa) minimum (*ASTM D 3786 test method*)

Puncture strength: 110 lbs (490 N) minimum (*ASTM D 4833 test method*)

CBR puncture strength: 500 lbs (2225 N) minimum (*ASTM D 6241 test method*)

Apparent opening size: 80 sieve (0.18mm) maximum (*ASTM D 4751 test method*)

Flow rate: 95 gal/min/ft² (3870 l/min/m²) minimum (*ASTM D 4491 test method*)

UV Resistance (at 500 hours): 70% strength retained

Products meeting this specification:

Mirafi 180 N as manufactured by Ten Cate Nicolon, Norcross, GA, (Distributed by Geosynthetic Systems in Ontario)

Geotex 801 as manufactured by Propex Geosynthetics, Chattanooga, TN, (Distributed by Nilex in Canada)

AGGREGATE SUB BASE (BELOW CELL FRAME)

Aggregate meeting one of the following specifications:

ASTM D1241-07, Type 1, Gradation B Standard Specification for Materials for Soil-Aggregate Sub base, Base, and Surface Courses.

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Type I mixtures shall consist of stone, gravel, or slag with natural or crushed sand and fine mineral particles passing a No. 200 sieve.

Sieve	Percent Passing
1.5" (37.5 mm)	100
1" (25 mm)	75-95
3/8" (9.5 mm)	40-75
No 4 (4.75 mm)	30-60
No 10 (2.0 mm)	20-45
No 40 (425 µm)	15-30
No 200 (75 µm)	5-15

Local Department of Transportation virgin aggregate that most closely meets the gradation of ASTM D1241-07.

Dense graded aggregates intended for use as granular base within the pavement structure, granular shouldering, and backfill.

Sieve	Percent Passing
26.5 mm	100
19.0 mm	85-100
13.2 mm	65-90
9.5 mm	50-73
4.75 mm	35-55
1.18 mm	15-40
300 µm	5-22
75 µm	2-8

BACKFILL MATERIAL (ADJACENT TO TREE CELLS):

Clean, compactable, coarse grained fill soil meeting the requirements of the Unified Soil Classification system for soil type GW, GP, GC with less than 30% fines, SW, and SC with less than 30% fines. Backfill material shall be free of organic material, trash and other debris, and shall be free of toxic material injurious to plant growth.

Submit supplier certificate for material meeting this specification.

ROOT BARRIER

Root Barrier shall be DeepRoot; Tree Root Barriers; UB 18-2, manufactured by DeepRoot Partners, L.P. (Deep Root); 530 Washington Street, San Francisco, CA 94111; 415.781.9700; 800.458.7668; fax 415.781.0191 or approved equal.

Material: Black, injection molded panels, 0.080"(2.03mm) wall thickness in modules 24" (61cm) long by 18" (46cm) deep; manufactured with a minimum 50% post-consumer recycled polypropylene plastic with UV inhibitors; recyclable. Integrated zipper joining system providing for instant assembly by sliding one panel into another.

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Prior to the start of work, layout and stake the limits of excavation and horizontal and vertical control points sufficient to install the Tree Cells and required drainage features in the correct locations.

EXCAVATION

Excavate to the depths and shapes indicated on the drawings. Base of excavation shall be smooth soil, level and free of lumps or debris. Do not over-excavate existing soil beside or under the limits of excavation required for the installation. If soil is over-excavated, install compactable fill material in lifts not more than 8 inches deep and compact to the required density. Confirm that the depth of the excavation is accurate to accommodate the depths and thickness of materials required throughout the extent of the excavation. Confirm that the width and length of the excavation is a minimum of 6 inches in all directions, beyond the edges of the Tree Cells.

SUBGRADE COMPACTION

Check compaction of the subgrade below the Tree Cells and confirm that the subgrade soil is compacted to a minimum of 95% of maximum dry density at optimum moisture content in accordance with ASTM D 698 Standard Proctor Method.

Proof compact the subgrade with a minimum of three passes of a suitable vibrating compacting machine or apply other compaction forces as needed to achieve the required subgrade compaction rate.

Apply additional compaction forces at optimum water levels.

INSTALLATION OF GEOTEXTILE OVER SUBGRADE

Where indicated on drawings, install geotextile over compacted subgrade.

Removal of the geotextile as a standard component of the Tree Cell system must be determined by professional civil or geotechnical engineer.

Install the geotextile with a minimum joint overlap of 18 inches (450 mm) between sections of material. Ensure geotextile is laid flat with no folds or creases.

INSTALLATION OF INSPECTION RISERS

Install 4" solid P.V.C. inspection risers to grade.

Install manufacturer's PVC solid "T's," elbows, and reducers at proper sizes.

Extend risers into sub base aggregate and or make connections to drain lines where indicated on the drawings.

Where inspection risers are indicated to be placed on top of the Tree Cell Deck, assemble riser and fittings to dimensions required such that the rim of the riser is flush with the paving. Set the rim top with a slope consistent with the slope of the pavement.

Adjust the location of the riser such that the center of the riser falls along the centerline of one of the ribbed sots in the deck. Cut the geotextile on top of the deck with an X cut and insert the riser through the geotextile.

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Make a geotextile collar secured to the riser with zip ties that overlap the surrounding geotextile a minimum of 12-inches.

Brace all risers while backfill and paving is being installed to secure its location and elevation.
Install cleanout caps on top of each riser flush to grade.

INSTALLATION OF AGGREGATE SUB BASE BELOW TREE CELL FRAME

Install aggregate sub base to the depths indicated on the drawings, under the second layer of Tree Cell frames. Sub base aggregate shall extend a minimum of 6 inches (150mm) beyond the edge of the Cell frames.

Compact aggregate sub base layer to a minimum of 95% of maximum dry density at optimum moisture content in accordance with ASTM D 698 Standard Proctor Method. Compact the subgrade with a minimum of three passes of a suitable vibrating compacting machine or apply other compaction forces as needed to achieve the required subgrade compaction rate.

The maximum slope on the surface of the sub base shall be 5%. Where proposed grades on finished paving are greater than 5%, the Cells shall be stepped to maintain proper relationships to the finished grade.

The grade and elevations of the base under the Tree Cells shall be approved by the landscape architect prior to proceeding with the installation of the Tree Cells.

INSTALLATION OF TREE CELLS, PLANTING SOIL, GEOGRID, AND BACKFILL

Identify the outline layout of the structure and the edges of paving around tree planting areas on the floor of the excavation, using spray paint or chalk line.

Lay out the first layer of Tree Cell frames on the sub base. Verify that the layout is consistent with the required locations and dimensions of paving edges to be constructed over the Tree Cells.

Check each Tree Cell frame unit for damage prior to placing in the excavation. Any cracked or chipped unit shall be rejected.

Place frames no less than 1 inch and no more than 3 inches apart at base. In the event that spacing between Cells exceeds 3 inches bridging slab details and methods shall be used to span these gaps. This will be done at no additional cost to the owner.

Install Tree Cell frames around, over, or under existing or proposed utility lines as indicated on plans.

Where any two adjacent Tree Cell frames must be installed at different elevations, the upper frame shall be supported by aggregate sub base with a maximum slope of 1:1. This may require installation of aggregate sub base within the adjacent lower Cell frame. No two frames shall differ in elevation by more than 15 inches (375 mm).

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Assure that each frame sits solidly on the surface of the sub base. Frames shall not rock or bend over any stone or other obstruction protruding above the surface of the sub base material. Frames shall not bend into dips in the sub base material. The maximum tolerance for deviations in the plane of the sub base material under the bottom of the horizontal beams of each Tree Cell frame shall be 1/4 inch (6 mm) in 4 feet (1200 mm).

Adjust sub base material including larger pieces of aggregate under each frame to provide a solid base of support.

Anchor each Tree Cell into sub base with four-10 inch (250 mm) spikes, driven through the molded holes in the Cell frame base. The purpose of the anchoring system is to maintain cell spacing and layout during the installation of planting soil and backfill.

For applications where cells are installed over waterproofed structures, develop a spacing system consistent with requirements of the waterproofing system. Do not use anchoring nails that will come within 6" or less of any waterproofing material.

Install the second layer of Tree Cell frames on top of the first layer. Comply with manufacturer's requirements to correctly register and connect the Cell frames together.

Register each frame on top of the lower frame post. Rotate each frame registration arrow in the opposite direction from the frame below to assure that connector tabs firmly connect. Each frame shall be solidly seated on the one below.

Build layers as stacks of frames set one directly over the other. Do not set any frame half on one Cell frame below and half on an adjacent frame.

Install Strongbacks on top of the Tree Cell frames prior to installing planting soil and backfill. Strongbacks are required only during the installation and compaction of the planting soil and backfill.

Strongbacks should be moved as the work progresses across the installation.

Strongbacks shall be removed prior to the installation of Tree Cell decks.

Install planting soil, geogrid and backfill as indicated on the drawings. The process of installation requires that these three materials be installed and compacted together in several alternating operations to achieve correct compaction relationships within the system.

Where required, place the geogrid curtain along the outside of the limit of the Tree Cell frames. Geogrid curtains are required between the edge of the Tree Cells and any soils to be compacted to support paving beyond the area of Tree Cells. Do not place geogrid curtains between the edge of the Cells and any planting area adjacent to the Cells.

Pre-cut the geogrid to allow for 6 inches minimum under lapping below backfill, and 12 inches minimum overlapping top of Tree Cell stack.

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Where Tree Cell layout causes a change direction in the plane of the geogrid, slice the top and bottom flaps of the material so that it lies flat on the top of the cell deck and aggregate base course along both planes.

Provide a minimum of 12 inch overlaps between different sheets of geogrid.

Place the geogrid in the space between the Tree Cell frames and the sides of the excavation. Attach the geogrid to the Tree Cell frames using 3/16 inch x 14-inch zip ties. Attach with zip ties at every cell and at Cell Deck.

Install no more than two layers of Tree Cell frames before beginning to install planting soil and backfill. Compact the planting soil within the Tree Cell frames and the backfill material outside the frames in alternating lifts until the desired elevations and density is achieved in both planting soil and backfill.

Install and compact backfill material in the space between the Tree Cells and the sides of the excavation in lifts that do not exceed 8 inches.

Compact backfill to 95% of maximum dry density using a powered mechanical compactor. Use a pneumatic compacting tool or narrow foot jumping jack compactor for spaces less than 12 inches wide and a 12-inch wide jumping jack compactor or larger equipment in wider spaces.

Maintain the geogrid curtain between the Tree Cells frames and the backfill material.

Install backfill in alternating lifts with the planting soil inside the Tree Cells.

Fill the first layer or layers of frames with planting soil, specified in Section 32 94 56 Planting Soil for Tree Cells.

Bring planting soil to the site using equipment and methods that do not overly mix and further damage soil peds within the soil mix. Soil mixes shall not be blown or pumped into the Cells using soil blowing equipment.

Install in lifts that do not exceed 16 inches. Lightly compact the soil inside the frames at each lift to remove air pockets and settle the soil within the frames.

Do not compact greater than 80% of maximum dry density. Check the soil compaction with a penetrometer or densiometer to achieve similar compaction levels provided in the mock up.

If the planting soil becomes overly compacted, remove the soil and reinstall. Use hand tools or other equipment that does not damage the Tree Cell frames.

Do not walk directly on horizontal beams of the frames.

Work soil under the horizontal frame beams of the second level of Cell frames and between columns eliminating air pockets and voids. Fill each frame such that there is a minimum of 10 inches of soil over the top of horizontal frame beams before beginning compaction.

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The top 1-2 inches of each frame post should remain exposed above the soil to allow the placement of the next frame or deck.

After the first two layers of Tree Cell frames have been installed, filled with planting soil and backfilled, proceed to install the third layer, if required, of Tree Cells frames. Comply with manufacturer's requirements to correctly register and connect the Cell frames together.

Remove the strongbacks. Sweep any soil from tops before adding the next layer of frames.

Register each frame on top of the lower frame post. Rotate each frame registration arrow in the opposite direction from the frame below to assure that connector tabs firmly connect. Each frame shall be solidly seated on the one below.

Build layers as stacks of frames set one directly over the other. Do not set any frame half on one Cell frame below and half on an adjacent frame.

Install Strongbacks on top of third layer of Tree Cells.

Continue to install and compact the planting soil within the Tree Cell frames and the backfill material outside the frames in alternating lifts until the desired elevations and density is achieved in both soils.

When using compost, add a final layer of planting soil as required to bring the planting soil level to not more than 3 inches below the bottom of the Tree Cell Deck when installed. When using air space rather than compost, the planting soil shall be brought to level not more than 1 inch below the bottom of the Tree Cell Deck when installed.

Obtain final approval by the landscape architect of soil installation prior to installation of the Tree Cell deck.

Remove Strongbacks after planting soil and backfill has been compacted to the top of the entire set of Tree Cells.

Install 3 inches of compost, or leave 1-inch air space, below Tree Cell Deck as indicated on the drawings.

TREE CELL DECK INSTALLATION

Install the Tree Cell Decks over the top of each frame stack. Clean dirt from the tops of the Tree Cell frame columns. Register the deck and make connections as recommended by the manufacturer to secure the deck to the top of the Tree Cell Frame. Secure each deck at the four corners with screw fasteners as recommended by the manufacturer. Assure that each deck is seated firmly on the frame top with all connectors attached.

Install and compact remaining backfill material such that the soil outside the limits of the Tree Cells is flush with the top of the installed deck.

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INSTALLATION OF GEOTEXTILE, GEOGRID, INSPECTION RISER AND AGGREGATE OVER THE DECK

Overlap geogrid from the sides of the Tree Cells over the top of the Tree Cell Decks, with minimum of 12 inches overlap.

Place geotextile over the top of the deck and where indicated on the drawings, extending beyond the outside edge of the excavation by at least 18 inches. Any joints must be overlapped by a minimum of 18 inches.

Install 4-inch diameter inspection risers above geotextile as indicated on the drawings. Install the aggregate base course (including aggregate setting bed if installing unit pavers) over the geotextile immediately after completing the installation of the fabrics and inspection risers. Work the aggregate from one side of the deck to the other to assure that the fabric and aggregate conforms to the cell deck contours. Do not apply aggregate in several positions at the same time. Aggregate base course shall be a minimum of 4 inches thick under pored in place concrete paving.

Aggregate base course shall be a minimum of 12 inches thick under unit pavers, asphalt paving, or porous paving.

Load the aggregate from equipment that is outside the limits of the excavated area. Work over material already in place.

For large or confined areas, where aggregate cannot easily be placed from the edges of the excavated area, obtain approval for the installation procedure and types of equipment to be used in the installation from the Tree Cell manufacturer.

Compact aggregate base course(s) in lifts not to exceed 6" in depth, to 95% of maximum dry density. Utilize a roller or plate compactor with a maximum weight of 1000 pounds. Make sufficient passes with the compacting equipment to attain the required compaction.

INSTALLATION OF PAVING ABOVE THE TREE CELL SYSTEM

Place paving material over Tree Cell system per project specifications. Take care when placing paving or other backfill on top of Tree Cell system not to damage the system components. Turn down edge of all concrete paving to Cell deck along the edges of all planting areas to retain the aggregate base course. When paving is a unit paver or other flexible material, provide a concrete curb under the paving at the edge of the Tree Cell deck to retain the aggregate base course material.

INSTALLATION OF ROOT BARRIERS

Install root barrier in accord with manufacturer's reviewed installation instructions.

REPAIR OF CUT GEOTEXTILE

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In the event that any geotextile over subgrades or the Tree Cell decks must be cut during or after installation, repair the seam with a second piece of geotextile that overlaps the edges of the cut by a minimum of 12-inches in all directions prior to adding aggregate material.

PROTECTION

Ensure that all construction traffic is kept away from the limits of the Tree Cells until the final surface materials are in place. No vehicles shall drive directly on the Tree Cell deck or aggregate base course.

Provide fencing and other barriers to keep vehicles from entering into the area with Tree Cell supported pavement.

Maintain a minimum of 4 inches of aggregate base course over the geotextile material during construction.

When vehicle must cross Tree Cells that does not have final paving surfaces installed, use construction mats designed to distribute vehicle loads to levels that would be expected at the deck surface once final paving has been installed. Use only low impact track vehicles with a maximum surface pressure under the vehicle of 4 pounds per square inch, on top of the mats over Tree Cells prior to the installation of final paving.

CLEAN UP

Perform cleanup during the installation of work and upon completion of the work. Maintain the site free of soil and sediment, free of trash and debris. Remove from site all excess soil materials, debris, and equipment. Repair any damage to adjacent materials and surfaces resulting from installation of this work.

MEASUREMENT

Tree Cells shall be measured by the horizontal square foot.

PAYMENT

Payment for the Tree Cell shall be by the horizontal square foot and the cost shall include, excavation, excavation support, gravel base, structures, planting soil, and all labor, equipment, materials, tools, incidental work, and construction methods necessary to install Tree Cells in the locations and dimensions as called out on the plan.

<u>ITEM 707.90</u>	<u>BICYCLE RING AND POST</u>	<u>EACH</u>
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GENERAL

This section specifies requirements for Bicycle Ring and Posts as shown on the Contract Drawings and as listed below:

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SUBMITTALS

The Contractor shall provide the following submittals in conformance with the General Requirements and Covenants and as stated herein.

Manufacturer's product literature: Submit manufacturer's material and installation instructions.

Submit color samples for Bicycle Ring and Post and Bicycle Swerve Rack.

PRODUCTS

CONCRETE BASES, SLABS, AND FOUNDATIONS

Concrete for foundations shall be 4000 psi 28 day compressive strength with $\frac{3}{4}$ " aggregate in compliance with requirements of Section 900 of the Standard Specifications. The contract shall submit shop drawings detailing the concrete foundation as per this specifications.

Reinforcing steel shall have a recycled content of 30% or greater and shall conform to the following standards;

1. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
2. Low-Alloy Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
3. Plain-Steel Wire: ASTM A 82, as drawn.
4. Plain Steel Welded Wire Fabric: ASTM A185, fabricated from as-drawn steel wire into flat sheets.
5. Reinforcing shall be uncoated unless indicated otherwise on the Contract Drawings.

GRAVEL SUBBASE

Gravel subbase for site furnishings shall comply with the requirements of M1.03.0 Type B gravel borrow of the Standard Specifications.

BICYCLE RING AND POST

Bicycle Ring and Post shall be "Bike Hitch" model as manufactured by DERO Bike Racks, Cycle-Safe, Inc. or DuMor or approved equal. Centerbeam shall be 2" schedule 40 pipe (2.375" OD) and the ring shall be 1.5" OD, 11 gauge tube with an outside diameter of 16.5". Finish shall be hot dipped galvanized. The finish color shall be black.

All attached hardware shall be galvanized.

NON-SHRINK GROUT

Non-shrink epoxy grout shall be Five Star Epoxy Grout as manufactured by Five Star Products, Fairfield, CT; Sika Corp. Lyndhurst, NJ or Fosroc-Preco Industries Ltd, Plainview, NJ.

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SEALANTS

Sealant shall be a polyurethane-based, one component, elastomeric sealant complying with Federal Spec. TT-S-00230C, Class A Type 1 for horizontal use and Type 2 for vertical use. Color shall match the color of the adjacent materials as approved by the Engineer. Sealants shall be self-leveling pour grade type for horizontal use and non-sag grade type for vertical use. Application of sealant for site improvements shall be in accordance with approved manufacturer's recommendations.

For horizontal use:

1. Vulkem 45, as manufactured by Mameko International, Cleveland, Ohio.
2. Urexpam NR-201, as manufactured by Pecora Corporation and supplied by Waldo Bros., Boston, MA
3. PRC-6006, as manufactured by Products Research and Chemical Corporation Gloucester City, NJ.

For vertical use:

1. Vulkem 45, as manufactured by Mameko International, Cleveland, Ohio.
2. Sikaflex 1-A, as manufactured by Sika Corp., East Hartford, CT.
3. Dynatrol 1, as manufactured by Pecora Corporation, Philadelphia, PA.

EXECUTION

All site furniture shall be fastened in accordance with the Drawings and per the manufacturer's recommendations. All Site Furniture shall be installed in a level, plumb condition, true to the lines and grades show on plans. The bike ring and post shall be vertical with a tolerance of +/-1 degree. Two magnetic levels affixed to the rack post shall be used in the field to ensure this tolerance is met.

The 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 must be protected from weather, careless handling and vandalism.

Cast-in-place concrete base and footings shall be installed in conformance with the requirements of Section 900 of the Standard Specifications.

Bicycle Ring and Post shall be embedded in a concrete foundation 20" in diameter and 12" deep. Embedment into concrete shall be a minimum 6". Set the bottom of the post such that the top of the post sits 35" above finished grade. Note that the concrete foundation shall be used in lieu of hot

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mix asphalt in brick sidewalk locations and that the top of the foundation is to be set at the bottom of the standard ¾" sand/asphalt setting bed.

Non-shrink grout for anchor bolts shall be installed as shown on Drawings and in conformance with manufacturer's instructions.

Sealant for anchor bolts shall be installed as shown on the Drawings and in conformance with manufacturer's instructions.

All bike rings and posts and bike swerve racks shall be fabricated and fastened in accordance with these specifications and per the manufacturer's recommendations. All bike rings and posts and bike swerve racks shall be installed in a level, plumb condition, true to the lines and grades shown on the detail drawings. Welding shall conform to the current standards of the AWS. Metal shall not be primed, painted, or galvanized before welding.

SPECIAL REQUIREMENTS

The following special construction method requirements are in addition to the general requirements listed above.

The Engineer shall provide the Contractor with the proposed locations of bike swerve racks and bike rings and posts. The Contractor shall then stake locations of proposed bike ring posts for approval by the Engineer. Following acceptance of staked locations, the Contractor shall install posts and bike rings per manufacturer's recommendations, and apply sealant around posts to seal the opening in the surrounding pavement.

MEASUREMENT AND PAYMENT

Item 707.9 BIKE RING AND POST, will be measured PER EACH installed complete-in-place including excavation, surface mounting appurtenances, pipe, hardware, concrete, reinforcement, concrete slab and footings, blocking, solid surfacing and all which price and payment shall constitute full compensation for complete compliance with requirements of this item, including all labor, equipment, materials, tools, incidental work, and construction methods.

ITEM 734. SIGN REMOVED AND RESET EACH

The work under this item shall conform to the relevant provisions of Section 828 of the Standard Specifications and the following:

This item includes removing, temporary stacking and resetting of all non-standard signs as shown on the plans and as directed by the Engineer.

ITEM 741. ENGINEERS FIELD OFFICE AND EQUIPMENT (TYPE B) MONTH

Work under this item shall conform to the relevant provisions of Section 740 of the Standard Specifications and the following:

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An English measuring wheel which shall remain the property of the Contractor.

For those contracts that require concrete testing, two sets of 2 neoprene pads for the concrete compression machine. The pads shall be 6" – 70 durometer. Supply a minimum of 4 pads (2 sets).

A computer system and a digital camera meeting the requirements set forth below and including installation, maintenance, power, paper and other supplies shall be provided at the Resident Engineer's Office. The diskettes and camera cards shall become the property of the Massachusetts Highway Department. The computer system shall consist of the following:

Computer:	DELL, Compaq, or IBM, Small form factor (Approx: 4"x12"x14", H x W x D), with speakers
CPU:	2.8 GHz Pentium 4 CPU with 800 MHz front side bus or better
RAM:	1 Gb of 400 MHz PC-3200 DDR (Dual Channel) or better
Video:	Internal Extreme Graphics 2 w/DVI capability for digital flat panels;
Hard Disk:	100Gb, 7200RPM, SATA-100 or better
Monitor:	19" LCD, TFT Height adjustable stand, 1280x1024 pixel pitch DVI, 24pin
DVI Flat Panel	
CD-RW:	CDRW, 40X speed and 10 CD-R diskettes
Modem:	56K/V.90 internal or external modem
Floppy:	Standard 3.5" 1.44MB floppy disk drive and 10-1.4Mb Diskettes
Keyboard:	Standard 104-key
Printer:	HP 1200 laserjet printer
OS:	Windows XP Professional
Office:	MS Office Professional (latest edition)
Software:	Cadd Light (latest version); McAfee Virus Scan
Connectivity:	8 high-speed USB 2.0 ports

Copier: One (1) plain paper copier, capable of producing Letter and Legal sized copies. The copier must be capable of copying Letter or Legal sized originals. The copier must be a separate machine from any other facsimile machine or printer. The copier must be equipped with an internal cartridge, cassette, or paper tray capable of holding at least 250 sheets of blank paper. The copier must be equipped with a fixed platen (copy glass). The copier must have a zoom function, capable of producing enlargements up to 140%, and reductions to 50%. The copier must be capable of producing at least 12 letter-sized copies per minute. Included shall be the cost of paper and chemicals. The total cost for the paper and chemicals shall not exceed \$500 for the life of the project. Only one copier will be required if there is more than one Field Office in the Contract.

The digital camera shall be Olympus, Nikon, Canon or approved equal with at least 3.2 Megapixel and 3X Optical Zoom/3.4X Digital Zoom. The memory/storage cards shall be a 16MB x D card and a 64MB x D card. Additional accessories include a USB Connect and 2 sets of batteries, a battery charger, carrying case, computer software if necessary and an AC adapter.

All computers must have an Internet access account. DSL (digital subscriber line) is preferred where available. If DSL is not available, a cable internet service provider will be acceptable.

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Only high speed internet access will be provided. Dial-up internet access is acceptable; if no other service is available. (America Online is not acceptable service.)

The Engineer's Field Office and the equipment included therein, including the computer system, and camera shall remain the property of the Contractor at the completion of the project.

<u>ITEM 775.431</u>	<u>LOCUST - HONEY - 'SHADEMASTER' 2-2.5 INCH CALIPER</u>	<u>EACH</u>
<u>ITEM 777.036</u>	<u>OAK-NORTHERN RED 2- 2.25 INCH CALIPER</u>	<u>EACH</u>
<u>ITEM 786.091</u>	<u>JUNIPER – 'BLUE PACIFIC' – PER FLAT</u>	<u>EACH</u>
<u>ITEM 790.330</u>	<u>ROCK COTONEASTER 'TOM THUMB' 18" TO 24"</u>	<u>EACH</u>
<u>ITEM 796.040</u>	<u>IVY VINE – ENGLISH PER FLAT</u>	<u>EACH</u>
<u>ITEM 796.043</u>	<u>MYRTLE VINE PER FLAT</u>	<u>EACH</u>
<u>ITEM 796.049</u>	<u>PACHYSANDRA PER FLAT</u>	<u>EACH</u>
<u>ITEM 796.445</u>	<u>LILYTURF 2 QUART</u>	<u>EACH</u>
<u>ITEM 799.001</u>	<u>GINKO BILOBA (MALE)</u>	<u>EACH</u>
<u>ITEM 799.002</u>	<u>SNOWHILL SAGE</u>	<u>EACH</u>
<u>ITEM 799.003</u>	<u>WHITE GAYFEATHER</u>	<u>EACH</u>
<u>ITEM 799.004</u>	<u>SWITCH GRASS</u>	<u>EACH</u>
<u>ITEM 799.005</u>	<u>SEDIUM</u>	<u>EACH</u>
<u>ITEM 799.006</u>	<u>BLUE FLAG IRIS</u>	<u>EACH</u>
<u>ITEM 799.007</u>	<u>KOBOLD-LILAC GAYFEATHER</u>	<u>EACH</u>
<u>ITEM 799.008</u>	<u>LITTLE BLUE STEM</u>	<u>EACH</u>
<u>ITEM 799.009</u>	<u>RUSSIAN SAGE</u>	<u>EACH</u>
<u>ITEM 799.010</u>	<u>WHITE FALSE INDIGO</u>	<u>EACH</u>

The work under these items shall conform to the relevant provisions of Section 771 of the Standard Specifications and the following:

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For the above items the Contractor shall provide and install plant material of genus, species, variety, size and quantities in locations as directed by the Engineer. The work of this section includes, but is not limited to, the following:

- A. Purchasing and transporting plant material to construction sites
- B. Installation of plant material
- C. Plant care during 60-day Maintenance Period and one-year Establishment Period
- D. Replacement of defective or dead plants at End of Maintenance Period
- E. Replacement of defective or dead plants at End of Establishment Period

Cooperation By Contractor (Supplementing Subsection 5.05)

The Landscape Contractor shall have five years continuous experience and expertise in management, handling and installation of ornamental plant material in large scale landscape construction projects. Site foreman shall have at least five years experience and shall be on-site during all times of plant installation.

Samples and Submittals

Plant Material: At least 180 days prior to anticipated planting, the Contractor shall submit a confirmation of availability for all plants on the list, accompanied by nursery sources. When the specified types and sizes of plants are not available, substitutions may be made upon request by the Contractor, if approved in writing by the Engineer. Substitutions proposed by the Contractor shall have equivalent overall form, height, and horticultural characteristics and must be approved in writing by the Engineer prior to tagging. At least 30 days prior to planting, the Contractor shall submit a schedule for tagging material to the Engineer.

For all other materials, at least 30 days prior to ordering, the Contractor shall submit to the Engineer material specifications and (where applicable) installation instructions attesting that the following materials meet the requirements specified. No materials shall be ordered until submittals have been approved by the Engineer. Delivered materials shall match the samples.

All material samples shall include supplier's literature and certification that material meets specifications. Submittals, including samples, material specifications, and installation specifications are as follows

Soil wetting agent: Submit two pound sample with supplier specifications and certification.

Fungal mycorrhizae: Submit sample with supplier specifications and certification.

Loam: The Contractor shall submit two 10 pound samples of loam to be used as backfill per the requirements of Section 751 of the Standard Specifications, accompanied by laboratory certified test results per the requirements of Section 751.

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Backfill Mix: The contractor shall submit a 10 pound representative sample of existing soil, which shall then be mixed with loam and tested according to the requirements specified herein. Mixing shall be done in the presence of the Engineer.

Water: Submit a watering schedule, including sources of water, methods of irrigation, and any incidental work required to provide water for the plants.

Testing Methods: The Contractor shall submit to the Engineer for his inspection and approval, equipment and methods for testing soil moisture and soil pH.

The Contractor shall provide to the Engineer two new functioning moisture gauges, including instructions for use and batteries if required, for his use during the duration of the Contract. The meters shall be hand held, and shall be capable of measuring moisture at a depth of 6 inches. The scale shall be sufficient to determine moist, dry, or wet soil. The meters shall be regularly checked for calibration against watered loam, and shall be replaced if found faulty at no additional cost.

In addition, the Contractor shall provide to the Engineer one copy of the "American Standard for Nursery Stock," ANSI Z-60.1, latest edition, published by American Association of Nurserymen (AAN) for the duration of this Contract.

References and Standards

The following standards shall apply to the Work of this Section.

ASNS: "American Standard for Nursery Stock," ANSI Z-60.1, latest edition, published by American Association of Nurserymen (AAN).

Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation and Uses. Michael Dirr. Stipes Publishing Company, latest edition.

Examination of Conditions

The Contractor shall be responsible for judging the full extent of work requirements involved. This responsibility includes, but is not limited to, the following: transportation, purchase, temporary storage and maintenance of plants; plant re-handling prior to final installation; removal and off-site disposal of existing loam determined by the Engineer to be unacceptable; purchase, transport, and supply of loam.

Plant Materials

The Contractor shall furnish all plants as shown on the plans, unless otherwise directed in writing by the Engineer. All plants shall be nursery grown.

All plants shall be legibly tagged with the botanical name. Only plant stock grown within hardiness Zones 1 through 6a, as established by the USDA Plant Hardiness Zone Map, will be

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accepted. The Contractor's suppliers must certify in writing that the stock has actually been grown under Zone 6a or hardier conditions. Plants not so certified will not be accepted.

All plants shall be typical of their species or variety in growth habit. Plant sizes, habit, rootballs, and containers shall be in accordance with the American Standard for Nursery Stock (ASNS), Standards of the American Association of Nurserymen (AAN) as a minimum requirement for acceptance.

All plants must be moved with the root systems in soil. Balled and burlapped plants shall be wrapped with untreated 8 ounce burlap, firmly held in place by a stout cord. Wire containers shall be of sufficient size to allow root development for the plant size, per ASNS requirements. Plants prepared with plastic or other non-biodegradable wrappings will not be accepted. Rootballs shall remain intact during all operations. No plant will be accepted if the rootball has been badly cracked or broken prior to, or during, the process of planting. Rootballs shall be moist upon arrival and shall be kept moist until installation. All balled and burlapped plants that cannot be planted at once must be heeled in by setting them in the ground, covering the rootballs with soil, and watering them adequately.

Container-grown stock shall have been grown in the container long enough for the root system to have developed sufficiently to hold its soil together firmly. No plants shall be loose in the container. Container-grown plants shall not be pot bound, with spiraling roots or roots growing densely against the sides of the container. Score or butterfly cut rootball of all container-grown plants prior to planting.

Each plant shall have plenty of fibrous roots, healthy buds, and shall be free of disease or insect pests, eggs or larvae. All plant parts shall show active green cambium when cut. They shall be densely foliated when in leaf.

The trunk of each tree shall be free from sun scald, frost cracks, or wounds resulting from abrasions, fire or other causes. Pruning wounds shall be no larger than 2 inches and shall show vigorous scar tissue. No trees with double-leaders or twin-heads will be acceptable without the written approval of the Engineer. No plant material from cold storage will be accepted. In regards to shrubs, no single stemmed or thin plants will be accepted. The side branches must be generous and well-twigged, and the plant as a whole must be well-branched to the ground. The plants must be in a vigorous condition, free from dead wood, bruises or other root or branch injuries.

Loam Borrow

Loam borrow, sometimes referred to as loam, for planting soil mix shall be in accordance with the requirements of Standard 751 of the Standard Specifications.

Soil Amendments

Soil amendments, including ground limestone, sulfur, gypsum, and organic materials, shall meet the requirement of Loam Borrow, as described herein.

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Planting Soil Mix

Planting soil for backfill shall be a mixture of equal parts approved loam and excavated material. Mixed material shall be pH tested by the Contractor in the presence of the Engineer, and adjusted according to particular planting applications, using lime or sulfur as required. For plants that require an acid soil, such as ericaceous plants and broad-leaved evergreens, planting soil shall have a true pH of 4.5 to 5.5. Planting soil for all other plants shall have a true pH value of 6.0 to 6.5. Proposed soil amendments shall be submitted to the Engineer for approval prior to application.

Bark Mulch

Bark mulch shall be shredded pine bark aged a minimum of six (6) months. The mulch shall be dark brown in color, free of chunks and pieces of wood thicker than ¼ inches and shall not contain, in the judgement of the Engineer, an excess of fine particles. Unless otherwise specified in these special provisions, bark mulch shall be incidental to the cost of the planting items. Do not use wood chips.

Water

The Contractor shall be responsible for furnishing his own supply of water to the site at no extra cost. All plants injured or damaged due to the lack of water, or due to the use of too much water, shall be the Contractor's responsibility to correct. Water shall be free from impurities injurious to vegetation.

Soil Wetting Agent

Soil Wetting Agent shall be a synthetic, non-toxic acrylic polyacrylamide or natural soluble plant extract. Application rates shall be per manufacturer's recommendations.

Fungal Mycorrhizae

Each plant shall be planted with fungal mycorrhizae. Mycorrhizae shall include at least three species of vesicular arbuscular (endomycchorizal) fungi as well as ectomycorrhizal fungi. Mycorrhizae shall be shipped in individual dosage packets.

Furnishing and planting of plant material shall include, but is not limited to, the following: digging of the pits and plant beds; amendment of loam as required to produce planting soil mix; provision of soil additives for pH requirements of specific plants; provision of soil wetting agents; provision of mycorrhizal fungi; furnishing the plants as specified; plant installation; watering and maintenance.

Seasons for Planting

Spring: Deciduous materials - March 21 through May 1
 Evergreen materials - April 15 through June 1

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Fall: Deciduous materials - Oct. 1 through Dec. 1
 Evergreen materials - Aug. 15 through October 15

Requests for exceptions to this schedule shall be submitted in writing to the Engineer for his approval.

Plant Tagging and Approval

The Contractor shall locate, secure, tag, and ship plant material in a sufficiently timely manner to ensure minimal substitution and storage of plants.

Plants shall be tagged at least one month prior to the expected planting date. The Contractor shall be responsible for tagging the material at the nursery and providing a representative. The Contractor shall request that the Engineer provide a representative to approve tagged stock to be planted under this Section. Contractor shall tag or allow the nursery to tag material for approval of the Engineer's representative. In the event that satisfactory material cannot be located, the Contractor shall be responsible for any necessary travel and overnight accommodations for the Engineer's representative during the period of time required to locate, select, and approve plant material.

All trees and a representative sample of each shrub species on the Plant List shall be tagged by the Contractor at the nursery and approved by the Engineer or his representative, prior to digging, for conformity to specification requirements as to quality, size, and variety. Cost of replacement of materials rejected by the Engineer at the site shall be borne by the Contractor.

Approval of tagged material at the nursery shall not prevent the right of inspection and rejection upon delivery at the site or during the progress of the work.

Tree trunks shall be protected during shipping by a heavy walled cardboard sleeve or other suitable material. Plants shall either be shipped in enclosed trucks or all surfaces, leaves and branches shall be wrapped to prevent damage.

Plant Delivery and Installation

Locations for all plants shall be approved by the Engineer before any plant pits or plant beds are excavated.

The Contractor shall locate all underground utilities within 10 feet of the proposed planting pits and notify the Engineer of any conflicts prior to digging plant pits.

The Contractor shall notify the Engineer 3 working days prior to the proposed arrival of plant material on the site. All plants shall be planted within 5 days of arrival on site or shall be rejected by the Engineer. Plants stored on site shall be shaded from direct sunlight at all times and shall not be stored on paved surfaces. Plants stored on site shall be watered daily.

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Prior to the installation of any plant material, the Contractor shall dig test pits to determine percolation rates. Percolation of less than 1 inch per hour shall require corrective measures as recommended by the Contractor and approved by the Engineer.

Plant pits shall be excavated as shown on plans and the sides scarified to prevent glazed soils.

Trees and shrubs shall be placed as shown on the plans, with the root crown exposed above finished grade. After placement of balled and burlapped plants and prior to backfilling, remove all rope, wire baskets and burlap from the root balls. For container material, remove pots just before planting, and loosen the perimeter roots and soil before placement. Handle plants carefully to prevent damaging roots or stems.

Add soil wetting agent and mycorrhizal fungi per manufacturer specifications. After planting, the Contractor shall submit wetting agent and fungi dose packets to the Engineer to certify installation of material.

Prepare planting soil mix as specified above to depths as shown on the drawings. Place backfill mix in layers of not more than 6 inches, and water each layer sufficiently to settle soil before the next layer is put in place. Backfill mix shall meet finished grade after settlement. Shape edge of planting pit to form a saucer for holding water and place mulch as shown in the plans. Do not cover the stem flare of the plants with mulch.

Water plants immediately following planting as necessary to thoroughly moisten rootball and planting soil.

Plants shall not be wrapped after installation. Wounds shall not be painted. Trees shall not be staked unless wind or other local conditions require the additional protection. Staking and guying shall be as directed and shall be incidental to tree installation. If guying is required, use cloth tape rather than wire. The Contractor shall be responsible for removing all staking and guying materials at the end of the Maintenance Period.

Daffodils shall be placed at depths per manufacturer's directions. Bulbs shall be planted with narrow tip end pointing up. All bulbs shall be planted in groups of at least 4 plants and shall be in a random pattern unless otherwise noted on plans. Bulbs shall be installed in the fall.

Plant Care

Contractor shall provide plant care for the duration of the Maintenance and Establishment periods

Adequate watering is essential to plant care. During the 60 day Maintenance Period, plants shall be inspected for watering needs at least twice each week using moisture meters supplied by the Contractor. In addition, during the portion of the Establishment period occurring between May 1 and October 1, the plants shall be inspected weekly using moisture meters.

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Plant care shall consist of keeping the plants in a healthy growing condition. Plant care shall include watering, weeding, pruning, re-mulching, removal of dead material, resetting plants to proper grades or upright position, and maintaining the planting saucer.

Trees and shrubs shall be pruned, if necessary, following planting and in accordance with the American Nurserymen's Association Standards for Class I, fine pruning, to preserve the natural character of the plant. All dead wood or suckers and all broken or badly bruised branches shall be removed. Do not cut leaders. The Engineer shall determine if plants require pruning, or should be rejected. All pruning work shall be done by a Massachusetts Certified Arborist.

Any decline in the condition of new plantings shall require the Contractor to take immediate action to identify potential problems and undertake corrective measures. If required, the Contractor shall engage professional arborists and/or horticulturists to inspect plant materials and to identify problems and recommend corrective procedures. The Engineer shall be immediately advised of such actions. Inspection and recommendation reports shall be submitted to the Engineer.

Absolutely no debris may be left on the site. The Contractor shall repair any damage to site as directed by the Engineer, at no additional cost.

Maintenance Period: 60 Days

The Maintenance Period shall begin immediately after each plant is planted and shall continue for a minimum of 60 days following the completion of all planting installations, or until the Conditional Acceptance of all planting work, whichever is a longer period of time.

At the end of the Maintenance Period, the Contractor will request inspection by the Engineer at least 10 days before the anticipated date of inspection.

At the time of inspection, if the plant materials and workmanship are acceptable to the Engineer, the Engineer shall issue a written Certificate of Conditional Acceptance to the Contractor. The date of the inspection shall establish the end of the Maintenance Period and the commencement of the required one year establishment period for planting work.

If in the Engineer's opinion, plant materials and/or workmanship is deficient, acceptance will not be granted, and the Maintenance Period for all the plants shall be extended until plant replacements are made or other deficiencies are corrected. All dead and unsatisfactory plants shall be removed promptly from the project. Replacement plants shall conform in all respects to the Specifications for the original plants and shall be planted in the same manner.

Establishment Period: One Year

The purpose of the Establishment Period is to nurture plants through at least one full growing season and one full winter. All plants shall be inspected by the Engineer one year after Conditional Acceptance and shall be alive and in satisfactory growth at the end of that time. The Contractor is responsible for arranging inspection early enough in the season to allow adequate time to procure and install replacement material.

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At the end of the Establishment Period, each plant shall show healthy growth on at least 75 percent of its terminal stems, as determined by the Engineer. Determination of healthy growth shall include, but is not necessarily limited to, viable leaves (in season) and terminal buds, as well as live cambium. Plants found to be unacceptable shall be removed promptly from the site and replaced immediately or during the next normal planting season, as permitted by the specifications.

Planted areas shall be free of weeds and debris, and plantings shall be re-mulched as necessary.

The Engineer will inspect the replacement planting work upon the request of the Contractor. Request for inspection shall be received by the Engineer at least ten days before the anticipated date of inspection.

Stakes and guying, if any, shall be removed from all plants before Final Acceptance.

Upon acceptance of the work of replacement planting, the Engineer shall issue a written Certificate of Final Acceptance for all plants installed under this Section to the Contractor.

MEASUREMENT AND PAYMENT

ITEMS listed above will be measured PER EACH. Each flat will consist of 24 plants. Payment will not be approved until satisfactory completion of the Maintenance Period. The Contract unit prices paid shall be full compensation for providing materials, equipment, labor, and incidentals to provide plant pit excavation, soil preparation, soil amendments, planting mix preparation, loam for planting mix, soil wetting agents, mycorrhizal fungi planting, plant protection, bark mulch (including placement), watering, maintenance, disposal of unsuitable soils, and all other incidentals required for furnishing and installing the plantings in accordance with the drawings, and as directed by the Engineer.

ITEM 812.99 PEDESTRIAN WARNING DEVICE FOUNDATION PRECAST EACH

The work under this item shall conform to the relevant provision of Section 801 and 901 of the Standard Specifications and the following:

The work under Item 812.99 shall include the installation of pre-cast concrete foundations for Pedestrian Warning Device as shown on the plans or as directed by the Engineer.

Pre-cast concrete shall conform to Subsection M4.02.14.

Item 812.09 will be measured and paid for at the contract unit price per each, which price shall include all labor, materials, excavation, backfill, compaction and finishing, along with all necessary components including (but not limited to) conduit sweeps, anchor bolts, reinforcing steel, hardware, tools and incidental costs required to complete the work.

All pvc conduit shall be paid for under Item 804.3 3 Inch Electrical Conduit Type NM-Plastic (UL).

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ITEM 813.82 **SERVICE CONNECTION (UNDERGROUND)** **EACH**

The work under this item shall conform to the relevant provision of Section 813 of the Standard Specifications and the following:

Service connections shown on the plans are approximate only. The Contractor shall determine exact locations from the servicing utility, arrange to complete the service connections, and be responsible for all charges incidental thereto.

Item 813.82 will be measured and paid for at the contract unit price per each, which price shall include all labor, materials, excavation, backfill, compaction and finishing, along with all necessary components including (but not limited to) conduit riser, conduit from power source to load center, wire from power source to load center, labor, tools and incidental costs required to complete the work. The cost of meeting with and coordinating with the utility company is also incidental to this item.

ITEM 815.90 **PEDESTRIAN WARNING DEVICE** **EACH**

The work under this item shall conform to the relevant provision of Section 800 of the Standard Specifications and the following:

Scope of Work: The contractor shall install and "Pedestrian Signal Warning Device" per the attached specification including all necessary materials and labor for a complete traffic signal device which shall operate on 110-volts of power. This power is supplied on site by underground service.

Description: The Pedestrian Warning Device shall have LED flashers facing the roadway warning drivers that a pedestrian is about to enter the crosswalk and LED flashers facing the pedestrian informing that the signal has been activated. The signal shall be mounted on a traffic signal pole and base at a specified height and flash a special flash rate as indicated in the these specifications. The flashing indications shall be activated by a standard push button. All underground conduit and foundations will be installed by the contractor at the location as shown on the construction drawings and the contractor is responsible for mounting the device onto the proposed foundations and installing all necessary wiring to each unit.

BASE: The "Pedestrian Signal – Special Warning Device" shall be attached to a precast concrete foundation with an Alloy Casting Company - Traffic Light Base model ACTB-14-10 or approved equal. The color shall be Black. 4" diameter anchors will have been installed in the foundation for this installation.

POLE: The "Pedestrian Signal – Special Warning Device" shall be attached to a 4 1/2" outside diameter, 12' high, black aluminum pole.

PUSH BUTTON: A standard push button (make and model shall be approved by the Engineer and/or the city of Cambridge Manager of Traffic Operations and Engineering) shall be installed to activate the flashing operation. This button shall be installed at a height noted in the drawings.

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SIGNAGE: Shall be paid for under the appropriate item.

FLASHING DEVICE: The flashing device shall consist of two rectangular LED yellow flashing beacons each 6" wide by 2.5" high, and placed 9" apart. A smaller LED white flashing beacon shall be mounted on the side of the device, facing the pedestrians which will also flash informing the pedestrian that the signal is activated. Both LED flashing beacons shall flash in a wig-wag flashing sequence and both shall flash in combination at rates second cycle.

The left LED flashing beacon shall flash two times during each sequence (at a slower rate) and then the right flasher shall flash three times during each sequence (at a faster rate).

CONTROL CABINET: A small standard traffic control box shall be installed onto one of the "Pedestrian Signal – Special Warning Device" traffic signal pole at the power source. The control cabinet shall have all necessary devices required to operate the "Pedestrian Signal – Special Warning Device" at the flashing rates indicated above and for service reasons, have a power termination point immediately after the electric meter. Make and model shall be approved by the Manager of Traffic Operations and Engineering. One control cabinet is required for this installation and will operate one to four "Pedestrian Signal Warning Device" by connecting additional devices two to four to the control cabinet. Pending on the number of "Pedestrian Signal Warning Device" installed, all units shall flash at the same interval.

Warranty:

The "Pedestrian Warning Device" complete system shall have a 24-month warranty effective once the device is accepted by The Manager of Traffic Operations. This warranty includes any malfunctions associated with the push button, controller, flasher beacons and wiring installed by the contractor. The contract shall repair or replace any malfunctioning device (including labor) within 14 days of notification by the City of Cambridge.

MEASUREMENT AND PAYMENT

The Pedestrian Warning Device shall be measure per each unit installed. The payment per each device installed shall include excavation, precast concrete footing, installation of device, 12' steel pole, base, LCD lights, push button, controller, flasher beacons, wiring and all work, equipment and materials required to provide a device complete installed in place and operational as per the City of Cambridge approval.

ITEM 823.715	HIGHWAY LIGHTING POLE AND ILLUMINATED	EACH
	<u>SIGN REMOVED AND STACKED</u>	

The work under this item shall conform to the relevant provisions of Section 820 of the Standard Specifications and the following.

The contractor shall coordinate the removal of the highway lighting poles and illuminated signs with City of Cambridge. These items shall be delivered to 147 Hampshire Street, Cambridge MA and this shall be considered incidental to the cost of the item.

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The contractor shall take all necessary precautions, including but not limited to, coordinating traffic operations with the City of Cambridge Police Department and all relevant utilities in the removal of this item.

Costs for any special equipment to aid in the removal of the lighting pole and illuminated sign, as well as any disconnection of existing utilities from said pole shall be considered incidental to the cost of this item.

<u>ITEM 850.41</u>	<u>ROADWAY TRAFFIC FLAGGER</u>	<u>HOUR</u>
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The work under this item shall conform to the relevant provisions of Section 850 of the Standard Specifications and the following:

The Contractor shall provide the number of flaggers required in either the appropriate Traffic Control Plan (TCP) template (Refer to MassDOT's website at <http://www.MassDOT.com>) or that the Engineer deems necessary for the direction and control of traffic within the site. A flagger shall be used as directed by the Engineer in accordance with 701CMR 7.00, this section, and the TCP. Any flagger determined by the Engineer to be ineffective in controlling traffic may be removed at the discretion of the Engineer. If a flagger is directed to be removed, the Contractor shall immediately comply with the directive from the Engineer and shall suspend operations as necessary until a qualified replacement can be provided. Such a suspension of operations shall not be considered as a basis for a claim or an extension of time.

Flaggers used during the performance of the work shall be at least eighteen (18) years of age and possess a current certificate of satisfactory completion from a flagger training program within the last two (2) years that has been approved by MassDOT. Prior to the start of work, the Contractor shall provide to the Engineer a written list of certified flaggers to be used, including the most recent date of certification or re-certification for each person listed. All flaggers shall carry their approved flagging training program certification card with them while performing flagging duties. Flagger certifications shall remain valid for the duration of the project or the flagger shall be removed from the project.

Flaggers used during the performance of the work shall have completed a First Aid training course according to the standards and guidelines of the American Heart Association or the American Red Cross. Flaggers shall carry their First Aid certification cards with them while performing flagging duties. First Aid certifications need not be renewed once the initial certification has expired.

Each flagger shall be equipped with the following high visibility clothing, signaling, and safety devices:

- (1) A white protective hard hat with a minimum level of reflectivity per the requirements of ANSI, Type I, Class E&G;
- (2) A clean, non-faded, un-torn, lime/yellow reflective safety vest and safety pants meeting the requirements of ANSI 107 Class 3;

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(3) A twenty-four (24) inch “STOP / SLOW” traffic paddle conforming to the requirements of Part 6E.03 of the Manual on Uniform Traffic Control Devices (MUTCD), a weighted, reflectorized, red flag, flagger station advance warning signage, and two-way radios capable of providing clear communication within the work zone between flaggers, the Contractor, and the Engineer. The traffic paddle shall be mounted on a pole of sufficient length to be seven (7) feet above the ground as measured from the bottom of the paddle;

(4) A working flashlight with a minimum of 15000 candlepower and a six (6) inch red attachable wand, a whistle with an attached lanyard, and a First Aid kit that complies with the requirements of ANSI Z308.1;

(5) An industrial/safety type portable air horn that complies with the requirements of the U.S. Coast Guard.

Compensation for flaggers will be paid on an hourly basis for only the actual time spent flagging and payment will be made under Item 850.41 Roadway Traffic Flagger. No allowance or additional payment will be made for required training, equipment, travel time, transportation, or any administrative charges associated with the costs of flaggers.

<u>ITEM 868.04</u>	<u>PAVEMENT ARROWS AND LEGENDS</u>	<u>SQUARE FOOT</u>
	<u>REFL. WHITE (EPOXY)</u>	
<u>ITEM 868.06</u>	<u>6 INCH REFLECTORIZED WHITE LINE (EPOXY)</u>	<u>FEET</u>
<u>ITEM 868.12</u>	<u>12 INCH REFLECTORIZED WHITE LINE (EPOXY)</u>	<u>FEET</u>
<u>ITEM 868.2</u>	<u>YIELD SYMBOL WHITE (EPOXY)</u>	<u>SQUARE FOOT</u>
<u>ITEM 869.06</u>	<u>6 INCH REFLECTORIZED YELLOW LINE (EPOXY)</u>	<u>FEET</u>
<u>ITEM 869.12</u>	<u>12 INCH REFLECTORIZED YELLOW LINE (EPOXY)</u>	<u>FEET</u>

The work under these items shall conform to the relevant provisions of Section 860 of the Standard Specifications and the following:

Yield symbol white (epoxy) shall include the “sharks teeth” as shown on the plans or as directed by the Engineer or the City Cambridge.

Item 868.06, 868.12, 869.06 and 869.08 will be measured for payment by the linear foot of actual markings installed, which price shall include all labor, materials, equipment, and incidental costs required to complete the work.

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Item 868.04 and 868.2 will be measured for payment by the square foot of actual markings installed, which price shall include all labor, materials, equipment, and incidental costs required to complete the work.

<u>ITEM 874.2</u>	<u>TRAFFIC SIGN REMOVED AND RESET</u>	<u>EACH</u>
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<u>ITEM 874.4</u>	<u>TRAFFIC SIGN REMOVED AND STACKED</u>	<u>EACH</u>
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The work under these items shall conform to the relevant provisions of the Standard Specifications and the following:

The contractor shall take all necessary precautions not to damage any of the signs during the removal process. Any signs damaged beyond use shall be replaced by the Contractor at no cost to MassDOT or the City of Cambridge.

All signs removed and stacked shall be delivered to the Department of Public Works, 147 Hampshire Street, Cambridge, MA at no additional cost.

All signs shall be reset as directed by the engineer at no additional cost.

Basis of Payment

Work under this Item shall be paid at the Contractor bid price, per each unit, which payment shall be considered compensation for all labor, tools, equipment and materials needed to do the work as described above.

<u>ITEM 999.001</u>	<u>POLICE DETAIL</u>	<u>HOUR</u>
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Item 999.001 to be inserted by the Construction Contract Section.