City of Cambridge

PURCHASING DEPARTMENT
795 Massachusetts Ave. • Cambridge, Massachusetts 02139-3219

Amy L. Witts
Purchasing Agent

TO: **All Bidders**

FROM: **City of Cambridge**

DATE: **October 18, 2016**

RE: **File No. 7404 – Sacramento Field Park Renovation - Addendum No. 1**

This addendum is comprised of:

1. **Sign in sheet from pre-bid meeting**
2. **Revised Set of Technical Specifications**
3. **Questions and answers**

The following question was asked and answered:

Question: **Can you tell me if the above named project includes synthetic turf?**

Answer: **No it does not.**

All other details remain the same.

Amy L. Witts

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Addendum No. 1

SACRAMENTO FIELD PRE BID

OCT 12, 2016
10:00AM

Name or Company	Address	Phone / Email
Mike Salem, Argus Const.	5 Shawsheen Ave Bedford, MA 01730	781 275 7417
Rick Amato R & S Landscaping	171 Mystic Ave. Medford MA	Mike@argusconstructioncorp.com 978-872-4264. RickAmato@RandSLandscaping.com

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 1

SUMMARY OF WORK

PART I GENERAL

1.01 LOCATION OF WORK

A. The work of this contract is located at the existing Project site. The Project site located within Cambridge, Massachusetts. The site is bounded as indicated in the bid invitation and as shown on the contract drawings.

1.02 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required to construct the site improvements for the Project site in its entirety as shown on the drawings and specified herein.

B. The work includes, but is not necessarily limited to, the following:

1. Clearing of existing trees, shrubs and vegetation indicated to be removed, grubbing of roots and stumps, stockpiling of excavated material, removal and disposal of existing topsoil, pavements and structures where indicated or necessary, sedimentation and erosion control, and removal of site debris and unsuitable materials, to approved locations, off the site, as specified herein and as shown on the drawings.

2. Furnishing all labor, equipment, and materials necessary to perform all excavation and grading, utility installation, drainage, installation of pavements as required, signs, gates and fencing, site furniture, site and sports lighting as required, automatic irrigation systems, all as required and all miscellaneous recreational and site appurtenances as specified herein and as shown on the drawings.

3. Furnishing all labor, equipment, and materials necessary to perform all loaming, and sodding, landscaping and planting, final cleanup and maintenance, all as specified herein and as shown on the drawings.

C. The owner may elect to increase the scope of work by selecting in order, any of the Add Alternates listed in the bid form.

1.03 CONTRACTOR'S USE OF PREMISES

A. Contractor shall have complete and exclusive use of the premises for the performance of the work.

B. Contractor shall assume full responsibility for security of all his and his sub contractors materials and equipment stored on the site.

C. Obtain and pay for use of additional storage or work areas if needed to perform the work.

1.04 ABBREVIATIONS AND REFERENCES

AAN	-	The American Association of Nurserymen
AASHTO	-	The American Association of State Highway and Transportation Officials
AISC	-	American Institute of Steel Construction
ANSI	-	American National Standards Institute
ASTM	-	American Society of Testing Materials
AWPA	-	American Wood Preservers Association
Fed. Specs.	-	Federal Specifications
NPS	-	National Park Service
NEWWA	-	New England Water Works Association
OSHA	-	Occupational and Safety Health Act
SSHB	-	Massachusetts Department of Public Works, Standard Specifications for Highways and Bridges
MUTCD	-	Massachusetts Manual on Uniform Traffic Control Devises
CPSC	-	Consumer Product Safety Commission
ADA	-	Americans with Disabilities Act

1.05 DEFINITIONS

"AS SHOWN ON THE DRAWINGS"	-	Shall mean all plan view Drawings, Elevations, Sections and Construction Details
"AS REQUIRED"	-	Shall mean as determined solely by the project engineer to complete the work of the contract

* END OF SECTION *

SECTION 2

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 BASE BID ITEMS

A. Measurement and payment for work to be performed under the respective unit bid items as listed in Section C-1.

B. Each unit of lump sum price stated in the base bid or in the add or deduct alternates shall constitute full compensation for furnishing and completely installing each item of work, in accordance with the drawings and specifications herein.

C. A complete installation of each unit or lump sum item includes but is not limited to all necessary excavation, grading, backfilling, backfill materials, furnishing and placing the item of work, and all other incidental work, and coordination with all other trades for which separate payment is not provided for under other items.

1.02 ADD or DEDUCT ALTERNATES

A. Alternates shall be bid such that at the owner's option, the owner may select, in order, any alternate or combination of alternates, or none of the alternates. The bidder is required to provide a bid for each alternate listed in the bid forms, and below. If selected by the owner, the alternate(s) will be added or deducted to/from the total base bid price.

1.03 EXTRA WORK

A. Extra work, if any, will be performed in accordance with Article 10 of the General Conditions and will be paid for in accordance with the provisions of Article ~~11~~ 116 of the General Conditions.

* END OF SECTION *

SECTION 3

CONTROL OF WORK

PART 1 GENERAL

1.01 EQUIPMENT AND PERSONNEL

A. Furnish personnel and equipment which will be efficient and appropriate and to secure a satisfactory quality of work and a rate of progress which will insure the completion of the work within the time stipulated in the Bid Form. If at any time available personnel and equipment appears to the Engineer to be inefficient, inappropriate or insufficient for securing the quality of work required or for producing the rate of progress aforesaid, he may order the Contractor to increase the efficiency, change the character or increase the equipment, and the Contractor shall conform to such order. Failure of the Engineer to give such order shall in no way relieve the Contractor of their obligations to secure the quality of the work and rate of progress required.

1.02 PRIVATE LAND

A. The Contractor shall not enter or occupy private land except by permission of the property owner or as approved by the City.

B. Where it is necessary for the Contractor to enter private property to perform work required under the Contract, Owner has obtained written approval from the property owner for access to the property to perform the required work. Contractor shall notify each affected property owner 48 hours in advance of beginning such work.

1.03 PIPE LOCATIONS

A. Pipelines shall be located substantially as indicated on the Drawings, but the Engineer reserves the right to make such modifications in locations as may be found desirable to avoid interference with existing structures or for other reasons. Where fittings are noted on the Drawings, such notation is for the Contractor's convenience and does not relieve him from laying and jointing different or additional items where required.

1.04 OPEN EXCAVATIONS

A. All work shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons, and damage to property. The Contractor shall, at their own expense, provide suitable and safe crossings for accommodating travel by pedestrians and workmen which shall be removed when no longer required. The length or size of excavation will be controlled by the particular surrounding conditions, but shall always be confined to the limits prescribed by the Engineer. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, the Engineer may require special construction procedures such as limiting the length of the open trench and requiring that the trench shall not remain open overnight.

B. The Contractor shall take precautions to prevent injury to the public due to open trenches. All trenches, excavated material, equipment, or other obstacles which could be dangerous to the public shall be well lighted at night.

1.05 TEST PITS

A. Test pits for the purpose of locating underground pipeline, structures, or determining below ground conditions in advance of the construction shall be excavated and backfilled by the Contractor at the direction of the Engineer. Test pits shall be backfilled immediately after their purpose has been satisfied and the surface restored and maintained in a manner satisfactory to the Engineer.

1.06 MAINTENANCE OF TRAFFIC

A. Unless permission to close a street is received in writing from the proper authority, all excavated material shall be placed so that vehicular and pedestrian traffic may be maintained at all times. If, in the opinion of the Engineer, the Contractor's operations cause traffic hazards, they shall repair the road surface, provide temporary ways, erect wheel guards or fences, or take other measure for safety satisfactory to the Engineer.

B. Detours around construction will be subject to the approval of the Owner and the Engineer. Where detours are permitted the Contractor shall provide all necessary barricades and signs as required to divert the flow of traffic. While traffic is detoured the Contractor shall expedite construction operations and periods when traffic is being detoured will be strictly controlled by the Owner.

C. The Contractor shall take precautions to prevent injury to the public due to open trenches. Night watchmen may be required where special hazards exist, or police protection provided for traffic while work is in progress. The Contractor shall be fully responsible for damage or injuries whether or not police protection has been provided.

D. Truck Routes

1. The Owner regulates where and when vehicles over 2.5 tons may travel in Section 21.12 Heavy Commercial Vehicles Prohibited From Using Certain Streets of the City of Cambridge Traffic Regulations. A copy of the tables showing truck traffic restrictions is attached to this Section. These restrictions shall apply to this Contract except where permitted in accordance with Subsection 17.2B of the regulation by the:

Department of Traffic and Parking
57 Inman Street
Cambridge, MA 02139
Telephone: 349-4700

2. Such permits are normally granted for construction, delivery, emergencies, etc.

3. The Contractor shall submit in writing, for the Engineer's and Owner's approval, routes and schedules for delivery and a copy of all traffic permits obtained per the above regulation at least two weeks prior to mobilization.

1.07 SITE ACCESS AND SECURITY

A. Contractor shall be responsible for site security to prevent vandalism and accidents by unauthorized access to the site prior to Provisional Acceptance. This shall include, but shall not be limited to, temporary fencing and/or watchmen as required. The Owner shall assist the Contractor by performing periodic police patrols of the area outside the normal working hours.

B. All other security personnel and materials shall be provided at Contractor's expense.

1.08 CARE AND PROTECTION OF PROPERTY

A. The Contractor shall be responsible for the preservation of all public and private property, and shall use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work on the part of the Contractor, such property shall be restored by the Contractor, at his expense, to a condition similar or equal to that existing before the damage was done, or he shall make good the damage in other manner acceptable to the Engineer.

1.09 PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES

A. The Contractor shall assume full responsibility for the protection of all buildings, structures, and utilities, public or private, including poles, signs, services to buildings, utilities in the street, gas pipes, water pipes, hydrants, sewers, drains, and electric and telephone cables, whether or not they are shown on the Drawings. The Contractor shall carefully support and protect all such structures and utilities from injury of any kind. Any damage resulting from the Contractor's operations shall be repaired by him at his expense.

B. Assistance will be given the Contractor in determining the location of existing services. The Contractor, however, shall bear full responsibility for obtaining all locations of underground structures and utilities (including existing water services, drain lines, and sewers). Services to buildings shall be maintained, and all costs or charges resulting from damage thereto shall be paid by the Contractor.

C. Protection and temporary removal and replacement of existing utilities and structures as described in this Section shall be a part of the work under the Contract and all costs in connection therewith shall be included in the Total Base Bid in the Bid Form.

D. If, in the opinion of the Engineer, permanent relocation of a utility owned by the City of Cambridge is required, he may direct the Contractor, in writing, to perform the work. Work so ordered will be paid for at the Contract unit prices, if applicable, or as extra work under Article 11 of the Supplementary Conditions. If relocation of a privately owned utility is required, the Owner will notify the Utility to perform the work as expeditiously as possible based on a request by the Contractor. The Contractor shall fully cooperate with the Owner and Utility, and shall have no claim for delay due to such relocation. The Contractor shall notify all utility companies in writing at least 72 house (excluding Saturdays, Sundays and Legal holidays) before excavating in any public way.

Contractor shall also notify Massachusetts Dig Safe, telephone 1-800-322-4844, at least 72 hours prior to start of work.

E. The Contractor shall coordinate the removal and replacement of traffic loops and signals, if required for the performance of the work, at no additional cost to the Owner.

1.10 WATER FOR CONSTRUCTION PURPOSES

A. The Contractor may be allowed to use water without charge for puddling backfill, dust control and other construction purposes, and for turf installation and maintenance.

B. Existing street hydrants, if any, shall only be operated under the supervision of the Owner's personnel.

C. In the absence of any city street hydrants or any other access to water, Contractor shall be responsible for providing water at his or her expense.

1.11 MAINTENANCE OF FLOW

A. The Contractor shall at his own cost, provide for the flow of sewers, drains and water courses interrupted during the progress of the work, and shall immediately cart away and remove all offensive matter. The entire procedure of maintaining existing flow shall be fully discussed with the Engineer well in advance of the interruption of any flow.

1.12 COOPERATION WITHIN THIS CONTRACT

A. All firms or persons authorized to perform any work under this Contract shall cooperate with General Contractor and his Subcontractors or trades, and shall assist in incorporating the work of other trades where necessary or required.

B. Cutting and patching, drilling and fitting shall be carried out where required by the trade or subcontractor having jurisdiction, unless otherwise indicated herein or directed by the Engineer.

1.13 CLEANUP AND DISPOSAL OF MATERIALS

A. During the course of the work, the Contractor shall keep the site of his operations in as clean and neat a condition as is possible. He shall dispose of all residue resulting from the construction work as well as any debris illegally dumped on the site by others prior to and during construction under this Contract, at least once per week. He shall remove from the site and haul away any trash, lumber, equipment, temporary structures, and any other refuse remaining from the construction operations, and shall leave the entire site of the work in a neat and orderly condition. Burial of construction debris or trash on site or burning of same is strictly forbidden.

B. In order to prevent environmental pollution arising from the construction activities related to the performance of this Contract, the Contractor and his Subcontractors shall comply with all applicable Federal, State and local laws, and regulations concerning waste material disposal, as well as the specific requirements stated in this Section and elsewhere in the Specifications.

C. The Contractor is advised that the disposal of excess excavated material in wetlands, stream corridors, and flood plains is strictly prohibited even if the permission of the property owner is obtained. Any violation of this restriction by the Contractor or any person employed by him, will be brought to the immediate attention of the responsible regulatory agencies, with a request that appropriate action be taken against the offending parties. Therefore, the Contractor will be required to remove the fill at his own expense and restore the area impacted.

D. Should the Contractor fail, refuse or neglect to remove rubbish and waste materials and temporary work, or clean the premises as required herein, then the Owner may, or shall without obligation to do so, remove and dispose of said rubbish, waste materials and temporary work, and clean the premises, and deduct the cost thereof from any money due or to become due the Contractor under his Contract.

* END OF SECTION *

SECTION 4

SPECIAL PROVISIONS

PART I GENERAL

1.01 GENERAL OBLIGATIONS OF THE CONTRACTOR

A. General obligations of the Contractor shall be as set forth in the Contract Documents. Unless special payment is specifically provided in the payment paragraphs of the Specifications, all incidental work and expense in connection with the completion of work under the Contract will be considered a subsidiary obligation of the Contractor, and all such costs shall be included in the appropriate items in the Bid Form in connection with the costs are incurred.

1.02 COORDINATION WITH LOCAL AGENCIES

A. The Contractor shall supply the local Police Department, Fire Department, School Department, Traffic and Parking Department and the Public Works Department with the following information:

1. A list of streets and intersections where work will be in progress to be supplied at intervals as required by the Engineer.

2. Areas where approved detours are in effect and limited street closing is required.

3. Immediate notification of any drain, gas or water main breaks.

4. Advance notice of time for connection of site utilities to existing City utilities.

B. The Contractor will be required to reimburse the Owner for the actual cost of the services of Water Department Personnel required during other than regular work hours. The emergency contact number for the Water Department during non-business hours in 498-9070.

1.03 PROGRESS SCHEDULE

A. The Contractor shall submit a progress schedule before starting any work which shall conform to the schedule requirements of paragraph 1.06 below and Section 5.

B. The Contractor shall review the progress schedule with the Engineer periodically. such review shall be made on a monthly basis or more frequently as required by the Engineer. The progress schedule shall be updated as required by the Engineer.

1.04 PERMITS

A. The Contractor shall be required to obtain all necessary permits for proper execution of certain phases of the project. The Contractor shall fill out all forms and furnish all drawings required to obtain the permits. A copy of the approved permit shall be submitted to the Project Engineer. Fees for City of Cambridge permits will be waived by the Owner. Work shall not commence on any phase of the work requiring a permit until the permit is obtained.

B. The Contractor shall obtain required street opening permits for excavations within streets or sidewalk areas. Owner will waive all fees associated with required permits.

1.05 HEALTH AND SAFETY CONSIDERATIONS

A. All Contractor safety and health procedures shall be consistent with OSHA Safety and Health Standards (29 CFR 1910).

B. All personnel working on site shall be at all times required to use basic protective equipment consisting of suitable work clothes as indicated by weather, hardhats, steel-toed and steel-shank safety boots, and any other protective equipment applicable or required for the task being performed (e.g., work gloves, eye and/or ear protection, etc.).

1.06 SPECIAL CONSTRUCTION SCHEDULE REQUIREMENTS

A. Contractors shall conform to the following schedule. All time limits specified below are measured from 10 days after the effective date of the Agreement.

1. Mobilization shall be completed within 10 days excluding Saturdays, Sundays, and holidays.

2. Project sign shall be prepared and installed within 30 calendar days.

3. Source materials testing results shall be delivered to the Engineer and samples to the Field Office within 30 days of authorization to proceed and a minimum of 2 weeks prior to delivery of any materials to the site for review by the Engineer.

4. Truck routes for materials shall be submitted to the City at least 2 weeks prior to anticipated start of materials delivery.

* END OF SECTION *

SECTION 5

SUBMITTALS

PART 1 GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

A. This Section specifies the general methods and requirements of submissions applicable to the following work-related submittals: (1) Construction Schedule, (2) Shop Drawings, Product Data, and Samples, (3) Construction Photographs. Additional general submission requirements are contained in Articles 104, 106 - 108, 120, 139 of the General Conditions. Detailed submittal requirements will be specified in the technical specification sections.

1.02 CONSTRUCTION SCHEDULE

A. In lieu of the progress schedules specified in the General Conditions, the Contractor shall, within 10 days after the effective date of the Agreement, provide and submit to the Engineer for approval, the Schedule he/she plans to maintain in order to successfully construct the work within the time allotted. In addition to all reasonable important construction activities, the Schedule shall provide for the proper sequence of construction considering the various crafts, purchasing time, submittal approval, material delivery, equipment fabrication, and similar time-consuming factors.

B. The Schedule shall include as a minimum, the earliest starting, finish, latest starting, latest finish dates, and the total float for each task or item. The Contractor Estimate and Pay Schedule.

C. While the Contractor bears full responsibility for scheduling all phases and stages of the work to insure its successful prosecution and completion within the time specified in accordance with all provisions of these Specifications, the Contractor is specifically required to complete fully or complete such stages of work to enable other Contractors to complete their work within the respective times specified.

1.03 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES

A. Shop Drawings

1. Shop drawings, as defined in the General Conditions, and as specified in individual work Sections include, but are not necessarily limited to, custom-prepared data such as fabrication and erection/installation drawings, scheduled information, setting diagrams, actual shopwork manufacturing instructions, custom templates, special wiring diagrams, coordination drawings, individual system or equipment inspection and test reports including performance curves and certifications, as applicable to the Work.

2. All shop drawings submitted by subcontractors for approval shall be sent directly to the Contractor for preliminary checking. The Contractor shall be responsible for their submission at the proper time so as to prevent delays in delivery of materials.

3. The Contractor shall check all subcontractors' shop drawings regarding

measurements, size of members, materials, and details to satisfy him/herself that they conform to the intent of the Drawings and Specifications. Drawings found to be inaccurate or otherwise in error shall be returned to the subcontractors for correction before submission thereof.

4. All details on shop drawings submitted for approval shall show clearly the relation of the various parts to the main members and lines of the structure, and where correct fabrication of the work depends upon field measurements, such measurements shall be made and noted on the drawings before being submitted for approval.

B. Product Data

1. Product data as specified in individual Sections, include, but are not necessarily limited to, standard prepared data for manufactured products (sometimes referred to as catalog data), such as the manufacturer's product specification and installation instructions, availability of colors and patterns, manufacturer's printed statements of compliance's and applicability, roughing-in diagrams and templates, catalog cuts, product photographs, printed performance curves and operational-range diagrams, production or quality control inspection and test reports and certifications, mill reports, product operating and maintenance instructions and recommended spare-parts listing, and printed product warranties, as applicable to the Work.

C. Samples

1. Samples specified in individual Sections, include, but are not necessarily limited to, physical examples of the work such as sections of manufactured or fabricated work, small cuts or containers of materials, complete units of repetitively-used products, color/texture/pattern swatches and range sets, specimens for coordination of visual effect, graphic symbols, and units of work to be used by the Engineer or Owner for independent inspection and testing, as applicable to the Work.

2. For materials furnished under this Contract, Contractor shall furnish the following:

   a. Two (2) twenty (20) lb. bag samples for quality control testing of each type of off site fill material required for each borrow source or supplier, at least three (3) weeks prior to intended field use.

   b. One (1) twenty (20) lb. bag sample for quality control testing of off site fill materials from haul trucks for each 1,000 cubic yards of material placed and compacted.

3. Samples shall be delivered to field office of the Engineer, as directed.

4. During the work, samples required in connection with compaction tests will be taken and transported by the Engineer.

1.04 CONTRACTOR'S RESPONSIBILITIES

A. The Contractor shall review shop drawings, product data and samples prior to submission to determine and verify the following:

1. Field measurements

2. Field construction criteria

3. Catalog numbers and similar data

4. Conformance with the Specifications

B. Each shop drawing, working drawing, sample and catalog data submitted by the Contractor shall have affixed to it the following Certification Statement, signed by the Contractor: "Certification Statement: by this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data and I have checked and coordinated each item with other applicable approved shop drawings and all Contract requirement."

C. Notify the Owner in writing, at the time of submittal, of any deviations in the submittals from the requirements of the Contract Documents.

D. The review and approval of shop drawings, samples or catalog data by the Engineer shall not relieve the Contractor from his responsibility with regard to the fulfillment of the terms of the Contract. All risks of error and omission are assumed by the Contractor and the Engineer will have no responsibility therefor.

E. No portion of the work requiring a shop drawing, working drawing, sample, or catalog data shall be started nor shall any materials be fabricated or installed prior to the approval or qualified approval of such item. Fabrication performed, materials purchased or on-site construction accomplished which does not conform to approved shop drawings and data shall be at the Contractor's risk. The Owner will not be liable for any expense or delay due to corrections or remedies required to accomplish conformity.

F. Project work, materials, fabrication, and installation shall conform with approved shop drawings, working drawings, applicable samples, and catalog data.

1.05 SUBMISSION REQUIREMENTS

A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Work or in the work of any other Contractor.

B. Number of submittals required:

1. Shop Drawings: "6" copies".

2. Product Data: Submit six copies

3. Samples: Submit the number stated in the respective Specification Sections.

C. Submittals shall contain:

1. The date of submission and the dates of any previous submissions.

2. The Project title and number.

3. Contractor identification.

4. The names of:

   a. Contractor
   b. Supplier
   c. Manufacturer

5. Identification of the product, with the specification section number.

6. Field dimensions, clearly identified as such.

7. Relation to adjacent or critical features of the Work or materials.

8. Applicable standards, such as ASTM or Federal Specification numbers.

9. Identification of deviations from Contract Documents.

10. Identification of revisions on resubmittals.

11. An 8" inch x 3" inch blank space for Contractor and Engineer stamps.

1.06 RESUBMISSION REQUIREMENTS

A. Make any corrections or changes in the submittals required by the Engineer and resubmit until approve.

B. Shop Drawings and Product Data:

1. Revise initial drawings or data, and resubmit as specified for the initial submittal.

2. Indicate any changes which have been made other than those requested by the Engineer.

C. Samples: Submit new samples as required for initial submittal

1.07 DISTRIBUTION

A. Distribute reproductions of approved shop drawings and copies of approved product data and samples, where required, to the job site file and elsewhere as directed by the Engineer but shall not exceed 6.

1.08 CONSTRUCTION PHOTOGRAPHS

A. The Contractor shall take before, monthly and completed project photos. The

photographs shall be of such views, locations and taken at such times as the Engineer directs.

B. Contractor shall engage a professional photographer as approved by Engineer, upon provisional acceptance of the project to spend a minimum of four (4) hours on site to take final site photos as directed by Engineer. A minimum of 140 proofs Shall be taken by the photographer for review by the Engineer and Owner. Photographs shall provide two (2) 8" inch x 10" inch copies of selected photos minimum twenty (20) different views of completed facility. Each print shall have a glossy finish and be mounted on a substantial backing. The overall dimensions of each mounted print shall be 8" inch x 10" inch with 1¼" inch flexible binding margin on the short left-hand side.

C. The film negatives shall be retained in the files of the photographer until the completion of the project and shall then be turned over to the Owner.

D. Each photograph shall have attached to the cloth backing a paper label, approximately 2¼" inch wide by 1-3/4" inch high containing thereon in neat lettering:

1. Contractor's name

2. Short Description of View

3. Photo No. an Date Taken

4. Photographer's Firm Name

1.09 GENERAL PROCEDURES FOR SUBMITTALS

A. Coordination of Submittal Times: Prepare and transmit each submittal sufficiently in advance of performing the related work or other applicable activities, or within the time specified in the individual work sections, of the Specifications, so that the installation will not be delayed by processing times including disapproval and resubmittal (if required), coordination with other submittals, testing, purchasing, fabrication, delivery and similar sequenced activities. No extension of time will be authorized because of the Contractor's failure to transmit submittals sufficiently in advance of the Work.

B. Within 10 days after award of Contract, the Contractor shall submit to the Engineer in triplicate, a breakdown of the lump sum items. This breakdown shall be subject to approval by the Engineer, and when so approved shall become the basis for determining progress payments and for negotiation of change orders, if required.

* END OF SECTION *

SECTION 6

TEMPORARY FACILITIES

PART 1 GENERAL

1.01 TEMPORARY OFFICES

A. Temporary offices shall be established on the job site where approved or directed by the Engineer, adequately furnished, and maintained in a clean, orderly condition by the Contractor for the duration of the Project. The Contractor or his/her authorized representative shall be present in the filed office at all times while work is in progress. Instructions received there from the Engineer shall be considered as delivered to the Contractor.

B. The Contractor shall provide partitioned-off space of at least 100 sq. ft. of floor space in his/her building for the exclusive use of the Engineer throughout the period of construction. The temporary office shall be weathertight, have a tight floor at least 8" inch off the ground and shall be insulated all around with rigid insulation board not less than ½" inch thick, and suitably ventilated. The office shall have adequate ventilation, screened windows capable of being opened and a solid door provided with cylinder lock and three keys. Temperatures within office to be maintained between 60° and 80° F. The office shall be provided with janitor service, heating equipment, electrical wiring, outlets, and fixtures suitable to light the tables and desk adequately as directed.

C. The office shall have the following furniture and equipment:

1. One plan table, 3' feet x 5' feet and one stool
2. Desk about 3' feet x 5' feet with desk chair
3. Three additional chairs
4. Plan rack, as directed
5. Shelves, as directed
6. Four-drawer, filing cabinet with lock
7. Coat rack and hooks
8. Desk calculator
9. Air Conditioner (12,000 BTU)
10. Fire extinguisher
11. One conference table (6' feet long)
12. Eight folding chairs

13. First aid kit suitable for 10 people with manual, American White Cross No. K10 or equal

14. Hot and cold water dispenser with supply of bottled water and cups

D. The Contractor shall supply all fuel for heating and pay all electrical bills.

E. An approved, suitably constructed and equipped trailer of proper size may be furnished for the Engineer's office.

1.02 TEMPORARY TELEPHONE

A. The Contractor shall install in the field office a telephone for the Engineer's use and, with the exception of charges for long distance and toll calls, shall pay all bills charged against the Engineer's telephone, including installation charge and all monthly charges throughout the construction period.

1.03 TEMPORARY LIGHT AND POWER

A. The Contractor shall furnish temporary light and power, complete with wiring, lamps, and similar equipment as required to adequately light all work areas and with sufficient power capacity to meet the reasonable needs of all his subcontractors. He shall make all necessary arrangements with the local electric company for temporary electric service, and pay all expenses in connection therewith.

1.04 TEMPORARY HEAT

A. The Contractor shall provide all heat as may be necessary for thawing out and heating the ground or materials and for proper execution, protection, and drying out of his/her and his/her subcontractor's work.

1.05 WEATHER PROTECTION

A. The Contractor shall furnish, install and maintain temporary heat and enclosures to provide adequate working areas for his/her and his/her subcontractors' men/women during the months of November through March.

B. The cost of furnishing, installing, maintaining and removing all materials and equipment necessary to provide temporary enclosures and heat shall be borne by the Contractor and be included in his/her Bid.

1.06 TEMPORARY AIR AND WATER

A. The Contractor shall provide all air and water, including temporary piping and appurtenances required therefor, as may be required for dust control and the cleaning and testing of pipelines and appurtenances as necessary for his/her and his/her subcontractor's work. Temporary piping and appurtenances shall be removed upon approval of the pipe and appurtenances being tested.

1.07 PROJECT SIGN

A. The Contractor shall furnish and install the project sign as shown on the detail appended to the Project Manual. The sign shall be placed as directed by the Engineer and shall remain in position for the duration of the construction period.

B. Plywood for sign shall be A-A EXT-APA grade (1") one inch thick. Posts shall be 4"x 4" inch pressure treated pine.

C. If desired and approved by the Engineer, an existing project sign, installed as part of past construction activities, may be altered to reflect current contract information.

1.08 SANITARY FACILITIES

A. Provide, place and maintain in good working order from commencement to final completion of contract, suitable temporary toilet facilities for use by Contractor, his/her subcontractors and the Engineer. Toilets to be rented from an approved temporary sanitary service company, and shall be kept clean, sanitary and secure at all times. The specific toilet enclosures shall be approved by the Engineer. The number of units shall be as recommended by the Department of Labor for the Commonwealth of Massachusetts.

* END OF SECTION *

SECTION 7

DUST CONTROL

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Perform dust control operations, in an approved manner, whenever necessary or when directed by the Engineer, even though other work on the project may be suspended. Accomplish dust control by the use of water or the use of calcium chloride as approved by the Engineer.

B. All methods of controlling dust shall meet all air pollutant standards as set forth by Federal and State regulatory agencies.

* END OF SECTION *

SECTION 8

POLICING

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Scheduling Police Details shall be the responsibility of the Contractor. A Police Detail is to be present during all construction activity. To schedule a detail officer, call (617) 349-3350.

B. The Cambridge Police Department requires 24-hour advance notice to obtain a Police Detail, except in emergencies and 4-hour advance notice to cancel a detail.

C. The Contractor must submit all signed detail forms to the project managers or engineer, so that Public Works can pay all submitted and approved Police detail invoices. Any invoices that are not approved will be the responsibility of the contractor to pay.

D. The City of Cambridge Police Department shall bill the City of Cambridge Department of Public Works or whatever department has oversight of the contract for the services of uniformed police officers provided by the Police department.

E. The Contractor will be required to reimburse Public Works or whatever department has oversight of the contract for Police Details, if the Contractor fails to show for the job or if the Contractor fails to cancel the detail with adequate advance notice.

* END OF SECTION *

SECTION 9

CONTROL OF MATERIALS

PART 1 GENERAL

1.01 APPROVAL OF MATERIALS

A. Unless otherwise specified, only new materials and equipment shall be incorporated in the work. All materials and equipment furnished by the Contractor shall be subject to the inspection and approval of the Engineer. No material shall be delivered to the work without prior approval of the Engineer.

B. As specified in Section 5, the Contractor shall submit to the Engineer, data relating to materials and equipment he/she proposes to furnish for the work. Such data shall be in sufficient detail to enable the Engineer to identify the particular product and to form an opinion as to its conformity to the specifications.

C. Facilities and labor for handling and inspection of all materials and equipment shall be furnished by the Contractor. If the Engineer requires, either prior to beginning or during the progress of the work, the Contractor shall submit additional samples or materials for such special tests as may be necessary to demonstrate that they conform to the specifications. Such samples shall be furnished, stored, packed, and shipped as directed at the Contractor's expense. Except as otherwise noted, the Owner will make arrangements for and pay for the tests.

D. Any delay of approval resulting from the Contractor's failure to submit samples or data promptly shall not be used as a basis of a claim against the Owner or the Engineer.

E. In order to demonstrate the proficiency of workmen or to facilitate the choice among several textures, types, finishes, and surfaces, the Contractor shall provide such samples of workmanship or finish as may be required.

F. The materials and equipment used on the work shall correspond to the approved samples or other data.

1.02 LEAD IN SOIL

A. All new soils and other materials incorporated into the work shall meet Massachusetts Department of Environmental Protection Chapter 21E levels for lead. New materials include but are not limited to play sand, topsoil, fills, gravels, wood safety surfacing, bark mulch, etc. The City reserves the right to at any time test for lead and other hazardous substances. Levels of contamination shall not exceed acceptable limits for exposure for the different soil categories as outlined by the Commonwealth of Massachusetts Department of Environmental Protection (D.E.P.) 310 CMR (effective 2/1/95). Specifically the "safe" lead level for all new materials is 200ppm; 30ppm for arsenic; and 30ppm for cadmium three toxic elements commonly present. If levels are found to be unacceptable through testing conducted by the City, the Contractor shall completely excavate, remove and dispose of said material(s) off site in a legal manner and replace with clean materials all at his or her expense. All related work necessary to restore disturbed area shall also be at the contractor's expense. This

provision applies to all new soils and other materials trucked to site from other sources.

1.03 HANDLING AND STORAGE OF MATERIALS

A. All materials and equipment to be incorporated in the work shall be handled and stored by the manufacturer, fabricator, supplier and Contractor before, during, and after shipment in a manner to prevent warping, twisting, bending, breaking, chipping, rusting, and any injury, theft or damage of any kind whatsoever to the material or equipment.

B. Cement and lime shall be stored under a roof and off the ground and shall be kept completely dry at all times. All steel shall be stored off the ground or otherwise to prevent accumulations of dirt or grease, and in a position to prevent accumulations of standing water and to minimize rusting. Precast concrete shall be handled and stored in a manner to prevent accumulations of dirt, standing water, staining, chipping or cracking. Masonry products shall be handled and stored in a manner to reduce breakage, chipping, cracking, and spilling to a minimum.

C. All equipment subject to damage by the atmosphere if stored outdoors (even though covered by canvas) shall be stored in a building to prevent injury. The building may be a temporary structure on the site or elsewhere, but it must be satisfactory to the Engineer.

D. Geotextile fabrics shall be stored in such a way as to be protected from ultraviolet radiation.

E. All materials which, in the opinion of the Engineer, have become so damaged as to be unfit for the use intended or specified shall be promptly removed from the site of the work, and the Contractor shall receive no compensation for the damaged material or its removal.

F. All pipe and other materials delivered to the job shall be unloaded and placed in a manner which will not hamper the normal operation of the Contractor or interfere with the flow of necessary traffic.

G. To the maximum extent possible, equipment and materials shall be brought to the site via approved truck routes. The Contractor shall issue instructions to his/her crews, suppliers, and delivery personnel to minimize construction related traffic on local residential streets.

* END OF SECTION *

DIVISION 2 - SITE WORK

SECTION 10

SITE PREPARATION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and perform all clearing, grubbing removals, and disposal as shown on the drawings and specified herein.

1.02 RELATED WORK NOT INCLUDED

A. Disposal of topsoil and all other unacceptable sub grade unsuitable material is included in Section 11.

PART 2 PRODUCTS

PART 3 EXECUTION

3.01 CLEARING AND GRUBBING

A. Except as otherwise directed by the engineer, contractor shall cut, grub, remove and dispose of all stumps, brush, shrubs, vines and small trees (6" inch caliper or less), to be removed, roots and any other objectionable material within the Limits of Work. Remove any building materials, or debris dumped up against perimeter fencing by abutting property owners or their tenants as necessary to implement the proposed fence improvements.

B. Areas outside the limits of work shall be protected from damage and no equipment or materials shall be stored in these areas.

C. Protect trees or groups of trees, designated by the engineer to remain, from damage by all construction operations by erecting temporary fence 4' from the trunk of trees, or by other approved means. Clearing operations shall be conducted in a manner to prevent falling trees from damaging trees designated to remain. There shall be no storage of materials inside the protected areas around trees by contractors or sub contractors throughout the project.

D. Burial of stumps, tree, limbs, roots or brush in fills or embankments will not be permitted.

E. All tree trunks, limbs, roots, stumps, brush, foliage, other vegetation and objectionable material shall be removed from the Site and disposed of in a manner satisfactory to the Engineer.

F. Burning of cleared and grubbed materials will not be permitted.

G. Clearing and grubbing of woody undergrowth and weeds that have been sprayed with herbicide shall be performed by hand or other means approved by the Engineer.

3.02 REMOVAL AND ABANDONMENT OF EXISTING DRAINAGE STRUCTURES

A. Where shown on the drawings and as required to complete the work of this contract, remove or abandon existing drainage structures and associated pipe to the limits shown on the drawings, as required to install new drainage structures.

B. Where the existing drain is to be "abandoned" the contractor shall remove a section of the pipe ends and completely fill the pipe with sand. The contractor shall then install masonry plugs at all manhole and catch basin inlets and outlets and completely fill each manhole and catch basin with sand compacted in 3' foot layers. The contractor shall remove the frame and cover/grate and cut off the top of the manhole or catch basis to a minimum of 2' feet below finished grade.

C. All manhole frames and covers from the existing drain manholes and frames and grates from catch basins being removed or abandoned shall remain the property of the owner. All other portions of the existing drainage facilities removed shall become the property of the contractor and shall be disposed of at his/her expense.

3.03 PAVEMENT AND CURBING REMOVAL

A. Where shown on the drawings and as required to complete the work of this contract, excavate and remove cement or bituminous concrete pavement and curb in streets, sidewalks and parking lots. Remove and disposed of off site in a legal and approved manner.

3.04 FENCING REMOVAL

A. Where shown on the drawings and as required to complete the work of this contract, contractor shall completely remove existing fencing and gates including fabric, posts, rails and concrete footings completely and to the satisfaction of the engineer.

B. Fencing and gates shall be removed not more than one week prior to the installation of new fencing and gates unless otherwise approved by the engineer.

C. All fencing to be removed shall be disposed of in a legal and approved manner.

3.05 REMOVAL AND MAINTENANCE OF EXISTING LIGHTING SYSTEM

A. Any existing lighting system shall be maintained fully by the contractor throughout the construction of new park or until any newly planned lighting system is operational.

B. Damage caused by construction to any existing lighting system shall be repaired by the contractor at his/her expense. All repairs to be completed and lighting restored to full operation within twenty-four hours of reporting problem to contractor.

C. Existing lights provide important year round security lighting for the area and therefore adequate levels of illumination must be maintained throughout the project area.

D. Once any newly planned lighting system is near operational the existing light fixtures shall

be removed by contractor from poles and delivered to a city designated storage area. The Contractor shall remove conduit which interferes with all proposed construction improvements.

E. Any salvageable light poles shall be delivered to a city designated storage area. All poles and concrete footings to be completely removed.

3.06 WOOD CURBING AND RETAINING WALLS

A. Where shown on the drawings and as required to complete the work of this contract, completely remove wood curbing edging or retaining walls. All associated steel reinforcement bars, spikes and concrete footings shall be removed and disposed of off site by the contractor.

3.07 PLAY AND SPORTS EQUIPMENT

A. Where shown on the drawings and as required to complete the work of this contract, existing playground equipment, rubber safety surfacing, sports equipment, park furniture (tables, benches, shelters) and all associated concrete footings shall be completely removed and disposed of off site by contractor.

3.08 WATER WORKS

A. Where shown on the drawings and as required to complete the work of this contract, existing water sprays, fountains or existing irrigation hose bibbs including water lines, concrete pedestals and bases serving them shall be removed from the site and disposed of in an approved manner.

B. Water lines shall be removed back to the nearest valve within site or on the main tapped for service to these structures.

3.09 TOPSOIL

A. Where shown on the drawings and as required to complete the work of this contract, strip and stockpile all re-useable topsoil from all areas to be excavated or filled. Topsoil determined by the Project Engineer to not be suitable for inclusion in the work shall be disposed of by the contractor off site in a legal and acceptable manner.

B. Topsoil considered unsuitable for reuse may be used as common fill if it meets the Massachusetts Department of Environmental Protection levels for lead. Refer to Section 9, 1.02, and may be stockpiled on site for that purpose.

3.10 TREE REMOVAL, TRANSPLANTING OR PRUNING

A. Where shown on the drawings and as required to complete the work of this contract, cut, remove and dispose completely of all trees within the limits of work of this contract as shown on the drawings. Remove all tree branches which overhang the site and otherwise prune all trees to remain, as directed by the engineer. The owner shall be responsible for notifying abutters and obtaining all necessary releases before proceeding with branch removal and tree pruning.

B. Remove all tree stumps completely Grind down stumps at least 18" inch below ground where complete stump removal will cause damage to abutters property, as directed by the engineer.

C. Transplant existing trees as shown on the drawings and as directed by the engineer. Personnel used to transplant trees shall have adequate transplanting equipment and training acceptable to the Engineer.

D. Prune all existing trees to remain within limit of work as directed by engineer. All tree pruning shall be done by a Massachusetts certified arborist or nurseryman.

E. Remove and reset any existing steel tree grates as shown on the drawings. Expand grate openings as directed by the engineer. Remove debris accumulated within tree pit and furnish and install an approved 3/4" inch crushed stone mulch. Paint grates with an approved exterior black enamel.

3.11 REMOVAL OF GRANITE CURBING

A. Where shown on the drawings and as required to complete the work of this contract, granite curb shall be removed and reset; removed, relocated and reset; or removed and disposed of off site as shown on the drawings or as directed by the engineer. The city reserves the right to keep removed granite curb.

3.12 PAVERS

A. Where shown on the drawings and as required to complete the work of this contract, existing concrete, brick or other pavers shall be removed and reset; removed, relocated and reset; or removed and disposed of as shown on the drawings or as directed by the Project Engineer.

3.13 SAW CUTTING

A. Where shown on the drawings and as required to complete the work of this contract, exposed concrete or bituminous concrete pavement shall be saw cut with a sharp cutting blade. Provide neat vertical cuts through the existing pavement, in order to perform the construction task, with a minimum amount of disturbance to existing pavement that is to be preserved.

B. Pavement breakers with a sharp spade bit will be used only for areas which will be covered over or otherwise concealed.

3.14 ADJUST UTILITY STRUCTURES

A. Where shown on the drawings and as required to complete the work of this contract, the contractor shall adjust existing drainage structures, water gates, gas gates, etc. within Limits of work to meet proposed grades.

B. Protect such structures shown on the drawings and/or designated by the engineer to remain, from damage by all construction operations by erecting suitable barriers or by other approved means.

3.15 TEMPORARY CONSTRUCTION FENCE

A. Where shown on the drawings and as required to complete the work of this contract furnish, install, relocate, and maintain temporary construction fencing. Contractor shall use either 6'-8' ft. high chain link fence # 9 gauge fabric, with steel posts driven into ground; or 6-8'ft. high free standing steel frame and wire mesh panels, as required by the Project Engineer. Furnish, install and maintain all access gates, as necessary in order to efficiently carry out the scope of work.

B. Projects that involve phases of construction activity will involve taking temporary fencing down, relocating and re installing, as the work progresses from one phase to later phases.

C. Furnish and install all required public safety and informational signage requested by the Project Engineer, including but not limited to, re directing pedestrian foot traffic away from the site in general, and work areas, providing public information on the progress of the work, or work schedule.

* END OF SECTION *

SECTION 11

EARTHWORK

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals necessary to perform all excavation, backfill, fill and grading required to complete the work shown on the Drawings and specified herein. The work shall include, but not necessarily be limited to; excavation for structures, footings, handholes, conduits, pipes, trenches, and paving; all backfilling and fill; embankment and grading; disposal of waste and surplus materials; and all related work such as sheeting, bracing, dewatering and pumping.

B. Topsoil excavated under this Section may be salvaged by the Contractor for his/her own convenience for use as common fill as specified under this Section.

1.02 RELATED WORK NOT INCLUDED

A. Dust control is included in Section 7.

B. Site preparation is included in Section 10.

C. Paving, and curbing and guardrails are included in Section 14.

D. Loaming and sodding is included in Section 27.

E. Landscaping is included in Section 25.

1.03 PROTECTION

A. Sheeting and Bracing

1. Furnish, put in place, and maintain such sheeting and bracing as may be required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction, and to protect adjacent structures from undermining or other damage. If the Engineer is of the opinion that at any points sufficient or proper supports have not been provided, he may order additional supports put in, and compliance with such order shall not relieve or release the Contractor from his responsibility for the sufficiency of such supports. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and rammed. Where soil cannot be properly compacted to fill a void, lean concrete shall be used as backfill.

2. Construct the sheeting outside the neat lines of the foundation, unless indicated otherwise, to the extent deemed desirable for the method of operation. Sheeting shall be plumb and securely braced and tied in position. Sheeting and bracing shall

be adequate to withstand all pressures to which the structure or trench will be subjected. Any movement or bulging which may occur shall be corrected to provide the necessary clearances and dimensions.

3. Where sheeting and bracing is required to support the sides of excavations for structures, the Contractor shall engage a Professional Engineer, registered in the State of Massachusetts, to design the sheeting and bracing. The sheeting and bracing installed shall be in conformity with the design, and certification of this shall be provided by the Professional Engineer.

4. Leave in place to be embedded in the backfill all sheeting and bracing not shown on the Drawings but which the Engineer may direct in writing to leave in place at any time during the progress of the work for the purpose of preventing injury to structures, utilities, or property, whether public or private. The Engineer may direct that timber used for sheeting and bracing be cut off at any specified elevation. Sheeting directed by the Engineer to be left in place will be paid for in accordance with Article 11 of the General Conditions. Payment for sheeting shown on the Drawings to be left in place will be included in the Base Bid. All timber sheeting to be left in place within the limits of the structure shall be treated.

5. All sheeting and bracing not left in place shall be carefully removed in such manner as not to endanger the construction or other structures, utilities, or property. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools especially adapted to that purpose, or otherwise as may be directed.

6. The right of the Engineer to order sheeting and bracing left in place shall not be construed as creating any obligation on his/her part to issue such orders, and his/her failure to exercise his/her right to do so shall not relieve the Contractor from liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise, growing out of a failure on the part of the Contractor to lease in place sufficient sheeting and bracing to prevent any caving or moving of the ground.

7. No sheeting is to be withdrawn if driven below mid-diameter of any pipe, and under no circumstances shall any sheeting be cut off at a level lower than (1') one foot above the top of any pipe.

1.04 DEWATERING - PUMPING AND DRAINAGE

A. The Contractor shall at all times during construction and up to the date of final acceptance provide and maintain proper equipment and facilities to remove all water entering excavations, and shall keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fills, structures or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural levels. The Contractor shall engage a Geotechnical Engineer, where required, to design the dewatering system. The Contractor shall submit to the Engineer for review the design of the dewatering systems prior to commencing work. Submit to the Engineer details of the silt collection system, description of the equipment to be used, filter design, design calculations and method of water disposal to be employed.

B. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation. Well or sump installations shall be constructed with proper sand filters to prevent drawing of finer grained soil from the surrounding ground. All pumps and equipment shall be maintained at all times in proper working order.

C. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and pumped from the excavation to maintain a bottom free from standing water. Water shall be disposed of by pumping from an approved temporary silt collection basin, through an approved filter medium and then to the discharge piping.

D. Take all additional precautions to prevent uplift of any structure during construction.

E. Drainage shall be disposed of in an approved area only so that flow or seepage back into the excavated area will be prevented. Dispose of discharge in accordance with all applicable regulations, ordinances and instructions of the City of Cambridge, or other authorities having jurisdiction.

F. Flotation shall be prevented by maintaining a positive and continuous operation of the dewatering system. The Contractor shall be fully responsible and liable for all damages which may result from failure of this system.

G. Remove the dewatering equipment after the system is no longer required.

H. Take all necessary precautions to preclude the accidental discharge of fuel, oil, etc. in order to prevent adverse effects on groundwater quality.

I. The Contractor shall obtain and pay for all necessary permits.

1.05 SUBMITTALS

A. Submit to the Engineer for review the proposed methods of construction, including dewatering, excavation, filling, compaction, and backfilling for the various portions of the work. Review shall be for method only. The Contractor shall remain responsible for the adequacy and safety of the methods.

1.06 COMPACTION

A. Previous to the general placement of the fill, and during such placement, the Engineer may select areas within the limits of the fill for testing the degree of compaction obtained. The Contractor shall cooperate fully in obtaining the information desired.

B. Payment for testing will be made by the Owner. If test results are unsatisfactory, all costs involved in correcting deficiencies in compacted materials to the satisfaction of the Engineer, will be borne by the Contractor.

1.07 MATERIALS TESTING

A. Prior to the delivery of any materials in this Section to the site, the Contractor shall submit samples of structural fill, common fill, select common fill, crushed stone, processed gravel, sandy gravel, screened gravel, sand for children's play areas, Indian clay, impermeable fill, and stone screenings to a materials testing consultant approved by the Engineer for testing to determine compliance with the gradation requirements of the specifications. Contractor shall pay for initial testing. Soils and other materials shall meet Massachusetts Department of environmental Protection Chapter 21E levels for lead safety. Refer to Section 9, paragraph 1.02.

B. Materials failing the testing procedures will be rejected for use on the Project. The Contractor shall be responsible for identifying another source of material and shall incur all expenses associated with resubmission and testing of additional samples.

1.08 CONSTRUCTION CONTROL

A. The Contractor is responsible for all construction layout and reference staking necessary for the proper control and satisfactory completion of all structures, cutting, filling, grading, drainage and utilities installation, fencing, and all other appurtenances required for the completion of the construction work and acceptance of the Contract as specified and as shown on the Drawings.

B. All construction layout and staking shall be performed by a Professional Land Surveyor registered by the Commonwealth of Massachusetts, experienced and skilled in construction layout and staking of the type required under this Contract, and acceptable to the Engineer and Owner.

C. The Engineer will furnish the Contractor control points, bench marks and other data as may be necessary for the construction staking and layout.

D. The Contractor shall be responsible for the placement and preservation of adequate ties to all control points necessary for the accurate reestablishment of all base lines or center lines shown on the Drawings.

E. The Engineer may check the control of the work, as established by the Contractor, at any time as the work progresses. The Contractor will be informed of the results of these checks, but in so doing, the Engineer in no way shall relieve the Contractor of his responsibility for the accuracy of the layout work.

PART 2 PRODUCTS

2.01 MATERIALS

A. STRUCTURAL FILL

1. Structural Fill (bank run gravel) for any required structural fill shall be gravel, sandy gravel, or gravelly sand free of organic material, loam, wood, trash, snow, ice, frozen soil, and other objectionable material and shall be well graded within the following limits:

Sieve Size	Percent Finer by Weight
3" inch	100
No. 4	20 - 70
No. 40	5 - 35
No. 200	0 - 10

2. The Contractor shall submit a representative sample of proposed structural fill, weighing approximately 50 lbs., at least 5 days prior to the date of anticipated use of such material.

B. COMMON FILL

Common fill for any required common fill shall consist of mineral soil substantially free from organic materials, loam, wood, trash and other objectionable materials which may be compressible or which cannot be properly compacted. Common fill shall not contain stones larger than 10" inches in largest diameter and shall have a maximum of 75 percent passing the No. 40 sieve and a maximum of 30 percent passing No. 200 Sieve. Common fill shall not contain granite blocks, broken concrete, masonry rubble or other similar materials. It shall have physical properties such that it can be readily spread and compacted during filling. Snow, ice and frozen soil shall not be permitted.

C. SELECT COMMON FILL

Select Common Fill for any required select common fill shall be as specified above for common fill except that the material shall contain no stones larger than 2" inches in largest dimension.

D. CRUSHED STONE

1. Crushed stone for any required crushed stone granite curb work, sitting walls, construction entrances, staging areas, sediment controls and french drain shall conform to Section M2.01.4 of the MADOTSSHB. Submit sample for Engineer's approval prior to delivery to the site.

E. DENSE GRADED CRUSHED STONE

For pathway and pavement sub base shall be a combination of crusher run coarse aggregate of crushed stone and fine aggregates of natural sand or stone screening uniformly premixed with a predetermined quantity of water conforming to Section M2.01.7 of the MADOTSSHB.

G. SANDY GRAVEL FILL

Any required sandy gravel fill material for use under playing fields shall conform to Section M1.04 Type b of SSHB. Submit sample for Engineer's approval prior to delivery to the site.

H. PROCESSED GRAVEL

Processed gravel for any planned use as base course material under bituminous concrete and cement concrete pavements, under pre-cast concrete pavers, and stone dust walks shall conform to Section M1.03.1 of SSHB. Submit sample for Engineer's approval prior to delivery to the site.

I. CLAY INFIELD MIX

Indian clay for any planned infields, warning paths, pitchers mounds, as necessary shall be inert materials which shall consist of three parts clean, washed, sharp concrete sand and one part Indian clay with 40 percent passing the number 200 sieve. Material shall be free from deleterious materials and be as manufactured by Heffron Materials, Wilmington, MA or approved equal. Submit sample for Engineer's approval prior to delivery to the site.

J. SCREEENED GRAVEL

1. Screened gravel shall be used for any necessary pipe bedding as detailed and at other locations indicated on the Drawings.

2. Screened gravel shall consist of hard, durable, rounded or subangular particles of proper size and gradation, and shall be free from sand, loam, clay, excess fines, and deleterious materials. The gravel shall be graded within the following limits:

Sieve Size	Percent Finer by Weight
5/8" inch	100
½" inch	40 - 100
3.8" inch	15 - 45
No. 10	0 - 5

K. PLAY SAND

1. Any sand required for children's play area shall be #50 as produced by Holliston Sand Company, Box 1168 Tifft Road, Slattersville RI 02876, Phone: (401)766-5010, Fax: (401) 762-4976, or approved equal. Submit sample(s) for approval of Project Engineer.

2. The material shall be free of silt and shall be free of deleterious soluble salts. The gradation shall meet the requirement of the following range:

Sieve Size	Percent Retained
No. 12.0	100%
No. 20.0	98.10%
No. 30.0	98.4%
No. 40.0	85%
No. 50.0	55.5%
No. 70.0	22.7%
No. 100.0	5.60%
No. 140.0	0.80%

No. 200	0.10%

3. Contractor shall submit samples for Engineer's approval prior to delivery to the site.

L. IMPERMEABLE CLAY

1. Any impermeable fill material necessary shall be from an off-site source accepted by the Owner and tested to insure a permeability coefficient of less than or equal to 1 x 10-7 cm/sec after compaction. The material shall be as specified under the Unified Soil Classification System as CL, CH, SC and OH in ASTM D2487. Prior to acceptance of the material it shall be tested by an outside independent soils analysis company for the maximum dry density as determined by the modified proctor test, ASTM Designation D1557. Moisture content must be not wetter than 5 percentage points above nor less than 2 percentage points below the optimum moisture content as determine by ASTM D1557. Certified results shall be sent to the Engineer for approval and acceptance.

M. STONE SCREENINGS

1. Stone screenings (stone dust) for specialty pavers, and walks as necessary shall be the by product of a crushed stone, free from surface coatings and deleterious materials, in conformance with SSHB specification M2.05.0. The gradation shall meet the requirement of the following range:

U.S. Standard Sieve Size	Percent Passing by Weight
No. 4	100
No. 8	96
No. 16	68
No. 30	43
No. 50	29
No. 100	17
No. 200	11

N. RICE STONE

1. Any "rice stone" required for children's play area shall be ¼" x 3/16"size rounded stone, as produced by Holliston Sand Company, Box 1168 Tifft Road, Slattersville RI 02876, Phone: (401)766-5010, Fax: (401) 762-4976, or approved equal. Submit sample(s) for approval of Project Engineer.

O. RIPRAP

1. Riprap shall be sound, durable rock which is angular in shape. Rounded stones, boulders, sandstone or similar soft stone or relatively thin slabs will not be acceptable. Each stone shall weigh not less than 50 pounds and at least 75% of the volume shall consist of stones weighing not less than 500 pounds each. The

remainder of the stones shall be so graded that when placed with larger stones the entire mass will be compact.

P. ROCKFILL

1. Rockfill shall be sound, angular in shape, free from structureal defects and comparatively free of chemical decay. From 50 to 70% of the stones shall weigh not less than 500 pounds each and remainder shall weigh not less than 50 pounds each.

PART 3 EXECUTION

3.01 ROCK, BOULDER AND CONCRETE EXCAVATION

A. Rock excavation shall be understood to mean ledge rock which in the opinion of the Engineer requires for its removal, drilling and blasting, wedging, sledging or barring, and boulders which in the opinion of the Engineer require blasting for removal. Rock excavation shall be made to the widths and depths directed by the Engineer in the field.

B. Boulder excavation shall be understood to mean only boulder sin any kind of excavation exceeding 1 cu yd in volume which can be excavated without resorting to blasting.

C. Concrete excavation shall be understood to mean concrete and/or steel reinforced concrete encountered in any excavation exceeding 1 cu yd in volume which can be excavated without resorting to blasting. Concrete excavation shall be made to the widths and depths directed by the Engineer in the Field.

D. All blasting operations shall be conducted in full compliance with all the laws of the State, all local ordinances, and with all possible care so as to avoid injury to persons and property. The rock shall be well covered, and sufficient warning shall be given to all persons in the vicinity of the work before blasting. Care shall be taken to avoid injury to all water pipes, gas pipes, or other structures and to private property. The Contractor, in addition to observing all municipal and other ordinances relating to the storage and handling of explosives, shall also conform to any further regulations which the Engineer shall deem necessary.

E. If rock below grade is shattered on account of holes having been drilled too deep or too heavy charges of explosives used or for nay other reasons due to blasting by the Contractor, and if, in the opinion of the Engineer, said shattered rock is unfit for foundation, the shattered rock shall be removed and the excavation refilled as required by the Engineer at the expense of the Contractor.

F. Where rock or concrete encountered, it shall be uncovered but not excavated until measurements have been made by the Engineer.

G. Measurement and payment for rock, boulder and concrete excavation shall be made as provided under the bid item and in accordance with Article 11 of the General Conditions.

3.02 EXCAVATION BELOW GRADE

A. If the bottom of any excavation is taken out below the limits shown on the Drawings or

specified or directed by the Engineer, it shall be refilled at the Contractor's expense with concrete, 8" inch layers of compacted structural fill or other material satisfactory to the Engineer. The type of material to be used shall be at the Engineer's option.

B. If the Contractor does not care for water properly, through failure to postpone final excavation immediately above the subgrade until shortly before placing of the new work thereon, or other failure or neglect to conduct the excavation and dewatering work properly so than the surface of the subgrade is in proper condition when he is ready for construction, the Contractor shall remove the unsuitable material and replace it with concrete, compacted structural fill, or other approved material at his own expense so that the condition of the subgrade meets with the approval of the Engineer before any work is placed thereon.

C. If, in the opinion of the Engineer, the material, in its undisturbed natural condition, at or below the normal grade of the excavation as indicated on the Drawings is unsuitable for foundations, it shall be removed to such depth and width as he may direct and be replaced with suitable material as directed by the Engineer for which compensation will be made in accordance with the respective bid item and Article 11 of the General Conditions.

3.03 SUBGRADE PREPARATION

A. Where existing grade in areas to receive the play fields, infield or general turf areas is above the subgrade elevation required to install the required minimum thickness of sandy gravel and loam or Indian clay, the Contractor shall excavate to the depth required to achieve final compaction thicknesses of the above materials at the finished surface grade indicated on the Drawings.

B. Where existing grades are below the subgrade elevation required to install the required minimum thicknesses of sandy gravel and loam or Indian clay the Contractor shall fill and compact suitable common fill as specified to the subgrade elevations required by the Drawings. In turf areas to be filled, sandy gravel shall be placed and compacted to a minimum thickness of 6" inch.

C. Prior to placing the sandy gravel, gravel base course, etc. the Contractor shall thoroughly compact the subgrade to the specified degree of compaction required.

D. Upon completion of any required excavation, filling or regrading, all subgrade surfaces shall have all boulders, rock fragments, or other rubble and debris exposed at the surface removed.

E. Subgrade under areas not to receive pavement shall be compacted to 92% of maximum density as defined by ASTM D1557.

F. Subgrade under area to be paved shall be compacted to 95% of maximum density as defined by ASTM D1557.

G. Notify the Engineer in advance of compaction activities and make prepared subgrade surfaces available to the Engineer for observation and testing.

3.04 STRUCTURE EXCAVATION

A. Excavation shall be made to the grades shown on the Drawings and to such widths as will

give suitable room for construction of the structures, for bracing and supporting, pumping and draining. The bottom of the excavations shall be rendered firm and dry and in all respects acceptable to the Engineer.

B. Excavation and dewatering shall be accomplished by methods which preserve the undisturbed state of subgrade soils. Exposed subgrades shall be proof rolled with at least two coverages of the specified equipment. (refer to Paragraph 3.09D). The Engineer shall waive this requirement if, in his opinion, the subgrade will be rendered unsuitable by such compaction. Subgrade soils which become soft, loose, "quick", or otherwise unsatisfactory for support of structures as a result of inadequate excavation, dewatering, proof rolling, or other construction methods shall be removed and replaced by structural fill as required by the Engineer at the Contractor's expense.

C. Dewatering shall be such as to prevent boiling or detrimental underseepage at the base of the excavation as specified herein before. All dewatering materials and methods shall be furnished by the Contractor so as to achieve and maintain firm and dry excavations.

D. Excavation equipment shall be satisfactory for carrying out the work in accordance with the Specifications. In no case shall the earth be ploughed, scraped, or dug with machinery so near to the finished subgrade as to result in excavation of, or disturbance of material below grade, the last of the excavated material being removed with pick and shovel.

E. When excavations have reached prescribed depths, the Engineer shall be notified and he will inspect conditions. If materials and conditions are not satisfactory to the Engineer, the Engineer will issue instructions as to the procedures, and if additional costs are involved, adjustments of the contract will be made on the basis of unit prices agreed upon by the Owner and the Contractor in accordance with the provisions of the contract documents.

F. During final excavation to subgrade level, take whatever precautions are required to prevent disturbance and remolding. Material which has become softened and mixed with water shall be removed. Hand excavation of the final 3" to 6" inch will be required as necessary to obtain a satisfactory undisturbed bottom. The Engineer will be the sole judge as to whether the work has been accomplished satisfactorily.

3.05 EXCAVATION AND BACKFILLING FOR FOOTINGS AND PIPE LINE TRENCHES

A. Excavation for all pipe lines beneath structures and excavation for all footings shall be carried out with the excavating equipment operating from the subgrade for the structure. The excavation shall be carried out "in-the-dry" and in a manner which will preserve the undisturbed state of the subgrade soils. The excavations may be completed with shoring and bracing of open cuts.

B. All excavation beneath structures shall be backfilled with structural fill compacted as specified above. Where it is impractical to us large equipment for compaction or when such methods, in the opinion of the Engineer, are disturbing the surrounding natural subgrade, the fill shall be compacted using hand-operated mechanical compactors. The lift thickness shall not exceed (6") six inches measured before compaction when hand-operated equipment is used.

3.06 TRENCH EXCAVATION AND BACKFILLING

A. Excavation for all trenches required for the installation of pipes shall be made to the depths indicated on the Drawings and in such a manner and to such widths as will give suitable room for laying the pipe within the trenches, for bracing and supporting, and for pumping and drainage facilities; and he shall render the bottom of the excavations firm and dry and in all respects acceptable to the Engineer. Pavement, when encountered, shall be cut with pneumatic chisels along straight lines before excavating.

B. Rock shall be removed to a minimum 8" inch clearance around the bottom and sides of all the pipe being laid.

C. Where pipe is to be laid in gravel bedding or encased in concrete, the trench may be excavated by machinery to, or just below the designated subgrade provided that the material remaining in the bottom of the trench is no more than slightly disturbed.

D. Where pipe is to be laid directly on the trench bottom, the lower part of the trenches in each shall not be excavated to grade by machinery, the last of the material being excavated manually in such a manner that will give a flat bottom true to grade so that pipe can be evenly supported on undisturbed material. Bell holes shall be made as required.

E. The Contractor shall meet the following criteria when his installation method included the use of a steel box:

1. When installing rigid pipe (R.C., V.C. A.C. etc.), any portion of the box extending below mid diameter shall be raised above this point prior to moving the box ahead to install the next pipe. This is to prevent the separation of installed pipe joints due to movement of the box.

2. When installing flexible pipe (PVC, ABS solid wall, ABS truss, DI, etc.), the bottom of the box shall not extend below mid diameter. This is to prevent loss of soil between the box and the pipe bedding which could result in excessive deflection of the installed pipe.

F. Where pipe is to be installed in fill of any type, fill shall be placed and compacted to the total depth required (rough grade elevation) and then re-excavation for pipe installation.

G. As soon as practicable after the pipe has been laid and jointed, backfilling shall begin and thereafter be prosecuted expeditiously. If required, as shown on the Drawings, screened gravel shall be placed around the pipe to mid-diameter. As the screened gravel is placed, it shall be compacted by suitable tools.

I. After the required screened gravel bedding (if required) has been placed to mid-diameter of the pipe, selected common fill shall be placed to a depth of 1 foot over the top of the pipe. Select common fill shall be thoroughly compacted by hand-tamping as placed with at least one man tamping for each man shoveling material into the trench.

J. Where the pipes are laid in unpaved areas, the remainder of the trench shall be filled with common fill in layers not to exceed 3 feet and thoroughly compacted by rolling reaming or puddling, as the Engineer may direct, sufficiently to prevent subsequent settling. The

backfill shall be mounded 6" inch above the existing grade or as directed. Whenever a loam or gravel surface exists prior to cross country excavations, it shall be removed, conserved, and replaced to the full original depth as part of the work under the pipe items. In the full original depth as part of the work under the pipe items. In some areas it may be necessary to remove excess material during the clean-up process, so that the ground may be restored to its original level and condition. If the Contractor prefers not to store loam or topsoil he shall replace it with loam or topsoil of equal quality and in equal quantity.

K. Where the pipes are laid in streets, or other paved areas, the remainder of the trench above the bedding and up to a depth of 1 foot below the bottom of the specified paving shall be backfilled with common fill in 1 foot layers thoroughly compacted by rolling, or ramming as the Engineer may direct. The 1 foot layer below the bottom of the specified paving and gravel sub-base shall be of structural fill compacted in 6" inch layers. L. Along the length of all pipeline trenches the Contractor shall construct impervious dams or bulkheads of clay or concrete in the trench bottom at 300 feet intervals or at manholes and structures, whichever is less, to obstruct the free flow of groundwater after construction is completed. Provide impervious dams at all points where a pipe trench enters an excavated area where a permanent underdrain system is installed.

M. The method and degree of compacting backfill as directed by the Engineer will be governed by the type of material and the extent to which any subsequent settlement can be permitted.

3.07 MISCELLANEOUS EXCAVATION

A. The Contractor shall perform all the remaining miscellaneous excavation. The Contractor shall make all excavations necessary to permit the placing of loam and plants, for constructing roadways and any other miscellaneous earth excavation required under this Contract.

3.08 BACKFILLING - COMMON FILL

A. Common Fill may be used as fill as indicated on the Drawings or in other areas as designated by the Engineer. Material conforming to the requirements of common fill shall be placed in layers having a maximum thickness of 12" inch measured before compaction. Note that in play field areas, sand gravel shall be placed in lieu of common fill in accordance with Paragraph 3.03.

B. Common Fill shall be compacted as per paragraph 3.03E and 3.03F.

C. Materials placed in fill areas shall be deposited to the lines and grades shown on the Drawings making due allowance for settlement of the material and the placing of loam thereon.

D. The surfaces of filled areas shall be graded to smooth true lines, strictly conforming to grades indicated on the grading plan, and no soft spots or uncompacted areas will be allowed in the work.

E. No compacting shall be done when the material is too wet either from rain or from excess application of water. At such times, work shall be suspended until the previously placed and new materials have dried sufficiently to permit proper compaction.

3.09 BACKFILLING - STRUCTURAL FILL

A. Structural fill shall be placed in layers having a maximum thickness of 8" inch in open areas and 6" inch in confined areas including points where conduit and piping join structures, measured before compaction. Each layer of fill shall be compacted to at least 95 percent of maximum density determined by the ASTM D1557 by methods approved by the Engineer.

B. Structural fill shall not be placed on a frozen surface or one covered by snow, or ice, nor shall snow, ice or frozen earth be incorporated in the compacted fill.

C. Structural fill shall be placed adjacent to structures and shall be compacted to at least 95 percent of maximum density determined by ASTM D1557 by methods approved by the Engineer. The limits of structural fill adjacent to structures shall extend as shown on the Drawings.

D. Compaction of structural fill in open areas shall consist of fully loaded ten-wheel trucks, a tractor dozer weighing at least 30,000 lbs. and operated at full speed, a heavy vibratory roller, or any method approved by the Engineer. Compaction of structural fill in confined areas shall be accomplished by hand operated vibratory equipment or mechanical tampers approved by the Engineer. As a minimum, compaction of structural fill shall consist of four coverages of the approved equipment.

3.10 BACKFILLING - SANDY GRAVEL

A. Sandy gravel is to be used as fill materials under playing fields as necessary and under other turf areas, to establish subgrade elevations parallel to finish grades. Sandy gravel shall be placed, spread and compacted to a minimum thicknesses as indicated on the Drawings and as specified.

B. Sandy gravel shall be placed in layers not exceeding one foot in thickness and compacted as specified in Paragraph 3.09D.

3.11 BACKFILLING - INDIAN CLAY

A. Indian Clay mix shall be spread over the compacted sandy gravel base and compacted to a final thickness of (4") four inches.

B. Indian clay shall be compacted with a minimum of four (4) coverages of a smooth drum roller weighing approximately 1000 pounds per foot of width.

C. The finished surface shall be smooth and grades shall be even and uniform without ruts, ridges, or abrupt changes in slope in transition areas. Contractor shall take special care to make a smooth transition between skinned areas and adjacent turf.

3.12 BACKFILLING - SAND

A. Sand shall be spread in the children's play area over compacted sandy gravel and geotextile.

B. Place woven geotextile fabric over compacted sandy gravel subgrade of all areas that are to

receive children's play sand. Fabric shall be free of tears and wrinkles after placement. Overlap fabric a minimum of 2 feet where necessary. Do not allow traffic of any kind on fabric prior to placement of sand. Follow manufacturer's other recommendations for fabric installation.

C. Sand shall be compacted by means of hand held vibratory tampers or other approved means, except for the upper (6") six inches.

D. The upper (6") six inches of sand shall not be compacted, but shall be raked so that the surface is smooth and even.

3.13 DISPOSAL OF SURPLUS MATERIAL

A. No excavated materials shall be removed from the site of the work or disposed of by the Contractor except as specified by the Engineer. Materials shall be neatly piled so as to inconvenience as little as possible the public and adjoining property owners until used or otherwise disposed of as specified below.

B. Suitable excavated material shall be used for common backfill on the different parts of the work as required.

C. Surplus Fill shall become the property of the Contractor and shall be removed and disposed of by him off the site.

3.14 DISPOSAL AND REPLACING OF ROCK

A. The Contractor shall remove and dispose of all pieces of ledge, concrete and boulders which are not suitable for use in other parts of the work. Ledge, concrete and boulders disposed of by hauling away to spoil areas are to be replaced by approved surplus excavation obtained elsewhere on the site, insofar as it is available. Any deficiency in the backfill material shall be made up with acceptable material approved by the Engineer.

B. Fragments of ledge and boulders smaller than 50 lb weight may be used in backfilling trenches unless in the opinion of the Engineer the quantity is excessive, in which case he may order the removal and disposal of some of this rock. The small pieces of rock used as backfill shall not be placed in trenches until the pipe has at least 2 feet of earth over it. The Contractor shall place these pieces of stone in thin layers alternating them with earth to be sure that all voids between the stones are completely filled with earth to prevent the occurrence of voids and settlement which will result therefrom.

C. Rock may be used in embankment fill only with the approval of the Engineer.

3.15 GRADING

A. Grading in preparation for placing of loam, planting areas, paved walks and drives and appurtenances shall be performed at all places that are indicated on the Contract Drawings, to the lines, grades, and elevations shown and otherwise as directed by the Engineer and shall be performed in such a manner that the requirements for formation of embankments can be followed. During the process of grading, the subgrade shall be maintained in such condition

that it will be well drained at all times. When directed, temporary drains and drainage ditches shall be installed to intercept or divert surface water which may affect the prosecution or condition of the work.

B. If at the time of grading it is not possible to place any material in its proper section of the permanent structure, it shall be stockpiled in approved areas for later use. No extra payment will be made for the stockpiling or double handling or excavated material.

C. The right is reserved to make adjustments as required or revisions in lines or grades if found necessary as the work progresses, due to discrepancies on the Drawings or in order to obtain satisfactory construction.

D. Stones or rock fragments larger than 4" inch their greatest dimensions will not be permitted in the top 6" inch of the finished subgrade of all fills or embankments.

* END OF SECTION *

SECTION 12

SEDIMENTATION AND EROSION CONTROL

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals necessary to perform all installation, maintenance, removal and area cleanup related to sedimentation and erosion control work as shown on the Drawings, or as required by the Engineer, and as specified herein. The work shall include, but not necessarily be limited to; temporary access ways and staging areas, silt fences, stone filter boxes, block and gravel filters, sediment removal and disposal, device maintenance, removal of temporary devices, temporary mulching, and final cleanup.

1.02 RELATED WORK NOT INCLUDED

A. Earthwork is included in Section 11.

B. Loaming and sodding is included in Section 27.

C. Dust control is included in Section 7.

1.03 SUBMITTALS

A. Within 10 days after award of Contract, the Contractor shall submit to the Engineer for approval, technical product literature for all commercial products to be used for sedimentation and erosion control.

1.04 PERFORMANCE REQUIREMENTS

A. The Contractor shall be responsible for the timely installation and maintenance of all sedimentation control devices necessary to prevent the movement of sediment from the construction site to off site areas or into streams and wetland areas via surface runoff or underground drainage systems. Measures shown on the Drawings and/or as directed by the Engineer, necessary to prevent the movement of sediment off site shall be installed, maintained, removed, and cleaned up at the expense of the Contractor. Measures necessary to control erosion or stabilize disturbed areas and or as directed by the Engineer shall be implemented at the expense of the Contractor.

PART 2: PRODUCTS

2.01 CRUSHED STONE

Crushed stone for sediment filtration devices shall conform to Mass DPW "Standard Specifications for Highway and Bridges" Section M2.01.3.
Crushed stone for construction entrances and access ways and staging areas shall conform to Mass DPW "Standard Specifications for Highways and Bridges" Section

M2.01.1.

2.02 SILT FENCE

1. Steel posts shall be a minimum of 5' feet in length, 2-1/2" inch x 2-1/2" inch x ¼" inch angle post with self-fastening tabs and a 5" inch x 4" inch (nominal) steel anchor plate at bottom.

2. Welded wire fabric shall be 4" inch x 4" inch mesh of 12 ga. x 12 ga. steel wire.

3. Silt fence fabric shall be a woven, polypropylene, ultraviolet resistant material such as Mirafi 100X as manufactured by Mirafi, Inc. Charlotte, N.C. or approved equal.

4. Tie wires for securing silt fence fabric to wire mesh shall be light gauge metal clips (hog rings), or 1/32" inch diameter soft aluminum wire.

5. Prefabricated commercial silt fence may be substituted for built-in-field fence. Prefabricated silt fence shall be "Envirofence" as manufactured by Celanese Corp., Charlotte, NC or approved equal.

2.03 WIRE MESH

One quarter inch woven wire mesh shall be galvanized steel or hardware cloth.

2.04 STRAW MULCH

Straw mulch shall be utilized on all newly graded areas to protect areas against washouts and erosions. Straw mulch shall be comprised of threshed straw of oats, wheat, barley, or rye that is free from noxious weeds, mold or other objectionable material. The straw mulch shall contain at least 50 percent by weight of material to be 10 inches or longer. Straw shall be in an air-dry condition and suitable for placement with blower equipment.

2.05 LATEX COPOLYMER

Latex acrylic copolymer, such as Soil Sealant with coalescing agent as manufactured by Soil Stabilization Co., Merced, California or approved equivalent shall be used as straw mulch tacking agent.

2.06 BLOCKS CMU units for block and gravel filters shall conform to ASTM C90 lightweight Grade N, Type I, hollow units of 8" inch x 16" inch nominal face size.

2.07 HAY BALE BARRIER

Straw or salt marsh hay bales shall be bound with binding wire or twine. Hay bale barriers are to be used in areas where soils are coarse or sandy, whereas silt fence shall be deployed to deal with finer soil erosion conditions. Or both may be used in combination, as directed by the Project Engineer.

2.08 COMPOST FILTER SOCK

Furnish and install the required number of compost filter socks perimeter sediment control system. Compost filter sock to be Filtrexx (TM), manufactured by Filtrexx International Erosion and Sediment Control, LLC 35481 Grafton Eastern Rd, Grafton, Ohio 4404; Phone: 440.926.2607; Fax: 440.926.4021; info@filtrexx.com , or approved equal.
Furnish and install 2" x2" x30" wood stakes to hold compost filter socks in place, as shown on the drawings.

PART 3: EXECUTION

3.01 INSTALLATION

A. Silt Fence Installation

1. Silt fences shall be positioned as indicated on the Drawings and as necessary to prevent off site movement of sediment produced by construction activities as directed by the Engineer.

2. Dig trench approximately 6 inches wide and 6 inches deep along proposed fence lines.

3. Drive metal-stakes, 8' feet on center (maximum) at back edge of trenches. Stakes shall be driven 2' feet (minimum) into ground.

4. Hang 4 x 4 woven wire mesh on posts, setting bottom of wire of trench. Secure wire to posts with self-fastening tabs.

5. Hang filter fabric on wire carrying to bottom of trench with about four inches of fabric laid across bottom of trench. Stretch fabric fairly taut along fence length and secure with tie wires 12 inches o.c. both ways.

6. Backfill trench with excavated material and tamp.

7. Install prefabricated silt fence according to manufacturer's instructions.

B. Construction filter boxes as detailed on the Drawings, from ¼" inch woven wire mesh or hardware cloth and wood. Fill with crushed stone and place over all drop inlets and manholes to storm drain system as each inlet is completed. This should be done prior to setting casting, if there is a delay between installation of inlet structures or drain manholes and setting of castings. An alternate method is to ring each inlet with a silt fence.

C. Staging areas and access ways shall be surfaced with a minimum depth of 4 inches of crushed stone.

D. Construction entrance shall be installed as shown on the Drawings.

E. Construct block and gravel filters as shown on the Drawings from 1/4 woven wire mesh, CMU, and crushed stone. Lower course of CMU shall be laid with openings facing to the

side. Top course shall be placed with openings facing up. Cover lower course of CMU openings with woven wire mesh and pile crushed stone as shown against block.

F. Hay bale barrier shall be installed as follows: excavate a trench 4" inches depth and the width of bale. Place and stake bales, two stakes per bale. Wedge loose straw between bales to create a continuous barrier. Backfill and compact the excavated soil on the uphill side of the barriers to prevent piping. Inspect barriers after each rainfall and repair any damage. Remove sediment deposits once they reach ½ the height of the barrier. Dispose of the sediment in a location far away from the sensitive areas on the property. Replace sections of the barrier that decompose or no longer filter properly.

3.02 MAINTENANCE AND INSPECTIONS

A. Inspections

1. Contractor shall make a visual inspection of all sedimentation control devices once per week and promptly after every rainstorm. If such inspection reveals that additional measures are needed to prevent movement of sediment to off site areas or into streams or wetland areas. Contractor shall promptly install additional devices as needed. Sediment controls in need of maintenance shall be repaired promptly.

B. Device Maintenance

1. Silt fences

a. Remove accumulated sediment once it builds up to one-half of the height of the fabric.

b. Replace damaged fabric, or patch with a two foot minimum overlap.

c. Make other repairs as necessary to ensure that the fence is filtering all runoff directed to the fence.

2. Filter Boxes and Block and Gravel Filters: Replace crushed stone when it becomes saturated with silt.

3. Add crushed stone to access ways, staging area,
and construction entrance as necessary to maintain a firm surface free of ruts and mud holes.

3.03 TEMPORARY MULCHING

A. Apply temporary mulch to areas where rough grading has been completed but final grading is not anticipated to begin within 30 days of the completion of rough grading.

B. Straw mulch shall be applied at rate of 120 lbs/1000 ft2 and tacked with latex acrylic copolymer at a rate of 1 gal/1000 ft 2 diluted in a ratio of 30 parts water to 1 part latex acrylic copolymer mix.

3.04 REMOVAL AND FINAL CLEANUP

A. Once the site has been fully stabilized against erosion, remove sediment control devices and all accumulated silt. Dispose of silt waste materials in proper manner. Regrade all areas disturbed during this process and stabilize against erosion with surfacing materials as indicated on the Drawings.

* END OF SECTION *

SECTION 13

TRAFFIC CONTROL

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Work under this Section consists of providing, installing and maintaining various traffic control devices for the protection of the traveling public and working personnel during construction and maintenance operations, and includes channelizing, signs, barricades, markings, lighting devices, and hand signal devices. The design, application, and installation of all devices shall conform to the Massachusetts Manual on Uniform Traffic Control Devices latest edition, Part VI, hereinafter referred to as MUTCO, and Massachusetts Department of Public Works, Standard Specifications for Highways and Bridges, 1973 (hereinafter referred to as SSHB). This work shall also consist of providing uniformed officers and flagman as required for the purpose of controlling the flow of traffic through the work area.

B. Contractor shall discuss proposed travel routes to and from the Site for equipment and materials delivery with the Traffic and Parking Department of the City of Cambridge.

C. During utility installation work required in streets, Contractor shall provide means of maintaining at least one clear lane for local traffic at all times. Additional requirements for maintenance of traffic are included in Section 3.

D. Contractor shall obtain from the City of Cambridge Traffic, Parking and Transportation Department all required permits for street closings, obstructions and temporary parking permits to facilitate park renovation. Phone (617) 349-4700

1.02 RELATED WORK NOT INCLUDED IN THIS SECTION

A. Policing is included in Section 8.

B. Demolition and site preparation is included in Section 10.

C. Earthwork is included in Section 11.

D. Dust control is included in Section 7.

E. Roadways, walkways, parking lots, and appurtenances are included in Section 14.

PART 2: PRODUCTS

2.01 MATERIALS

A. General

1. Materials required under this Section need not be new but must be in first class condition and acceptable to the Engineer. All materials that in the judgement of the

Engineer are unsatisfactory in appearance and/or performance shall be removed and immediately replaced by acceptable units.

B. Construction Signs

1. Materials shall conform to Section 82B of SSHB.

2. Sign Blanks shall be prepared in accordance with current practices as recommended by the sheeting manufacturer.

3. Reflective Sheeting shall be applied over the entire surface of the sign, and shall conform to Section M9.30.1 of SSHB.

4. Application of Sign Text. The sign text shall consist of the letters, digits and symbols either applied by brush or screened, to conform with the dimensions and designs indicated on the Drawings for the various types of signs. The materials and methods shall be in accordance with standard commercial processes as approved.

5. Symbols, legend and background shall conform with MUTCD.

6. Supports. Posts and easels shall conform to Section 840 of SSHB.

7. Hardware required to attach signs to supports shall be such that no straining or discoloration from exposure occurs on the face of the sign.

C. Portable Barricade Type III

1. If required, an 8' foot unit of portable barrier fence shall be constructed in accordance with MDPW Construction Standard Drawing 406.1.0 with the following revisions.

2. The alternating 6" inch wide diagonal stripes shall be orange and white and shall slope downward at 45 degrees toward the end by which traffic is to pass. Barriers that block the passage of traffic or designate the end of the traveled way shall have alternating vertical orange and white stripes on the rails.

3. Barrier fences shall be maintained in good and serviceable condition throughout the project. Portable barriers shall be moved from place to place as required during construction and as directed by the Engineer.

D. Warning Lights

1. Barricades and drums that will be left in place overnight shall be equipped with Type A low intensity flashing warning lights conforming to Section 6D5 of MUTCD.

E. Reflectorized Drums

1. Reflectorized drums shall be 55-gallon size with a minimum of 18" inches of orange and white striping reflectorized as stipulated in Subsection 850.43 of SSHB. Newly

developed products providing equivalent target value and stability that are acceptable to the Engineer may be used under this item.

2. All drums shall be maintained in a satisfactory manner including the removal of dirt or road film that cause a reduction in sign reflective efficiency.

F. Traffic Cones

1. Traffic cones shall be conical in shape and shall be a minimum of 28" inches high with a broadened base and should be made of materials that will withstand impact without damage to themselves or to vehicles. Orange shall be the predominant color on cones. Cones should be kept clean and bright for maximum target value. Reflectorization of the cones shall be provided by a minimum of 6-white reflectorized band placed a maximum of 3" inches from the top if used during darkness.

G. Police Detail

1. Police detail shall be clothed in a suitable and characteristic uniform that will readily distinguish them from other employees. Flagmen shall be attired with regulation caps and blaze orange vests with or without white stripes. Extra reflectorization and lighting may be necessary at night.

2. Police detail shall possess the following qualifications: at least average intelligence and alertness, good sight and hearing, courteous but firm manner, neat and presentable appearance, pleasing personality, and a sense of responsibility. They shall have been given specific instructions from the Contractor as to their duties and responsibilities, both to the public and to their fellow workers on the job. They shall handle the movement of the traveling public and shall do all that is reasonable to expedite that movement. They shall have authority to direct the actions of the construction vehicles as well as vehicles of the traveling public.

PART 3: EXECUTION

3.01 MAINTENANCE OF TRAFFIC

A. Whenever a street is open to public traffic through any part of the construction area, the Contractor shall provide and maintain sufficient surface for at least one lane of traffic, and two lanes whenever possible. One lane traffic shall be controlled as directed by the use of flagmen.

B. Whenever heavy equipment is operating adjacent to a street open to public travel, the Contractor shall provide adequate traffic control to keep traffic lanes open and safe for such travel.

C. Guide sign showing route designations, Directions and other information as required by the Engineer shall be maintained at appropriate locations for the use of the traveling public during the construction period. Signs that are removed or relocated will be retained and re-erected by the Contractor.

D. Before any suspension of the work, the Contractor shall make passible and shall open to traffic such portions of streets as may be agreed upon between the Contractor and the Engineer.

E. When work is resumed after suspension, the Contractor shall replace or renew any work or materials lost or damaged during the suspension.

F. If proper maintenance of traffic facilities, including, but not limited to, a reasonable smooth surface, and proper provisions for traffic control are not being provided by the Contractor, the Owner may assume maintenance of the streets and deduct the cost from any money due or to become due under the Contract.

G. Any work performed by the Owner, either when construction operations are taking place or during periods of suspension, shall not invalidate any of the provisions of the Contract.

H. During construction of sidewalk areas along streets within the limit of work, a safe alternative pedestrian passage must be maintained during construction of sidewalk. Schedule and method by Contractor shall be approved by the Engineer and the City's Department of Traffic and Parking.

3.02 CONSTRUCTION SIGNS AND WARNING DEVICES

A. All construction signs, barricades and warning devices supplied at the beginning of the project shall be free from scratches, abrasions, chipping or any other damages that may, at the discretion of the Engineer, be such as to render them unsatisfactory for use or to reduce reflectivity to less than 70 percent of new material.

B. At any time during the life of the Contract, at the discretion of the Engineer, any sign, barricade or warning device that is damaged, disfigured or found to be in unserviceable condition may be required to be replaced. Such replacement shall be performed by the Contractor without compensation.

C. Signs not specifically mentioned in the Specifications or on the Drawings, shall be designed, constructed, placed, operated and maintained in accordance with the requirements of the "Manual on Uniform Traffic Control Devices for Streets and Highways" or as ordered.

D. Construction signs shall be erected at the locations shown on the Drawings or as ordered. The posts shall be plumb. The signs shall be installed on posts, barricades or easels so that the text will be horizontal.

E. Barricades and delineators shall be erected wherever necessary for the protection of public travel. Such hazards as pits and open trenches, drop offs, exceptionally rough stretches of the traveled way, and all obstructions of any kind, including equipment parked on the roadway, shall be barricaded in an approved manner.

F. Lighting devices shall be placed that they are clearly visible.

G. Adequate artificial lighting shall be provided on streets under construction to clearly reveal hazards. Hazards shall be lighted from sunset to sunrise when so ordered by the Engineer or the Owner. The type and number of lights and flashing beacons shall be satisfactory to the Engineer.

H. All signs, barricades, guard rails, delineators, lighting devices, and other materials furnished by the Contractor shall remain the property of the Contractor unless otherwise specified.

* END OF SECTION *

SECTION 14

BITUMINOUS PAVING WORK

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required to install the bituminous paved roadways, parking areas, ball courts and walks; including bituminous concrete curb, crack sealing, acrylic color coating of ball courts, and aggregate treatment of bituminous walks.

1.02 RELATED WORK NOT INCLUDED

A. Site preparation is included in Section 10.

B. Earthwork is included in Section 11.

C. Dust control as required is included in Section 7.

D. Specialty pavers as required are included in Section 15.

E. Handicapped parking signage as required is included in Section 24.

F. Color coat system for ball courts as required is included in Section 24.

1.03 SUBMITTALS

A. Submit to the Engineer in accordance with Section 5, shop drawings showing dimensions layouts and details of construction and accessories required.

B. Submit the Engineer samples of guard.

1.04 REFERENCE SPECIFICATIONS

A. Except as otherwise specified herein, the material and construction shall be in accordance with the Department of Public Works, Standard Specifications for Highways and Bridges (hereafter SSHB) of the Commonwealth of Massachusetts, latest edition, including all addenda.

PART 2: PRODUCTS

2.01 BITUMINOUS CONCRETE

A. Bituminous concrete paving shall be Class I, type I-1 for binder and top course, as specified in Section M3.11.0 of SSHB. Class I Dense bituminous concrete, type ST shall be used for top course for all pedestrian paths and walks.

B. Processed gravel for pavement base course shall be as specified in Section 11.

C. Bituminous tack coat shall consist of liquid asphalt, grade RC-70 conforming to Section M3.02.0 of SSHB.

2.02 PAVEMENT MARKING

A. Where shown on the Drawings and as required to complete the work of this Contract, furnish and install pavement markings shall be either white thermoplastic reflectorized tape conforming to Section M7.01.03 of SSHB. Sizes shall be (4") four and (6") six inch widths; or pavement markings shall be white traffic paint (4")four and (6") six inch widths in conformance with SSHB.

2.03 BITUMINOUS CONCRETE SEALCOAT FOR BALL COURTS AND WALKS **(TYPE A, B, C, D)**

Where called for on the Drawings and as required to complete the work of this Contract, existing or new asphalts basketball, tennis, handball courts and walks shall be color or black seal coated. Color and/or black seal coating products shall be manufactured Nova Sports U.S.A. of Holliston, MA 01746, phone (508) 429-5650 or approved equal.

TYPE A: NOVA SPORTS ACRYLIC SURFACE SYSTEM: (For color seal coating of existing ball court(s) with cracks)

Furnish all labor, material and equipment to repair structural and random cracks in bituminous concrete surface and apply to bituminous concrete surface as follows:

1. Reshape cracks and reface crack walls where necessary using a vertical spindle and rotary routers equipped with carbide tipped cutters and blow out cracks with minimum 125 CFM 90 PSI air pressure.

2. Install a base in the crack where needed.

3. Fill all cracks with Dow Corning 890 SL Self Leveling Silicone Joint Sealant.

4. Sweep and air clean area to be surfaced.

5. Apply two (2) coats of Novacrylic Play Surface for basketball courts and Novacrylic Combination Surface for tennis courts, at a rate of approximately .05 gallon per square yard per coat.

6. Apply one (1) coat of Novacoat Finish applied at the same rate.

7. Layout, mask and stripe playing lines using a paintbrush with Novatex 100% acrylic textured line paint.

8. Color: as shown on Drawings.

NOTE: Cracks may reappear after a period of time. Hairline cracks will not be routed or filled with

the 890 SL. Due to the flexibility of the Dow Corning 890 SL the color coating may wear off the crack sealant prematurely.

TYPE B: NOVA SPORTS ACRYLIC SURFACE SYSTEM: (For color seal coating of existing courts without cracks)

Furnish and apply to bituminous concrete surface as outlined below:

1. Sweep and air clean area to be surfaced.

2. Apply two (2) coats of Novacrylic Play Surface for basketball courts and Novacrylic Combination Surface for tennis courts, at a rate of approximately .05 gallon per square yard per coat.

3. Apply one (1) coat of Novacoat Finish applied at the same rate.

4. Layout, mask and stripe playing lines using a paintbrush with Novatex 100% acrylic textured line paint.

5. Remove masking tape and clean up general work area.

TYPE C: NOVA SPORTS ACRYLIC SURFACE SYSTEM: (For new bituminous concrete courts)

APPLICATION: Furnish and apply the Nova Sports Acrylic Surface System as outlined below:

1. Sweep and air clean area to be surfaced.

2. Apply one (1) coat mixed with 5-10 lbs of 50-60 mesh silica sand per gallon of resurfacer and applied at a rate of .07 to .10 gallon per square yard.

3. Apply two (2) coats of Novacrylic Play Surface for basketball courts and Novacrylic Combination Surface for tennis courts, at a rate of approximately .05 gallon per square yard per coat.

4. Layout, mask and stripe playing lines with a paintbrush using Novatex 100% acrylic textured line paint.

5. Remove masking tape and clean up general work area.

6. Color: as shown on Drawings.

TYPE D: NOVA SPORTS ACRYLIC SURFACE SYSTEM: (for walks and paved areas in parks, playgrounds and school yards)

APPLICATION: Furnish and apply Nova Sports Acrylic Surface System to new bituminous concrete walks and other paved surfaces)

1. Apply two (2) coats of Novacrylic Resurfacer mixed with 5 to 10 lbs of 50-60 mesh silica sand per gallon of resurfacer and applied at a rate of .07 to .10 gallons per square yard.

Color: shall be black.2.04 BITUMINOUS CONCRETE CURB:

Where shown on the Drawings and as required to complete the work of the Contract, bituminous Concrete for curbing shall be Class I conforming to the applicable requirements for Dense Mix (See Table A, M3.11.03 of SSHB) WITH THE FOLLOWING ADDITIONS:

A. Bitumen content shall be 7.5 to 8.5%.

B. Total Mineral aggregate shall be from 89.0% to 90%.

C. Asbestos fibre conforming to Subsection M9.17.0 of SSHB shall be added to the mix and be between 1.25% to 2.50% by weight of mix.

D. After aggregates and asbestos have been charged into the pugmill and thoroughly dry mixed for not less than 15 seconds the asphalt shall be added and the mixing continued for at least 30 seconds or more if necessary to produce a uniform mixture in which all particles are coated; the wet mixing period shall not exceed 60 seconds.

2.04 PATCHING

A. Patching of pavements disturbed during the course of the work and collapsed pavement over existing drain line and in old tennis net post locations shall be done in accordance with the requirement of the Massachusetts SSHB.

B. Patches shall be as thick as the original pavement, but in no case shall they be less than three (3") inches thick.

C. Patching shall be done with "Patching Mix" as defined in Section M3.11.00 of Massachusetts SSHB.

D. Edges of patches shall be sawn or cut smooth and the patch shall be regular in shape.

E. Where patching is to be done in existing court areas, the Contractor shall excavate to 15" inches below existing grade, compact existing subgrades to 96% of the maximum dry density, place and compact (to 96%) gravel fill in two (2") six (6") inch lifts and place patching mix on top of gravel to the line and grade of the existing court pavement.

2.05 RANDOM-CRACK SEALING BY FIBER REINFORCED METHOD

A. Scope of Work - the work covered by this section of the Specification consists of furnishing all plant, labor, equipment and materials necessary to perform all operations in connection with the cleaning and sealing of construction and random cracks in bituminous concrete pavements, and vegetation removal and sterilization of cracks where necessary.

B. Material - crack sealer shall be an asphalt-fiber compound designed especially for improving strength and performance of the parent asphalt sealant.

Asphalt-fiber compound shall be mixed at a rate of 5-8% fiber weight to weight of asphalt cement. This compound having the same chemical base provides compatibility and exhibits

excellent bond strengths. The fiber functions to redistribute high stress and strain concentrations that are imposed on the sealant by thermal sources, traffic loading, etc.

C. Equipment - equipment used in the performance of the work required by this Section of the Specification shall be subject to the Engineer and maintained in a satisfactory working condition at all times.

1. Air Compressor: Air compressors shall be portable and capable of furnishing not less than 100' cubic feet of air per minute at not less than 90 lbs. per square inch pressure at the nozzle. The compressor shall be equipped with traps that will maintain the compressed air free of oil and water.

2. Manually operated, gas powered air-broom or self-propelled sweeper designed especially for use in cleaning highway and airfield pavements shall be used to remove debris, dirt and dust from the cracks.

3. Hand tools shall consist of brooms, shovels, metal bars with chisel shaped ends, and any other tools which may be satisfactorily used to accomplish this work.

4. Melting Kettle: The unit used to melt the joint sealing compound shall be double boiler, indirect fired type. The space between the inner and outer shells shall be filled with a suitable heat transfer oil or substitute having a flash point of not less than 600 degrees F. The kettle shall be equipped with a satisfactory means of agitating the joint sealer at all times. This may be accomplished by continuous stirring with mechanically operated paddles and/or by a continuous circulating gear pump attached to the heating unit. The kettle must be equipped with the thermostatic control calibrated between 200 degrees F. and 550 degrees F.

D. Preparation

1. Debris Removal: All old material and other debris removed from the cracks shall be removed from pavement surface immediately by means of power sweepers or hand brooms or air brooms.

2. Vegetation: When cracks show evidence of vegetation, it shall be removed and sterilized by use of Propane Torch unit eliminating all vegetation, dirt, moisture and seeds.

3. General: No crack sealing material shall be applied in wet cracks or where frost, snow or ice is present nor when ambient temperature is below 40 degrees F.

E. Preparation of Sealer

1. Joint sealing material shall be heated and applied at a temperature specified by the manufacturer and approved by the Engineer. Minimum application temperature shall be 320 degrees F.

F. Workmanship - All workmanship shall be of the highest quality and excess or spilled sealer shall be removed from the pavement by approved methods and discarded. any workmanship

determined to be below the high standards of the particular craft involved will not be accepted, and will be corrected and/or replaced as required by the engineer in charge.

2.06 BITUMINOUS REINFORCING FABRIC

A. Where shown on the Drawings and as required to complete the work of this Contract furnish and install bituminous reinforcing fabric. Description - this work shall consist of applying a synthetic reinforcing fabric over the existing pavement surface in designated areas.

B. Materials

1. The bituminous material for tack coating shall be AC-5, AC-10, or AC-20 paving grade asphalt cement.

2. The reinforcing fabric shall be 6 ox. Petromat Pavement Reinforcing Fabric by Phillips Fibers Corporation, P.O. Box 66, Greenville, SC 29602, (803) 242-66001 a needle punched, nonwoven, polyprophylene fabric having the following properties (or approved equal):

	Typical	Minimum
Weight, ounces per square yard	6.5	6.0
Tensile strength, pounds (1)	157.0	140.0
Elongation-at-break % (1)	65.0	60.0
Mullen Burst Strength, psi (2)	375.0	320.0
Asphalt Retention, gallons per square yard (3)	.0	.35
Color	Black Blend	
Width, inches	150	
Length per roll, yards	100	

(1) ASTM D-1682-64
(2) ASTM D-751
(3) Phillips Fibers Procedure (or approved equal)

C. Construction

1. The existing surface shall be free of dirt, water or other foreign material. Sweeping with a power rotary broom may be required.

2. A tack coat shall be uniformly sprayed over the existing pavement at the rate of .30 to .35 gallons per square yard. Tack coat shall only be applied if outside temperatures are below 70° F.

3. Immediately after spraying, the fabric shall be machine placed into the fresh binder. Care shall be exerted to insure that the fabric is essentially wrinkle-free. Brooming may be required to remove air bubbles and insure complete contact with the pavement surface.

4. The fabric shall overlap adjacent fabric panels from a minimum of six (6") inches. Additional asphalt must be applied to make the joints.

5. Paving operations should follow the fabric placement as soon as possible. Paver or other vehicle turning should be gradual and kept to a minimum to avoid damage to the fabric. Any damaged fabric shall be repaired to the satisfaction of the Engineer. If equipment tires tend to stick to the fabric during paving, a small quantity of sand or mix may be broadcast ahead of the vehicle to relieve this problem. Minimum traffic may be allowed on the fabric.

2.07 POROUS BITUMINOUS CONCRETE PAVEMENT

A. Mix materials consist of modified performance grade asphalt binder (PGAB), coarse and fine aggregates, and optional additives such as silicone, fibers, mineral fillers, fatty amines, and hydrated lime. Materials shall meet the requirements of the NAPA's Design, Construction, and Maintenance of Open-Graded Friction Courses, Information Series 115 (2002), except where noted otherwise below or approved in writing by the Project Engineer. Porous asphalt mix shall be a minimum of 3" inches thick layer of ½" to ¾" aggregate.

B. Porous media infiltration beds include, as detailed, from top to bottom, a 4"inch layer "Choker" course of ½" inch crushed stone, a 12"inch minimum thickness reservoir (storage) course of 1"-2" crushed stone designed for water storage needs and/or frost penetration.

C. Non –woven geotextile filter fabric shal be Mirafi 160N, or approved equal, to be installed between subgrade (existing soil) and base or reservoir course.

PART 3: EXECUTION

3.01 BITUMINOUS CONCRETE PAVEMENT

A. General

1. Materials for pavement shall be mixed, delivered, placed and compacted in accordance with the referenced SSHB specifications, Section 460 and as specified herein.

2. When the air temperature falls below 50 degrees F, extra precautions shall be taken in drying the aggregates, controlling the temperatures of the materials and placing and compacting the mixtures.

3. No mixtures shall be placed when the air temperature is below 40 degrees F, nor when the material on which the mixtures are to be placed contains frost or has a surface temperature not suitable to the Engineer.

4. No vehicular traffic or loads shall be permitted on the newly completed pavement until adequate stability has been attained and the material has cooled sufficiently to prevent distortion or loss of fines. If the climatic or other conditions warrant it, the period of time before opening to traffic may be extended at the discretion of the Engineer.

5. All pavement shall be maintained by the Contractor for a period of one year. During

this period all areas which have settled or are unsatisfactory shall be refilled and replaced. The guarantee period shall begin on the day following final acceptance of the work by the Engineer.

6. Placement and compaction of gravel base course shall be performed in accordance with SSHB Section 405.

B. Pavement Repair and Resurfacing

1. Temporary pavement (binder course bituminous concrete) shall be placed wherever existing pavement has been removed or disturbed as soon as practical, but in no case more than one week after backfilling is completed.

   a. The gravel base shall be excavated to a depth of 2" inch below the surface of the existing pavement, shaped and compacted.

   b. The 2" inch temporary pavement shall be placed and compacted by steel-wheeled rollers of sufficient weight to thoroughly compact the bituminous concrete without damaging the existing pavement. The temporary pavement shall be rolled smooth and even with the existing pavement.

   c. Hose clean all road surfaces adjacent to the trench area to be paved. No paving is to be placed until subsurface is dry.

   d. Temporary pavement shall be maintained in a condition suitable for traffic until replaced or overlaid by final pavement. Defects shall be repaired within 3 days of notification of such defects.

2. Permanent pavement shall not be placed over trenches in less than 90 days after completion of the backfilling unless otherwise directed in writing by the Engineer.

3. Permanent pavement over trenches shall be constructed as follows:

   a. Remove temporary pavement and base to 3" inch below the surface of the existing pavement. Shape and compact base to 95 percent of maximum density as determined by ASTM D1557.

   b. Trim loose edges of existing pavement. Trimming of pavement edges shall be done with power saws. Cuts shall be clean and straight. Broom and tack coat all edges with cutback asphalt applied at the rate of 0.1 gal/sy.

   c. Place Binder Course and compact to 2" inch thickness by steel wheeled roller. Broom and tack coat edges of existing pavement and Binder Course with liquid asphalt applied at the rate of 0.1 gal/sy.

   d. Place Top Course and compact to (1") one inch minimum thickness, finish smooth, dense and flush with surface of existing pavement.

   e. Along curbs, structures and all places not accessible with a roller,

bituminous materials shall be thoroughly compacted with tampers. Such tampers shall not weigh less than 25 pounds and shall have a tamping face of not more than fifty square inches. Bituminous surfaces shall be smooth and true to the established line and grade.

C. New Bituminous Concrete Pavement

1. Currently unpaved areas that are to receive new pavement shall be stripped of all topsoil, vegetation, roots and other unsuitable materials including soft soils which cannot be sufficiently compacted.

2. Proof roll and compact subgrade to at least 95% of maximum density as defined by ASTM D1557.

3. In fill areas, place common or structural fill in maximum (8") eight inch lifts and compact to at least 95% maximum density.

4. Back dump and grade base course material on compacted sub-grade. Compact material as specified in SSHB, Section 405.

5. Apply bituminous tack coat at the rate of 0.1 gal/sy to all contact surfaces of curbing, concrete structures, and edges of existing bituminous concrete to be paved against.

6. Minimum Material Thickness (after compaction)

Location	Base Course	Binder Course	Top Course
Roadways, Parking Lots	10"	2"	1"
Pedestrian Paths, Walks and Mowstrips	6"	1-1/2"	1"(dense mix)
Overlays or Existing Walks			2"(dense mix)

7. Spread and compact binder course of bituminous concrete and compact to final thickness. Bituminous concrete shall be placed by mechanical spreader except in areas inaccessible to the spreader.

   Compaction of binder course shall be obtained by the use of power rollers weighing not less than 240 pounds per inch width of tread.

8. Place top course and compact to finished thickness by the use of power rollers weighing not less than 285 pounds per inch width of tread.

9. Along curbs, structures and all places not accessible with a roller, bituminous materials shall be thoroughly compacted with tampers. Such tampers shall not weigh less than 25 pounds and shall have a tamping face of not more than (50") fifty square inches. Bituminous surfaces shall be smooth and true to the established line and

grade.

10. Clean all pavement penetrations and remove all loose aggregate from the site.

D.

3.02 PAVEMENT MARKINGS

A. Markings shall be as follows:

1. Stop bars, parking space lines, and crosswalks as shown on the Drawings.

2. Contractor shall note that roadway markings are not to scale on Drawings.

3. Reline all streets with pavement markings equal in type and location where existing prior to paving.

4. Handicapped symbols in each handicapped parking space.

B. Marking Dimensions and Locations

1. All markings to delineate parking spaces shall be 4" inch wide.

2. Stop bars shall be 12" inch wide.

3. Crosswalk markings shall be 6" inch wide spaced 6' feet apart.

4. All other markings (outlines and cross hatched areas) shall be 6" inch wide with hatches placed 2' feet on center.

5. Handicapped symbols for parking spaces shall be as detailed on the Drawings.

C. All surface dirt within the areas to be marked shall be removed. Large areas of tar, grease or foreign materials may require sand blasting, steam cleaning or power brooming to accomplish complete removal. Application of markings shall not proceed until final authorization is received from the Engineer.

D. All equipment used for the application of pavement markings shall be of standard commercial manufacture. All other equipment and devices necessary for the application of the pavement markings and protection thereof shall be as is usually required for this type of work and shall be furnished by the Contractor.

E. The markings shall be applied in accordance with the manufacturer's recommendations. Marking configurations shall be in accordance with the "Manual on Uniform Traffic Control Devices".

F. Markings for newly paved asphalt concrete surfaces shall be applied before public traffic is allowed on freshly paved surface.

G. If for any reason material is spilled or tracked on the pavement, or any markings applied by the Contractor in the Engineer's judgement fail to conform because of deviation from the desired pattern, the Contractor shall remove such material by a method that is not injurious to the pavement surface and is acceptable to the Engineer, clean the pavement surface and prepare the surface for a reapplications.

3.03 BITUMINOUS CONCRETE SEALCOAT FOR BALL COURTS AND WALKS

A. APPLICATION

24" to 36" 50 Durometer flexible rubber squeegees as approved by the Manufacturer.

B. DRYING TIME

Approximately one hour depending on ambient temperature and humidity. Allow to cure 24 hours before use.

C. COVERAGE

Two (2) or Three (3) coats

D. LIMITATIONS

Apply only when ambient temperature is 50 degrees F. and rising;
Do not apply when rain or high humidity is imminent;
Do not apply if surface temperature is in excess of 140 degrees F.;
Do not allow spillage to dry on surface;
Keep container tightly closed when not in use;
Allow new asphalt to cure at least 14 days.

3.04 BITUMINOUS CONCRETE CURB

A. The bituminous concrete mixture shall be placed and compacted with a machine acceptable and approved by the Engineer. The machine shall be capable of spreading the mixture true to line and grade and to the shape stipulated.

B. The bituminous concrete curb shall be placed on a bituminous concrete binder course, or directly on a gravel foundation, depending on the type of pavement surface, as shown in the current Department Standards.

C. If at any time before the acceptance of the work any soft or imperfect spots develop in the exposed surface of the curb, such material placed shall be removed and replaced with new material and compacted, without additional compensation.

3.05 **TYPE A** AGGREGATE SURFACE TREATMENT

A. The asphalt-rubber material shall be applied uniformly by distributor truck at the

temperature and rate specified by the manufacturer. If a job delay occurs, the heater in the distributor should be turned off and restarted sufficiently before start of spreading to reheat material to at least the minimum application temperature prior to resumption of spreading. No spread shall be in excess of a length which can be immediately covered with aggregate.

Longitudinal joints shall be reasonably true to line and parallel to centerline. The overlap in application of the asphalt-rubber material shall be the minimum to assure complete coverage. Where any construction joint occurs, the edges shall be broomed back and blended so there are no gaps and the elevations are the same, and free from ridges and depressions.

B. The application of aggregate shall follow as closely as possible behind the application of the hot asphalt-rubber material which shall not be spread further in advance of the aggregate spread that can be immediately covered. Construction equipment or other vehicles shall not drive on the uncured pavement.

The dry aggregate shall be spread uniformly by a self-propelled spreader at the rate of spread between 30 and 40 pounds per square yard. Any deficient areas shall be covered with additional material.

Aggregate may be preheated before application but to a temperature not to exceed 300 degrees Fahrenheit.

During application, adequate provision shall be made to prevent marring, or discoloration of adjacent pavements, structures, vehicles, foliage or personal property.

C. Rolling shall commence immediately following spread of aggregate. There shall be at least three complete coverages by pneumatic-tired rollers to embed the aggregate particles firmly into the bituminous concrete top course.

D. When the maximum of aggregate has been embedded into the asphalt-rubber membrane, all loose material shall be swept or otherwise removed at such time and in such manner as will not displace any embedded aggregate or damage the bituminous concrete surface.

E. No vehicular traffic of any kind shall be allowed to pass over the newly finished surface until it has had time to set. Twelve hours will be considered sufficient time for the pavement to set in most cases, but this period may be extended by the City Engineer as required by the weather or other reasons.

F. All areas of finished paving on which water stands or which are found to vary in excess of 1/8" in 10' from the proposed grades indicated on the plans shall be promptly brought to the correct grade and line,

* END OF SECTION *

SECTION 15

SPECIALTY PAVING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and perform installation of new specialty paver walkways as shown on the Drawings.

B Remove and reset existing specialty pavers, as shown on the Drawings and as directed by the Engineer.

1.02 SUBMITTALS

A. At least five samples of new matching specialty pavers for incorporation into the work, shall be submitted to the Engineer.

1.03 RELATED WORK NOT INCLUDED

A. Earthwork is included in Section 11.

B. Bituminous paving and granite curbing are included in Section 14.

PART 2 PRODUCTS

2.01 INTERLOCKING PERMEABLE CONCRETE PAVERS

A. Where shown on the Drawings and as required to complete the work of this Contract, furnish and install new concrete pavers manufactured and supplied by Ideal Concrete Block Company, 232 Lexington Street, Waltham, MA 02154; Phone: (781) 894-3200, or Hanover Architectural Products, supplied by Specifier Services, 17 Patten Road, Bedford, NH 03110; Phone: (603) 425-1438, or an approved equal United States manufacturer with at least 5 years experience in manufacturing interlocking paving stones.

1. Shape shall 4" x 8" (4.5pcs/sf) "Aqua Bric Pavers".

2. Color shall be "Beacon Hill" Blend, "Quarry Blend" or "Vinyard Blend" as determined by Project Engineer. A contrasting color paver shall also be included to achieve the desired pattern(s), feature strips or decorative elements, all as shown on the drawings, and as directed by the Project Engineer.

3. Thickness shall be 2-3/8" inch (6cm)

4. Paver model shall be "Aqua Bric" Paver with concrete paver edging restraint system or other edge restraint product acceptable to Project Engineer.

B. Interlocking Paving Stones - All interlocking concrete paving stones shall conform to ASTM

C936-82 "Standard Specifications for Solid Concrete Interlocking Paving Units".

1. The average compressive strength shall exhibit a 28 day strength of not less than 8,500 psi with no individual paver less than 7,200 psi.

2. No paver shall have a water absorption of greater than 5% when tested in accordance with ASTM C140.

3. Pavers shall have proven field performance or laboratory freeze-thaw test in accordance with ASTM C67-73, Section 8, Method A, 50 cycles.

4. Materials used to manufacture interlocking concrete paving stones shall conform to the following:

   a. Cement - ASTM C150 Portland Cement.

   b. Aggregates - ASTM C33 (washed, graded sand and limestone aggregates).

   c. Other Constituents - Non fading synthetic iron oxide color pigments, integral plasticizers and densifying agents established as suitable for use in concrete.

5. Size, shape, design and colors shall be in accordance with the Drawings and specifications and shall match the samples provided by the contractor under paragraph 1.02 above.

2.02 BRICK PAVER-CITY HALL PAVER

A. Where shown on the Drawings and as required to complete the work of this Contract, furnish and install Brick Pavers: Bricks used for paving shall be identical in appearance to:

"City Hall Pavers" manufactured by Stiles and Hart Inc., Bridgewater, MA.

"Morin Waterstruck Paving Brick" manufactured by Morin Brick Company, Danville, Maine.

"Cambridge Pavers", and Glen Gary "Standard Pavers" both manufactured by Glen Gery Corp., Wyomissing, PA.

B. Color Range: Brick shall have a color range of medium red to dark red, mixed with dark purple. NO ORANGE colored bricks shall be allowed.

The ideal color range is 50% old Westbury and 50% Rosecroft as manufactured by Glen Gery Corporation, Wyomissing, PA.

C. Paver Materials: The paving brick shall be clay brick, uniform in size and evenly burned, and when broken shall show a dense structure free from lime, air pockets, cracks and lamination. Laminated bricks will not be accepted. Paver soldier course shall be used as border at back of curb and walkways typically.

The bricks shall be for exterior paving, and shall meet the requirements of ASTM C-902-Class SX Type I with average water absorption of not more than 5% with the five hour boil,

and average compressive strength of 8,000 p.s.i. or more. Brick shall pass a minimum of 100 freeze thaw cycles.

Brick shall be 2-1/4"x4"x8" inch in size, and shall have no end or side lugs.

D. ___Brick pavers to be tagged for acceptance by the Engineer at supply source prior to procurement and delivery to site.

2.03 BRICK PAVER-WIRE CUT PAVER

A. Where shown on the Drawings and as required to complete the work of this Contract, furnish and install wire cut brick pavers: Bricks used for paving shall be identical in appearance to:

"Pine Hall Brick" 4" x 8" x 2-1/4" 2701 Shorefair Drive Winston-Salem, NC 27105; phone: (800) 334-8689. The local supplier is S&H Bricks, Inc.

B. Color Range: Brick shall have a color range of medium red to dark red.

C. Brick pavers to be tagged for acceptance by the Engineer at supply source prior to procurement and delivery to site.

2.03 BLUE STONE PAVER

A. Where shown on the Drawings and as required to complete the work of this Contract, furnish and install 2" inch thick Blue Stone Pavers; supplied by McVey Monument, Inc., 662 Arsenal Street, Watertown MA (or approved equal), Phone: (617) 923-8866.

B. Blue stone pavers shall be laid out and installed in conformance with the dimensions and patterns indicated on the drawings. Furnish and install 4" inch thick cement concrete sub base. Stones to be set into a one 1"inch thick cement mortar setting bed. All joints shall be approximately one-half ½"inch wide swept with stone screenings.

C. Blue stone pavers of varying size: 12"x 12"inch; 12"x18"inch;12"x24"inch;12"x30"inch; 18"x18"inch; 18'x24"inch; 18"x30"inch; 18"x36"inch; 24"x24"inch; 24"x30"inch, 24"x36"inch; 24"x 42"inch;30"x30"inch; 30"x36"inch. Joints shall be staggered.

2.04 PRECAST CONCRETE PERMEABLE PAVER

A. Where shown on the Drawings and as required to complete the work of this Contract, furnish and install 3-1/8" thick "Turfstone Grid Pavers"; supplied by Ideal Concrete Bloc k Company, Inc. , 235 Lexington Avenue, Waltham, MA (or approved equal), Phone: (781) 894-3200; Fax: (978) 692-0817; www.IdealConcreteBlock.com .

B. "Turfstone Grid Pavers", or equal pavers, shall be laid out in either a running bond or stack bond with a ¾" inch offset. Place the side with the false joints facing up. and installed as specified by the manufacturer, including a compacted aggregate base, geo-textile fabric, sand setting bed, pavers, sod plugs or grass seed, and compacted soil at perimeter.

B. "Turfstone Grid Pavers" to be tagged for acceptance by the Project Engineer at supply source

prior to procurement and delivery to site. Compressive strength shall be 5,000 psi.

2.05 STONE SCREENINGS AND STONE DUST

A. Material for setting bed and jointing shall be stone screenings and stone dust for swept joints as specified in Section 11.

B. Care shall be taken to protect the stone screenings and stone dust against rain when stockpiled on the site prior to setting. Stone screenings and stone dust which is frozen shall not be used.

2.06 BASE MATERIAL

A. The base shall be a processed gravel base course as specified in Section 11.

2.07 PLASTIC EDGING MATERIAL

A. Edging material required shall be "Pave Edge" paver edge restraint system as manufactured by Pave Tech, Inc., Bloomington, MN or approved equal. Phone: (800) 728-3832; Fax: (612) 881-2169. Use rigid for straight sections and flexible for radius sections.

B. Spikes for edging shall be 12" inch long by 3/8" inch diameter steel spikes.

2.08 COBBLESTONES

A. Where shown on the Drawings and as required to complete the work of this Contract, furnish and install granite rubble block as specified in Section M2.03.0 and Section 485 of the Massachusetts Department of Public Works Standard Specifications for Highways and Bridges, latest edition.

B. Where used as pavers over tree planting trench install without concrete base or mortared joints. Instead install over a (6")"six inch compacted processed gravel base and (2") two inch stone screenings setting bed. Fill in joints with stone screenings.

C. Submit samples for size and color approval by Engineer.

2.09 GRANITE SETTS

A. Where shown on the Drawings and as required to complete the work of this Contract, furnish and install 4"x 4" x 4" inch granite setts. Color shall be charcoal dark granite range. Top and bottom of setts shall be sawn, with split sides. Face dimension tolerances shall be plus or minus (1/4") one quarter inch and thickness tolerances of plus or minus (1/2") one half inch.

B. Install pavers on a (6") six inch sub base of compacted processed gravel.

C. Submit sample granite setts for size and color approval.

PART 3 EXECUTION

3.01 SUB-BASE

A. Sub-base shall be compacted to 95% of maximum dry density in accordance with ASTM D-1557.

3.02 BASE

A. The base shall be of a thickness no less than 6" inches of processed gravel after compaction followed by a one half to one inch setting bed of stone screenings. It shall be compacted to not less than 95% of maximum dry density as defined by ASTM D1557.

B. The finished surface of the base shall be uniformly flat, and shall not deviate by more than + 0 and - 1/2" inch over 10' when measured by a straight edge laid in any direction and shall have a pitch or crown not less than 2% (or 1/4" inch per foot). Base shall be approximately 3-1/2" inches below the desired finished grade when the setting bed is screened to a thickness of 1-1/2" inch.

C. The base shall extend to no less than the rear face of all edge restraints or to the edge of suitable established structures. Along free edges the base shall extend to 6" inches beyond the Paver Edge.

D. Furnish and install where required a four (4") inch thick cement concrete on a (6") six inch base of processed gravel. Concrete shall be as specified in Section 29.

E. Furnish and install where required a one and one half inch (11/2") thick bituminous binder on a six inch (6") base of processed gravel. Bituminous concrete as specified in Section 14.

3.03 PLASTIC EDGING

A. Edge restraints shall be installed as required around the entire perimeter in all cases. Pave-Tech Paver Edge shall be securely set on the base. Existing structures and new granite curb may be used. All shall be accurate and true.

3.04 SETTING BED

A. The setting bed shall be spread loose and screened level by the use of screened rails and boards to a uniform thickness not to exceed (1") one inch and conforming to the grade of the base. The exact thickness of the setting bed shall be determined at the job site on the basis of field trials to provide a uniform depth of not less than 1/2" inch and not greater than (1") one inch after compaction of the paving units.

B. Care shall be taken to insure the setting bed is not disturbed or pre-compacted in any way. If the screened stone screenings are accidentally pre-compacted by walking or rain, and re-screen as above.

C. Do not screen more of an area of setting bed on which the pavers can be set that day.

3.05 PAVER INSTALLATION

A. Paving stone installation shall be plumb, level and true to line and grade. Finished work shall conform to and align with elevations. Care shall be taken during the layout to minimize cutting. Work shall be performed by experienced crews under the supervision and direction of the paver manufacturer.

B. Starting at a 90° corner or straight edge, commence laying the paving stones 1/8" inch wide between pavers. String lines shall be used frequently to hold pattern lines true and accurate. Typically lay a soldiers course of brick around entire perimeter of brick pavement areas.

C. Paving stones shall be installed hand tight to achieve uniform joints approximately 1/8" inch wide between pavers. String lines shall be used frequently to hold pattern lines true and accurate.

D. Full units shall be laid first and cuts done subsequently. Use manufactured edge pieces or, as required, cut full units with a masonry saw to insure all cuts fit neat and accurate without damaged edges. Where cutting will result in a space less than 25% of the size of a full units, a 1:2:4 concrete mix may be used at the discretion of the Engineer.

E. Installers shall lay subsequent paving stones by moving forward on the top of the previously installed units.

F. Care should be taken when transporting material over un-compacted paving stones to prevent damage to the pavement or premature compaction of the sand bedding.

3.06 COMPACTION

A. After substantial area of pavers have been installed, a plate vibrator or roller vibrator with high frequency, low amplitude shall be used to tamp the paving stones into place and to vibrate the sand up into the joints.

B. Three or more passes with the vibrator shall be made at a 90° angle until the pavers are brought to the design levels and profiles. Compaction shall continue until lipping has been eliminated between adjoining pavers. Care shall be taken to keep 3-feet from the edge of unrestrained pavers prior to completion of installation.

C. Stone dust shall be spread and broomed over the installed paving stones. At least one pass of the plate vibrator shall be made to consolidate the stone dust in the joints.

D. Remaining stone dust shall be swept into the joints until they are filled flush to the top of the paving stones. Sweep excess stone dust clean from the paving surface.

E. All pavers installed during the day must be compacted by day's end.

3.07 COMPLETION

A. The completed paving stone surface shall be swept clean and washed down with water to provide a finished workmanlike installation.

B. Stains that occur during construction shall be removed in accordance with manufacturer's recommendations.

* END OF SECTION *

SECTION 16

PRECAST CONCRETE CATCH BASINS, MANHOLES AND DRAIN INLETS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required to install pre cast concrete catch basins, manholes, drain inlets, frames, grates or solid covers, hoods, ladder rungs and all other appurtenances; all as shown on the drawings and as specified herein.

B. Catch basins and manholes shall be constructed of 48" inch pre cast sections on pre cast bases with 6'ft. minimum sumps. 1.02 RELATED WORK NOT INCLUDED

A. Earthwork is included in Section 11.

B. Concrete is included in Section 29.

C. Connections to and work on the existing system is included in Section 20.

1.03 SUBMITTALS

A. Submit shop drawings to the Engineer as provided in Section 5, showing details of construction, reinforcing, joints, pipe connections to drainage structures, frames, grates, and hoods.

1.04 REQUIRED PERMITS AND INSPECTIONS

A. All storm water and sanitary sewer construction requires Cambridge D.P.W. (Department of Public Works) permits and inspections to ensure compliance with E.P.A. (U.S. Environmental Protection Agency), D.E.P. (Commonwealth of Massachusetts Department of Environmental Protection) and the M.W.R.A. (Metropolitan Water Resource Authority) requirements. Requests for permits and inspections should be directed to the Cambridge Department of Public Works Engineering Division.

1.05 AS BUILT DRAWINGS

A. Three (3) sets of As-Built drawings should be submitted to the Cambridge D.P.W. and the Cambridge Water Department upon completion of all drainage and water work.

1.06 QUALITY ASSURANCE

A. The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and approval by the Engineer, or other representative of the Owner. Such inspection may be made at the place of manufacture, on the work after delivery, or at both places, and the materials shall be subject to rejection at any time because of failure to meet any of the Specification requirements; even though samples may have been accepted as satisfactory at the place of manufacture. Material rejected after delivery to the site shall be marked for identification and shall be immediately removed from the site. All materials

which have been damaged after delivery will be rejected, and if already installed, shall be acceptably repaired, if permitted, or removed and replaced, entirely at the Contractor's expense.

B. At the time of inspection, the materials will be carefully examined for compliance with the ASTM designation specified below and these Specifications, and with the approved manufacturer's drawings. All manhole and catch basin sections, and drain inlets, shall be inspected for general appearance, dimension, "scratch-strength", blisters, cracks, roughness, soundness, etc. The surface shall be dense and close-textured.

C. Imperfections in catch basin sections may be repaired, subject to the approval of the Engineer, after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final approval. Cement mortar used for repairs shall have a minimum compressive strength of 4,000 psi at 7 days and 5,000 psi at 28 days, when tested in 3" inch by 6" inch cylinders stored in the standard manner. Epoxy mortar may be utilized for repairs subject to the approval of the Engineer.

PART 2 PRODUCTS

2.01 PRECAST CONCRETE SECTIONS

A. Precast concrete barrel sections and transition top sections, shall conform to Specifications for Precast Reinforced Concrete Manhole Sections, ASTM C478 and meet the following requirements:

1. The wall thickness shall not be less than 5" inch for 48" inch reinforced barrel sections.

2. Catch basin and manhole top section shall be concentric top sections or top slabs.

3. Barrel sections shall have tongue and groove joints.

4. All sections shall be cured by an approved method and shall not be shipped nor subjected to loading until the concrete compressive strength has attained 3,000 psi and not before 5 days after fabrication and/or repair, whichever is longer.

5. Precast concrete barrel sections with precast top slabs and precast concrete transition sections shall be designed for a minimum of H-20 loading plus the weight of the soil at 12 pcf.

6. The date of manufacture and the name and trademark of the manufacturer shall be clearly marked on the inside of each precast section.

7. Precast concrete bases shall be constructed and installed as shown on the drawings. The thickness of the bottom slab of the precast bases shall not be less than the thickness of the barrel sections or to slab whichever is greater.

8. Precast leaching basins shall be HD 20 1000 gallon capacity, 6'ft. in diameter and depth, with 2'ft. sump, (4) 8" knockouts for water distribution and top slab, as detailed.

2.02 BRICK MASONRY

A. The bricks shall be good, sound, hard and uniformly burned, regular and uniform in shape and size, of compact texture and satisfactory to the Engineer. Underburned or salmon brick will not be acceptable and only whole brick shall be used unless otherwise permitted. In case bricks are rejected by the Engineer, they shall be immediately removed from the site and satisfactory bricks substituted therefor.

1. Bricks for building up and leveling catch basin frames shall conform to ASTM C62.

2. Bricks for restoring channels and shelves in existing combined sewers shall comply with the latest specifications of ASTM C32 for Sewer Brick, Grade SS (from clay or shale) except that the mean of five tests for absorption shall not exceed 8% and no individual brick exceed 11%.

B. Mortar used in the brickwork shall be composed of one part Type II portland cement conforming to ASTM C150 to two parts sand to which a small amount of hydrated lime not to exceed 10 lbs to each bag of cement be added.

C. The sand used shall be washed, cleaned, screened, sharp and well graded as to different sizes and with no grain larger than will pass a No. 4 sieve. It shall be free from vegetable matter, loam, organic or other materials of such nature or of such quantity as to render it unsatisfactory.

D. The hydrated lime shall also conform to ASTM C207.

2.03 FRAMES AND GRATES

A. Catch basin and manhole frames and grates or covers shall be good quality, strong, tough, even-grained cast iron smooth, not brittle, free from scale, lumps, blisters, sand holes and defects of any kind which render them unfit for the service for which they are intended. Grate and frame or cover and frame seats shall be machined to a true surface. Castings shall be thoroughly cleaned and subject to hammer inspection. Before shipment from the foundry, castings shall be given one coat of coal tar pitch varnish which shall present a casting that is smooth. Cast iron shall conform to ASTM A48, Class 30.

B. Catch basin and drain inlet frames and grates shall be model LF278 as manufactured by LeBaron Foundry, Mechanics Iron Foundry, Neenah Foundry, or approved equal. Catch basin frames shall be 3-flange type where installed against granite curb, otherwise 4-flange type shall be used. Catch basin frames and grates within play areas shall be Model R-2501, as manufactured by Neenah Foundry or, approved equal.

C. Manhole basin frames and covers shall be model LAH268 as manufactured by LeBaron Foundry Co., Mechanics Iron Foundry, Neenah Foundy, or approved equal.

2.04 JOINTING PRECAST SECTIONS

A. Tongue and groove joints of precast catch basin sections shall be sealed with mortar both inside and outside. "O"-ring gaskets or a preformed flexible joint sealant may be used at the Contractor's option.

2.05 CAST IRON HOODS

A. Cast iron hoods shall be LeBaron Foundry Co. L203, Neenah Foundry Co., or approved equal.

2.06 PIPE CONNECTION TO CATCH BASIN AND MANHOLE

A. Catch basin and manhole pipe connections may be accomplished in the following ways:

1. A tapered hole filled with non-shrink waterproof grout, Hallemite, Waterplug, Embeco or equal, after the pipe is inserted is acceptable, providing the grout is placed carefully to completely fill around the pipe. If this method is used, place concrete encasement to assure a total 12" inch. of concrete including the thickness of the wall around the pipe stub.

2. "KOR-N-SEAL" joint shall be installed as recommended by the manufacturer. The stainless steel clamp shall be protected from corrosion with a bituminous coat.

3. "Res-Seal" shall be a rubber-like "O"-ring set in a formed opening in the structure. Once the pipe is in place, the "O"-ring and pipe shall be secured in place by means of a cast iron follower or compression flange. All exposed metal shall be protected from corrosion with a bituminous coat.

2.07 TRENCH DRAIN

A. Where required to complete the work of this contract furnish and install Model No. Z886 HDPE 6" wide channel trench drain, manufactured by Zurn Industries, LLC, Flo-Thru Operation, 2640 South Work Street, Falconer, NY 14733; Phone: 716-665-1132; Fax: 716-665-1185; www.zurn.com, or approved equal.

1. Modular channel sections shall be made of high density polyethylene (HDPE), have interlocking ends, and radiused bottom. Channels shall be provided either flat (neutral) or with a .75% built in slopw. Channels shall have clips molded into the sides of the channel to accommodate vertical rebar for positioning and anchoring purposes. Channel shall be 6" inch overall wide trench drain/4" inside throat, in 80 "inch modular sections with 20" inch grates.

2. Grates shall be ductile iron grate-Class C with lockdowns and anchor tabs, color: black, with H-20 and /or FAA load ratings and /or ADA compliance with mechanical lockdown devices.

3. Closed end caps, end outlets, bottom outlets and side outlets shall be available in 2",3",4",6" diameters.

PART 3 EXECUTION

3.01 INSTALLATION

A. Catch Basin and Manhole Installation:

1. Catch basins and manholes shall be constructed to the dimensions shown on the Drawings and as specified in these Specifications. All work shall be protected against flooding and flotation.

2. Pre cast bases shall be placed on a bed of 12" inch screened gravel as shown on the Drawings. The drainage structure shall be set at a grade to assure that a maximum of 8" inch thickness of brickwork will bring the frame and cover/grate to final grade.

3. Pre cast concrete barrel sections shall be set vertically and with sections in true alignment with a ¼" inch maximum tolerance to be allowed. The joints of pre cast barrel sections shall be sealed with mortar, a rubber "O"-ring set in a recess or the preformed flexible joint sealant used in sufficient quantity to fill 75 percent of the joint cavity. The outside and inside joints shall be filled with non-shrink mortar and finished flush with the adjoining surfaces. Allow joints to set for 24-hours before backfilling. Backfilling shall be done in a careful manner, bringing the fill up evenly on all sides. If any leaks appear, the inside joints shall be caulked with lead wood to the satisfaction of the Engineer. The Contractor shall install the pre cast sections in a manner that will result in a watertight joint.

4. Holes in the pre cast concrete sections required for handling or other purposes shall be plugged with a non-shrinking grout or non-shrinking grout in combination with concrete plugs, and finished flush on the inside.

5. Where holes must be cut in the pre cast sections to accommodate pipes, cutting shall be done prior to setting the sections in place to prevent any subsequent jarring which may loosen the mortar joints.

6. Catch basins without sumps shall have concrete channels formed to direct flow, as directed by the Engineer and as shown on the Drawings.

7. All drain inlets shall be constructed as detailed on the drawings.

B. Pipe Connections:

1. Pipe connections shall be accomplished in the ways specified hereinbefore.

C. Cast Iron Hoods:

1. Cast iron hoods shall be installed on all precast concrete catch basins and manholes with sumps as shown on the Drawings. The hoods shall be set in mortar in the formed openings as shown on the drawings.

D. Brickwork:

1. Mortar shall be mixed only in such quantity as may be required for immediate use and shall be used before the initial set has taken place. Mortar shall not be retained for more than one and one-half hours and shall be constantly worked over with hoe or shovel until used. Anti-freeze mixtures shall not be added to the mortar. No masonry shall be laid when the outside temperature is below 40F unless provisions are made to protect the mortar, bricks, and finished work from frost by heating and enclosing the work with tarpaulins or other suitable material. The Engineer's decision as to the adequacy of protection against freezing shall be final.

2. Where new pipe connects to existing combined sewer manholes, existing brick channels and shelves shall be repaired with brick and concrete to the satisfaction of the Engineer.

3. Setting Frames and Grates. Frames shall be set in a full mortar bed and bricks, a maximum of 8" inch thick, to assure that frame and grate are set to the required grade.

3.02 CLEANING

A. All existing catch basins and manholes shall be thoroughly cleaned of all silt, debris and foreign matter of any kind, prior to final inspection.

* END OF SECTION *

SECTION 17

REINFORCED CONCRETE DRAIN PIPE

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals necessary to install and test reinforced concrete pipe and fittings for drains complete as shown on the Drawings and as specified herein.

1.02 RELATED WORK NOT INCLUDED

A. Excavation and backfilling are included in Section 11.

B. Precast concrete catch basins, manholes and inlets are included in Section 16.

C. Concrete is included in Section 29.

1.03 SUBMITTALS

A. Submit to the Engineer, as provided in Section 5, shop drawings, and a schedule of pipe lengths (including the length of individual pipes by size) for the entire job.

B. Prior to each shipment of pipe, submit certified test reports that the pipe for this Contract was manufactured and tested in accordance with ASTM, AASHO and ANSI/AWWA Standards specified herein.

1.04 QUALITY ASSURANCE

A. All reinforced concrete pipe to be installed under this Contract may be inspected at the plant or on the site after delivery, or both places, for compliance with these Specifications by an independent testing laboratory provided by the Owner. The Contractor shall require the manufacturer's cooperation in these inspections. The cost of inspection of all pipe approved for this Contract, plus the cost of inspection of a reasonable amount of disapproved pipe will be borne by the Owner.

PART 2 PRODUCTS

2.01 REINFORCED CONCRETE PIPE

A. Except as otherwise shown on the Drawings, reinforced concrete pipe shall conform to ASTM C76, Class III, Wall B or C. Where Class IV pipe is shown on the Drawings, pipe shall conform to ASTM C76, Class IV, Wall B or C. The pipe interior shall be smooth and even, free from roughness, projections, indentations, offsets, or irregularities of any kind. The concrete mass shall be dense and uniform.

B. Non-air-entraining portland cement conforming to ASTM C150, Type II shall be used. The use of a non-bleeding, water reducing, dispersing agent may be permitted subject to the specific approval of the Engineer. The use of any other admixture will not be permitted.

C. Fine aggregate shall consist of washed inert natural sand conforming to the requirements of ASTM C33. Coarse aggregate shall consist of well-graded crushed stone or washed gravel conforming to the requirements of ASTM C33. Documentation that the aggregates to be used in the manufacture of reinforced concrete pipe meet these requirements shall be submitted to the Engineer.

D. The 28-day compressive strength of the concrete, as indicated by cores cut from the pipe shall be not less than 6,000 psi. The concrete mass shall be dense and uniform in conformance with ASTM. Reinforcement shall be as required by the appropriate ASTM Specification. Quadrant steel shall not be used. Reinforcement shall be installed in both the bell (or groove) and the spigot (or tongue) pipe end. At least one circumferential reinforcement wire shall be in both the pipe ends, and reinforcement in the bell (or groove) and spigot (or tongue) shall be adequate to prevent damage to concrete during shipping, handling and after installation. Cores indicating reinforcing steel having less than 85 percent bond shall be cause for rejection of the lot of pipes.

E. Pipe may be rejected for any of the following reasons:

1. Exposure of any wires, positioning spacers or chairs used to hold the reinforcement case in position, or steel reinforcement in any surface of the pipe, except for ends of longitudinal reinforcing.

2. Any shattering or flaking of concrete at a crack.

3. Voids, with the exception of a few minor bugholes, on the interior and exterior surfaces of the pipe exceeding ¼" inch in depth unless properly and soundly pointed with mortar or other approved material.

4. Unauthorized application of any wash coat of cement or grout.

5. A hollow spot (identified by tapping the internal surface of the pipe) which is greater than 30" inches in length or wider than 3 times the specified wall thickness. Repair of such defective areas not exceeding these limitations may be made as specified in Paragraph 2.01M.

6. Defects that indicate imperfection molding of concrete; or any surface defect indicating honeycomb or open texture (rock pockets) greater in size than area equal to a square with a side dimension of 2-1/2 times the wall thickness or deeper than two times the maximum graded aggregate size; or local deficiency of cement resulting in loosely bonded concrete, the area of which exceeds in size the limits of area described in Paragraph 5 above when the defective concrete is removed. Repair of such defects not exceeding these limits may be made as specified in Paragraph 2.01M.

7. Any of the following cracks:

   a. A crack having a width of 0.005"inch to 0.01"inch throughout a continuous length of 36" inch or more.

   b. A crack having a width of 0.01" inch or more throughout a continuous length of one foot or more.

   c. Any crack greater than 0.005" inch extending through the wall of the pipe and having a length in excess of the wall thickness.

   d. Any crack showing two visible lines of separation for a continuous length of 2' feet or more, or an interrupted length of 3' feet or more anywhere in evidence, both inside and outside.

   e. Cracks anywhere greater than 0.03" inch. in width.

F. The pipe shall be clearly marked as required by ASTM C76 in a manner acceptable to the Engineer. The markings may be at either end of the pipe for the convenience of the manufacturer, but for any one size shall always be at the same end of each pipe length. Pipe shall not be shipped until the compressive strength of the concrete has attained 4,000 psi and not before 5 days after manufacture, and/or repair, whichever is the longer.

G. Pipe shall have a laying length of approximately 8 ft, except for closure and other special pieces as approved by the Engineer. The Contractor shall have available at the site sufficient pipe of various lengths to affect closure at manholes or structures that cannot be located to accommodate standard lengths. Short lengths of pipe made for closure etc. may be used in the pipeline at the end of construction if properly spaced. The length of the incoming and outgoing concrete pipe at each structure shall not exceed 4 ft, except where the joint is cast flush with the exterior wall of the structure.

H. The quality of all materials and the finished pipe shall be subject to inspection and approval by the Engineer. Such inspection may be made at the place of manufacture, or on the work after delivery, or at both places, and the pipe shall be subject to rejection at any time on account of failure to meet any of the specification requirements, even though sample pipes may have been accepted as satisfactory at the place of manufacture. Pipe rejected after delivery shall be marked for identification and shall be removed from the site at once.

I. The Engineer shall have the right to cut cores from such pieces of the finished pipe as he desires for such inspection and tests as he may wish to apply. Holes left by the removal of cores shall be filled in an approved manner by and at the expense of the manufacturer. Core drilling shall be carried out by the pipe manufacturer at his expense.

J. The Engineer shall also have the right to take sample of the concrete after it has been mixed, or as it is being placed in the forms or molds, and to make such inspection and tests thereof as he may wish.

K. The pipe will be carefully examined for compliance with the appropriate ASTM and project specifications, and the approved shop drawings. Pipes may be inspected for general appearance, dimension, "scratch-strength", blisters, cracks, roughness, soundness, etc.

L. Unsatisfactory or damaged pipe and flared end sections will be either permanently rejected or returned for minor repairs. Only that pipe actually conforming to the specifications and accepted will be listed for approval, shipment and payment. Approved pipe will be so stamped or stenciled on the inside before it is shipped. All pipe which has been damaged after delivery will be rejected, and if such pipe already has been laid in the trench, it shall be acceptably repaired, if permitted, or removed and replaced, entirely at the Contractor's expense.

M. Pits, blisters, rough spots, breakage, and other imperfections may be repaired, subject to the approval of the Engineer, after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final approval. Non-shrink cement mortar used for repairs shall have a minimum compressive strength of 6,000 psi at the end of 7 days and 7,000 psi at the end of 28 days, when tested in 3" inch cylinders stored in the standard manner. Epoxy mortar may be utilized for repairs subject to the approval of the Engineer.

2.02 JOINTS FOR CONCRETE PIPE

A. Joints for circular reinforced concrete pipe shall be the tongue and groove or bell and spigot type of joint with provisions for using a round rubber "O"-ring gasket in a recess in the spigot end of the pipe. The bevel on the bell of the pipe shall be between 1-1/2 deg. and 2-1/2 deg. The diameters of the joint surfaces which compress the gasket shall not vary from the true diameters by more than 1/16" inch.

B. The round rubber "O-Ring" gaskets shall conform to ASTM C443.

C. The manufacturer shall inspect all pipe joint surfaces for out-of-roundness and pipe ends for squareness. The manufacturer shall furnish to the Engineer a notarized affidavit stating all pipe meets the requirements of ASTM C76, these Specifications and the approved joint design.

PART 3 EXECUTION

3.01 LAYING CONCRETE PIPE

A. Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe, fittings and the joint surfaces. Pipe and fittings shall not be dropped. All pipe and fittings shall be examined before laying, and no piece shall be installed which is found to be defective.

B. As soon as the excavation is completed to the normal grade of the bottom of the trench, the Contractor shall place screened gravel in the trench, and the pipe shall be firmly bedded in this gravel to conform accurately to the lines and grades indicated on the Drawings. Screened gravel shall conform to the requirements of Section 11. Blocking under the pipe will not be permitted.

C. Screened gravel shall be placed and compacted to give complete vertical and lateral support for the pipe as indicated on the Drawings. A depression shall be left in the supporting gravel at the joint to prevent contamination of the rubber gasket immediately before being forced home. Before the pipe is lowered into the trench, the spigot and bell shall be cleaned and free from dirt.

D. Gasket and bell shall be lubricated by a vegetable lubricant which is not soluble in water, furnished by the pipe manufacturer, and harmless to the rubber gasket. The pipe shall be properly aligned in the trench to avoid any possibility of contact with the side of the trench and fouling the gasket. As soon as the spigot is centered in the bell of the previously laid pipe, it shall be forced home with jacks or come-alongs. After the gasket is compressed and before the pipe is brought fully home, each gasket shall be carefully checked for proper position around the full circumference of the joint. Steel inserts shall be used to prevent the pipe from going home until the feeler gage is used to check the final position of the gasket. The jacks or come-alongs shall be anchored sufficiently back along the pipeline (a minimum of 5 lengths) so that the pulling force will not dislodge the pieces of pipe already in place. Only a jack or come-along shall be employed to force the pipe home smoothly and evenly and hold the pipe while backfilling is in progress. Under no circumstances shall crowbars be used nor shall any of the motordriven equipment be used.

E. When installing pipe using the steel box, any portion of the box extending below mid-diameter of the pipe shall be raised above this point prior to moving the box ahead. This is to prevent the separation of installed pipe joints due to movement of the box.

F. As soon as the pipe is in place and before the come-along is released, screened gravel backfill shall be placed evenly on each side of the pipe to mid-diameter and compacted for at least one-half the length of pipe. Hand tools shall be used to force the screened gravel under the haunches of the pipe and into the bell holes to give firm continuous support of the pipe. Not until this backfill is placed shall the come-along be released. If any motion at joints can be detected, a greater amount of backfill shall be placed before pressure is released. Select common fill shall then be placed and compacted to one foot above the top of the pipe. The remainder of the backfill shall be placed in one foot layers and carefully compacted. Generally the compaction shall be done evenly on each side of the pipe and compaction equipment shall not be operated directly over the pipe until sufficient backfill has been placed to ensure that such compaction equipment will not have a damaging effect on the pipe. when pipe laying is not in progress, including lunchtime, the open ends of the pipe shall be closed by a watertight plug or other approved means.

G. The Contractor shall carefully regulate his equipment and construction operations such that the loading of the pipe does not exceed the loads for which the pipe is designed and manufactured. Any pipe damaged during construction operations shall promptly and satisfactorily be repaired or replaced at the Contractor's expense.

3.02 TESTING

A. If an inspection of the completed pipe line or any part thereof shows manholes, catch basins, pipes, or joints which allow an appreciable amount of infiltration, the defective work or material shall be replaced or repaired as directed.

3.02 CLEANING

A. At the conclusion of the work, the Contractor shall thoroughly clean all of the new pipe lines by flushing with water or other means to remove all dirt, stones, pieces of wood or other material which may have entered during the construction period. Debris cleaned from the lines shall be removed from the lowest manhole. If, after this cleaning, obstructions remain, they shall be removed. After the pipe lines are cleaned and if the groundwater level is above the pipe, or following a heavy rain, the Engineer will examine the pipe for leaks. If defective pipes or joints are discovered at this time, they shall be repaired by the Contractor.

* END OF SECTION *

SECTION 18

DUCTILE IRON PIPE AND FITTINGS

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install ductile iron pipe and fittings complete as shown on the Drawings and as specified herein.

B. Ductile iron pipe for water mains shall be restrained mechanical joint type.

1.02 RELATED WORK NOT INCLUDED

A. Excavation and backfilling are included in Section 11.

B. Granular materials are included in Section 11.

C. Valves and appurtenances are included in Section 19.

D. Concrete is included in Section 29.

1.03 SUBMITTALS

A. Submit to the Engineer, within thirty days of the Effective Date of the Agreement, the name of the pipe and fitting suppliers and a list of materials to be furnished.

B. Submit to the Engineer, as provided in Section 5, completely detailed working drawings and schedules of all ductile iron pipe and fittings required.

C. Prior to each shipment of pipe, submit certified test reports that the pipe for this Contract was manufactured and tested in accordance with the ASTM and ANSI/AWWA Standards specified herein.

1.04 QUALITY ASSURANCE

A. All ductile iron pipe and fittings shall be from a single manufacturer. All ductile iron pipe to be installed under this Contract may be inspected at the foundry for compliance with these Specifications by an independent testing laboratory provided by the Owner. The Contractor shall require the manufacturer's cooperation in these inspections. The cost of foundry inspection of all pipe approved for this Contract, plus the cost of inspection of a reasonable amount of disapproved pipe will be borne by the Owner.

B. Inspection of the pipe will also be made by the Engineer or other representatives of the Owner after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the Specification requirements, even though pipes may have been

accepted as satisfactory at the place of manufacture. Pipe rejected after delivery shall be marked for identification and shall immediately be removed from the job.

PART 2: PRODUCTS

2.01 GENERAL

A. Ductile iron pipe shall conform to ANSI/AWWA C151, Class 51.

B. Ductile iron fittings shall be compact type and shall conform to ANSI/AWWA C153.

C. All pipe and fittings shall have a bituminous outside coating in accordance with ANSI/AWWA C151 and C153, respectively. All pipe and fittings shall be cement-mortar lined and seal coated in accordance with ANSI/AWWA C104 except the lining thickness shall be twice that specified in Section 4.8.1.

2.02 RESTRAINED PIPE AND FITTINGS FOR WATER MAINS

A. Joints for water main pipe shall be restrained mechanical joints conforming to ANSI/AWWA C153.

B. Restrained joints shall be suitable for 250 psi working pressure and fabricated of heavy section ductile iron casting. Gaskets shall meet the material requirements of ANSI/AWWA C111 for mechanical joint gaskets. Bolts and nuts as required shall be low carbon steel conforming to ASTM A307, Grade B. Restrained joints shall be Lok-Fast Joint by American Cast Iron Pipe Company or equal, incorporating a retainer gland.

C. Glands, bolts, nuts and gaskets used in mechanical joint assemblies for fittings and pipe shall meet the material and dimension requirements of ANSI/AWWA C153 and C111, respectively. Bolts and nuts as required shall be low carbon steel conforming to ASTM A307, Grade B. Rubber gaskets for mechanical joints shall conform to ANSI/AWWA C111.

PART 3: EXECUTION

3.01 LAYING DUCTILE IRON PIPE AND FITTINGS

A. Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe, lining, or coatings. Pipe or 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 linings or coatings shall be repaired as directed by the Engineer. Handling and laying of pipe and fittings shall be in accordance with the manufacturer's instruction and as specified herein.

B. All pipe and fittings shall be sound and thoroughly cleaned before laying, shall be kept clean until they are used in the work, and when laid, shall conform to the lines and grades required. Ductile iron pipe and fittings shall be installed in accordance with

requirements of AWWA Standard Specification C600 except as otherwise provided herein. As soon as the excavation is completed to normal grade of the bottom of the trench, screened gravel bedding shall be placed, compacted and graded to provide firm, uniform and continuous support for the pipe. Bell holes shall be excavated so that only the barrel of the pipe bears upon the bedding. The pipe shall be laid accurately to the lines and grades indicated on the Drawings. Blocking under the pipe will not be permitted. Screened gravel shall be placed evenly on each side of the pipe to mid-diameter and hand tools shall be used to force the screened gravel under the haunches of the pipe and into the bell holes to give firm continuous support for the pipe. Screened gravel shall then be placed to 1 ft. above the top of the pipe. Where directed by the Engineer, filter fabric shall be placed in the trench bottom and wrapped around the screened gravel bedding. Backfill above the screened gravel backfill shall be placed in one foot layers and carefully compacted. Generally the compaction shall be done evenly on each side of the pipe and compaction equipment shall not be operated directly over the pipe until sufficient backfill has been placed to ensure that such compaction equipment will not have a damaging effect on the pipe. Equipment used in compacting the initial three feet of backfill shall be approved by the pipe manufacturer's representative prior to use.

C. When laying is not in progress, including lunchtime, the open ends of the pipe shall be closed by watertight plugs or other approved means. Good alignment shall be preserved in laying. The deflection at joints shall not exceed that recommended by manufacturer. Fittings, in addition to those shown on the Drawings, shall be provided, if required, for crossing utilities which may be encountered upon opening the trench. Solid sleeves shall be used only where approved by the Engineer.

D. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be jointed with a bell shall be beveled to conform to the manufactured spigot end. Cement lining shall be undamaged.

E. If any defective pipe is discovered after it has been laid, it shall be removed and replaced with a sound pipe in a satisfactory manner by the Contractor, at his own expense.

F. The Contractor shall have on hand at the start of the job, one 1/32 bend, one 1/16 bend and one 1/8 bend for each size of pipe. These shall be used as job conditions require.

G. Concrete thrust blocks for water mains shall be installed where directed by the Engineer. Minimum bearing areas shall be as shown on the Drawings. Joints shall be protected by felt roofing paper prior to placing concrete. Concrete shall be placed against undisturbed material, and shall not cover joints, bolts or nuts, or interfere with the removal of any joint. Wooden side forms or sand bags shall be provided for thrust blocks.

3.02 RESTRAINED MECHANICAL JOINTS

A. Restrained mechanical joints shall be made in accordance with the manufacturer's instructions. Thoroughly clean and lubricate the joint surfaces and rubber gasket with

soapy water before assembly. Bolts shall be tightened to the specified torques. Under no conditions shall extension wrenches or pipe over handle of ordinary ratchet wrench be used to secure greater leverage.

3.03 CLEANING

A. At the conclusion of the work thoroughly clean all of the new pipelines by flushing with water or other means to remove all dirt, stones, pieces of wood or other material which may have entered during the construction period. If, after this cleaning, obstructions remain, they shall be removed.

3.04 TESTING (FOR WATER MAINS)

A. Furnish all necessary equipment and labor for carrying out a pressure test and leakage test on the water pipelines. The procedures and method for carrying out the pressure and leakage tests shall be approved by the Engineer.

B. Make any taps and furnish all necessary caps, plugs, etc., as required in conjunction with testing a portion of the pipe between valves. Furnish a test pump, gauges, and any other equipment required in conjunction with carrying out the hydrostatic tests.

C. All pipelines shall be subjected to a hydrostatic pressure of 50% above the normal operating pressure and this pressure maintained for at least one hour. A leakage test shall be conducted at the maximum operating pressure as determined by the Engineer, and this pressure shall be maintained for at least two hours during the test. Hydrant branch gate valves shall remain open during this test. The amount of leakage which will be permitted shall be in accordance with the Specifications for Installation of Cast Iron Water Mains, AWWA C600.

3.05 CHLORINATION OF WATER MAINS

A. Before being placed in service, all new water pipelines shall be chlorinated using the continuous feed method specified in AWWA C651. The procedure shall be approved by the Engineer in advance.

B. The location of the chlorination and sampling points will be determined by the Engineer in the field. Taps for chlorination and sampling shall be installed by the Contractor. The Contractor shall uncover and backfill the taps as required.

C. The general procedure for chlorination shall be first to flush all dirty or discolored water from the lines, and then introduce chlorine in approved dosages through a tap at one end, while water is being withdrawn at the other end of the line. The chlorine solution shall remain in the pipeline for 24 hours.

D. Following the chlorination period, all treated water shall be flushed from the lines at their extremities, and replaced with water from the distribution system. All treated water flushed from the lines shall be disposed of by discharging to the nearest sanitary sewer or by other approved means. No discharge to any storm sewer or natural water course will be allowed. Bacteriological sampling and analysis of the replacement water may then be made by the Engineer in full accordance with AWWA Specifications C501. The Contractor will be required to rechlorinate, if necessary and the line shall not be placed in service until the requirements of the State Public Health Department are met.

E. Special disinfecting procedures shall be used in connection to existing mains, and where the method outlined above is not practical.

* END OF SECTION *

SECTION 19

BURIED VALVES AND APPURTENANCES

PART 1: GENERAL

1.01 SCOPE OF WORK

A: Furnish all labor, materials, equipment, appurtenances, and incidentals required to install tapping sleeve and valve and appurtenances for water mains, complete as shown on the Drawings and specified herein.

1.02 RELATED WORK NOT INCLUDED

A. Earth excavation and backfill is included in Section 11.

B. Rock and boulder excavation is included in Section 11.

C. Ductile iron pipe and fittings are included in Section 18.

D. Water service connections are included in Section 21.

E. Concrete for thrust blocks is included in Section 29.

1.03 APPROVAL AND SCHEDULE OF MATERIALS

A. The Contractor shall submit to the Engineer as specified in Section 5 a list of materials to be furnished, the names of the suppliers, and the sate of delivery of materials on the job site.

PART 2: PRODUCTS

2.01 TAPPING SLEEVES AND VALVES

A. Tapping sleeves shall be mechanical joint type and shall be Mueller H-615, American-Darling 1004, Tyler 5-149, equal by Dresser (M & H) or equal.

B. Tapping valves shall meet the requirements of AWWA C500. The valves shall be flanged by mechanical joint outlet with non-rising stem, designed for vertical burial and shall open right or clockwise. Tapping valves shall be rated at 200psi working pressure and shop tested at 400 psi. Stuffing boxes shall be the "O"-ring type. The operating nut shall be 2"inch square. The valves shall be provided with oversized seats to permit use of full size cutters. Gaskets shall cover the entire area of flange surfaces. Valves shall be Mueller H-667, Dresser (M & H) style 751-09, equal by American Darling Tyler, or approved equal.

2.02 VALVE BOXES

A. Valve boxes shall be provided for each buried valve (including tapping valves). Valve boxes shall be cast iron, or heavy pattern, adjustable type and provided with cast iron cover. The upper section of each box shall have a bottom flange or sufficient bearing area to prevent settling. The bottom of the lower section shall enclose the stuffing box and operating nut of the valve. Boxes shall have barrels of not less than 5"inch in diameter and be of length adapted to pipe cover. Boxes shall be adjustable, with a lap of at least 6" inch when in the most extended position. Covers shall have the word "WATER" and an arrow indicating the direction of opening cast into covers in raised letter. Stem extensions to one foot below grade shall be provided.

B. Three tee-handled gate wrenches of suitable length shall be furnished to operate all valve boxes.

PART 3: EXECUTION

3.01 TAPPING SLEEVES AND VALVES

A. Contractor shall dig a test pit to determine the exact location and material of the existing water mains to be tapped and to confirm the fact that the proposed position for the tapping and to confirm the fact that the proposed position for the tapping sleeve will be satisfactory and no interference will be encountered such as the occurrence of existing utilities or of a joint or fitting at the location proposed for the connection. No tap will be made closer than 3 ft from a pipe joint. This shall be done prior to ordering the tapping sleeve to assure purchase of the proper gaskets.

B. Installations shall be made under pressure and the flow of water through the existing main shall be maintained at all times. The diameter of the tap shall be a minimum of ¼" inch less than the inside diameter of the branch line.

C. The entire operation shall be conducted by workmen thoroughly experienced in the installation of tapping sleeves and valves. The tapping machine shall be furnished by the Contractor.

D. Before backfilling, all exposed portions of any bolts used to hold the two halves of the sleeve together shall be heavily coated with two coats of bituminous paint comparable to Bitumastic No. 50, by Koppers Co., Inc.

E. Tapping sleeves and valves with boxes shall be set squarely centered on the main to be tapped. Adequate support shall be provided under the sleeve and valve during the tapping operation. Sleeves shall be no closer than three (3) ft from water main joints. Thrust blocks shall be provided behind all tapping sleeves. Minimum bearing areas shall be as shown on the Drawings. Concrete shall be as specified in Section 29. Proper tamping of supporting earth around and under the valve and sleeve is mandatory. After completing the tap, the value will be flushed to ensure that the valve seat is clean.

3.02 VALVE BOXES

A. Valve boxes shall be installed vertically, centered over the operating nut, and the elevation of the top shall be adjusted to conform with the finished surface of roadway or other surface at the completion of the contract. Boxes shall be adequately supported during backfilling to maintain vertical alignment.

3.03 CLEANING AND PRIME COATING VALVES AND APPURTENANCES

A. Prior to shop prime coating, all surfaces of the valves and appurtenances shall be thoroughly clean, dry, and free from all mill-scale, rust, grease, dirt, paint and other foreign substances to the satisfaction of the Engineer.

B. All ferrous surfaces shall be sand blasted or pickled according to SSPC-SP6 or SSPC-SP98 respectively.

C. All gears, bearing surfaces and other surfaces not to be painted shall be given a heavy coat of grease or other suitable rust resistant coating unless otherwise specified herein. This coating shall be maintained as required to prevent corrosion during any period of storage and installation and shall be satisfactory to the Engineer through the time of final acceptance.

3.04 SHOP PAINTING VALVES AND APPURTENANCES

A. Valves and appurtenances requiring painting shall be painted and/or coated by suitable material to prevent rust on components until the time of installation. The pipe connection openings shall be capped to prevent the entry of foreign matter prior to installation.

3.05 TESTING

A. Testing of values shall be in conjunction with testing of the water mains as specified in Section 18. Operation shall be satisfactory to the Engineer in all respects.

* END OF SECTION *

SECTION 20

CONNECTIONS TO AND WORK ON THE EXISTING DRAINAGE SYSTEM

PART 1: GENERAL

1.01 SCOPE OF WORK

Where shown on the Drawings or required to complete the work of this Contract, the Contractor shall proceed with work on existing drain structures in the following manner.

A. The Contractor shall supply all materials, equipment and labor required to maintain flow in existing combined sewers, sewers and drains, handle existing wastewater and drainage flow, construct and maintain all temporary connections and bypasses and construct the permanent connections to the new system as shown on the Drawings and as directed by the Engineer.

B. The Contractor shall supply all materials, equipment and labor required for plugging existing drains, all work on existing manholes (including all work and materials required to reshape existing manhole inverts with brick or concrete and connecting new drain pipes to existing manholes and catch basins) and all additional work required.

C. Should damage of any kind occur to the existing combined sewers, sewer and drains, the Contractor shall at his own expense, as part of the work under this Item make repairs to the satisfaction of the Engineer.

D. The Contractor shall notify the engineer immediately of any discrepancies in elevations of existing combined sewers, sewers and drains, manholes and catch basins between those shown on the Drawings and those established during construction in order that the Engineer can make the necessary modifications.

E. All new drain pipe for connection shall conform to the pipe specifications in Section 17.

1.02 RELATED WORK NOT INCLUDED

A. Demolition and site preparation is specified in Section 10.

B. Earthwork is included in Section 11.

C. Concrete is specified in Section 29.

D. Concrete catch basin and manholes are specified in Section 16.

E. Miscellaneous Work and Cleanup is specified in Section 26.

PART 2: PRODUCTS

(None this Section)

PART 3: EXECUTION

3.01 HANDLING WASTEWATER AND DRAINAGE FLOWS

A. The Contractor shall provide all labor, equipment and materials necessary to maintain existing flows, including temporary bypasses and all pumping of wastewater and drainage that may be required to prevent backing up of combined sewers, sewers and drains and shall immediately cart away and remove all offensive matter at his own expense.

B. The Contractor shall not be permitted to overflow, bypass, pump or by any other means convey drainage to any brook, or other water course without permission of the Engineer.

C. All procedures for maintaining flows must meet the approval of the Engineer, and the Contractor shall be required to submit to the Engineer, for approval, a detailed written plan of all methods of flow maintenance ten (10) days in advance of flow interruption.

* END OF SECTION *

SECTION 21

WATER SERVICE CONNECTIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

Where shown on the Drawings or required to complete the work of this Contract furnish and install water service connections as follows.

A. Furnish all labor, materials, equipment and incidentals as required in tapping and making service connections for drinking fountains, yard hydrants and other water works equipment, where directed by the Engineer. The Contractor shall furnish all necessary labor and equipment to excavate the trenches, backfill the trenches after the new connection is completed, and restore the site to its original condition. Trench excavation and backfilling shall be done in accordance with all of the applicable sections of these Specifications.

B. Corporation stops and service clamps shall be furnished and installed for connecting all new service connections to new or existing water mains as required. Pipe, curb stops and necessary adapters shall be used to make connections between new corporation stops and new service piping. New curb stops shall be located and installed in the locations shown on the Drawings and as directed by the Engineer.

C. Furnish all labor, materials, equipment and incidentals as required to install backflow preventer cabinet, backflow device, water meter, silcocks, valves, pipe, plumbing connections, and mounting brackets.

1.02 RELATED WORK NOT INCLUDED

A. Earthwork is included in Section 11.

B. Drinking fountains is included in Section 24.

1.03 APPROVAL OF MATERIALS

A. The Contractor shall submit to the Engineer within ten days after the Effective Date of the Agreement a list of materials and equipment to be furnished, the name of suppliers, and the date of delivery of materials on the job site.

1.04 REQUIRED PERMITS AND INSPECTIONS

A. The Contractor will follow all required permit procedures for installation of backflow prevention device(s) in conformance with the City of Cambridge Cross Connection Office at the Water Department. Contact the Cross Connection supervisor at (617)
For other water works construction contact the
Cambridge Water Department at (617) 349-4786.

PART 2 PRODUCTS

2.01 MATERIALS

A. Pipe for drinking fountains, water spray jet or yard hydrants shall be seamless type "K" copper tubing one inch heavy duty walled and hard tempered with all brass compression fittings, conforming to MDPW Specification M5.06.0. Solder for joints in water supply pipe shall consist of ninety-five (95%) percent tin and five (5%) percent antimony. The name or trademark of the manufacturer shall be stamped along the tubing as specified in Section 22. Copper pipe under pavements and walks to be sleeved through PVC plastic, minimum Class 160 water pipe shall be used.

B. Corporation stops for service connections shall be City of Cambridge Standard, open right (clockwise), have tapered "CC" threads conforming to AWWA Standard C800 on inlet end and with straight outlet coupling for connection to copper pipe. Corporation stops shall be Mueller H-15008 (one inch) or H-15013 (2" inch), Hays Water Service Products 5200-CF, Ford F1000 or FB1000 Series with the head adapters, Red Hed 438/AG or approved equal.

C. Service clamps shall be bronze, double strap type with "CC" threads. Service clamps shall be Mueller H-16130, equal by Hays Water Service Products, Ford or Red Hed, or approved equal.

D. Curb stops shall be City of Cambridge Standard, open right (clockwise) and shall be of the check design without drain. Pipe connections shall be suitable for the type of service pipe used with compression-pattern flared tube couplings. All parts shall be of bronze and shall be designed for a hydrostatic test pressure not less than 200 psi. Curb stops shall be Mueller Oriseal III H-1504-2 (for one inch) or Mask II Oriseal H-1S172 (for 2" inch), Hays Water Service Products 5045-CF, Ford B-44 Series, Red Hed B-415-G or approved equal.

E. Curb boxes shall be cast iron. Extension curb boxes of the required length and having slide-type adjustment shall be installed at all curb box locations. The boxes shall have housings of sufficient size to completely cover the curb stop and shall be complete with covers marked "WATER".

F. Line fittings and adapters shall be City of Cambridge Standard three-part unions conforming to AWWA C-800, Hays Water Service Products, Mueller Co., or equal.

G. Meter: Water Department shall provide water meter. Contractor shall furnish and install remote read wired to water meter. Contractor will install. Size of water meter as required and as shown on Drawings. Threaded unions will be used to disconnect meter.

H. Backflow preventer: shall be a reduced pressure assembly, Watts 909 Series as approved by the City of Cambridge Cross Connection Office and Massachusetts Department of Environmental Protection. Threaded unions will be used for seasonal disconnection of backflow preventer and isolate with two (2) ball valves. Size of backflow and ball valves as required and as shown on Drawings. Backflow preventer will be supplied with four (4) test adapters ¼" inch x ¼" inch with end caps.

I. Valves: Isolation valves for system shut-off shall be ball type bronze construction manufactured by Hammond Valve, #667 series or approved equal. Size of ball valves as required and as shown on drawings. Ball valves will be furnished and installed for potable and non-potable water sides of backflow preventer.

Enclosure for 1" Backflow: Shall be Model #SB-36SS 36" Wide Double Door Enclosure, stainless steel cabinet, dimensions 36"wide 36"high by 12"inches depth, with Model #PED-36SS 12" Riser Pedestal base, supplied by Strong Box/ V.I.T. Products, Inc. 920 S. Andreasen Drive,
Suite 106 Escondido, CA 92029, www.vitproducts.com; Phone: (800) 729-1314; Fax: (888) 310-3946, or approved equal.

Enclosure for 2" Backflow: Shall be Model SBBC-60ALHP high profile cabinet, 60" length x 39" high x 24" wide, or approved equal. The enclosure shall have a mounting lip on one end and a locking mechanism on the other end. The mounting base shall be submerged into concrete a minimum of two 2" inches, and position the enclosure 2 ½" inches above the concrete for drainage. The locking mechanism shall be of the full release type which allows for complete removal of the enclosure from its mounting base without the use of tools. The handle controlling the locking mechanism shall be concealed within the surface of the enclosure and provide for a padlock.. Color shall be factory applied powder coated black. Supplied by Strong Box/ V.I.T. Products, Inc. 920 S.Andreasen Drive, Suite 106 Escondido, CA 92029, www.vitproducts.com; Phone: (800) 729-1314; Fax: (888) 310-3946, or approved equal.

Backflow device, meter and pipe within cabinet to be securely mounted using City of Cambridge Water Department approved threaded rod, "F and M" rings and flanges and other hardware as required. All mounting hardware, fittings and methods of attachment shall be in conformance with the Cambridge Water Department Cross Connection Office requirements. All water piping in backflow preventer cabinet shall be properly Labeled (i.e. potable, non-potable water.) All pipe within backflow enclosure to be cooper K tubing.

K. Pressure Reducer Valve: Shall be Watts Series U5/U5B reducer valve, sized as required manufactured by Watts Industries, Inc. 815 Chestnut Street, North Andover MA. 01845-6098 or approved equal. Set reducer valve for 50 psi typically.

L. Blown Down Drain Valve: Blow down drain valves required on all lines (to water play equipment, irrigation system, drinking fountains) sized as required.

M. Yard hydrants will be a one inch brass silcock manufactured by Hammond Valve, or approved equal housed within a 6" inch City of Cambridge standard street service box. Each silcock will be equipped with a Watts No. 8B back siphonage backflow preventer for hose bibb applications manufactured by Watts Regulator Company, North Andover, MA 01845, or approved equal.

N. Drinking fountain will be as described in Section 24. All drinking fountains will be equipped with in line backflow check valves.

PART 3 EXECUTION

3.01 INSTALLATION

A. Corporation stops. The tapping machine shall be rigidly fastened to the pipe as near the horizontal diameter as possible. The length of travel of the tap should be so established that when the stop is inserted and tightened with a 14" inch wrench, not more than one to three threads will be exposed on the outside. When a wet tapping machine is used, the corporation cock shall be inserted with the machine while it is still in place. Stops shall be tightened only sufficiently to give water tightness and care must be constantly exercised not to over tighten them.

B. Curb stops and boxes shall be installed in a satisfactory manner as described herein and as directed by the Engineer, and shall place compacted screened gravel around and below the curb stop and water gate to permit ready draining of the pipe through the waste opening.

C. Curb boxes shall be set in a true vertical position and, if they are within the limits of the roadway or within limits where the plowing of snow will take place in the winter, the tops of the boxes shall be set about ½" inch below the top of the finished grade. In locations where these boxes are not likely to be disturbed, the tops shall be set flush with the adjoining ground.

D. Type "K" copper pipe. Care shall be exercised in the placing and laying of pipe to be sure that the pipe does not have kinks or sharp bends and to assure against its being in contact with sharp stones or ledge which would cause damage to the pipe. Where pipe less than 1" inch diameter is required, one inch diameter tubing shall be installed to beyond the curb stop and adapted to the required diameters. Depth of excavation for trench shall be a minimum of 4'-6" inch. The bottom of trench to be filled with 8" inch of screened gravel fill. At least 6" inches of screened gravel fill shall be placed adjacent to and above the pipe, and no stone will be placed over the pipe until the depth of backfill above the latter is in excess of one foot. All water piping shall have a minimum of four (4') feet of ground cover.

E. 1. Backflow preventer cabinet will be mounted on a reinforced concrete foundations as shown on the plans.

2. Cabinet shall be anchor bolted to the foundation.

3. Backflow preventer shall be equipped with a brass tag upon which will be engraved the location where the backflow preventer is to be used, to permit subsequent replacement following seasonal removal and storage.

4. Threaded unions will be used to disconnect backflow preventers and valves within mounting cabinet.

F. Water Meter Installation

1. Install Neptune water meter and remote read device in enclosure. Meter to be supplied by City of Cambridge Water Department and installed by Contractor in accordance with City of Cambridge Standards.

2. Install unions at each side of water meter for ease of servicing and removal.

* END OF SECTION *

SECTION 22

AUTOMATIC IRRIGATION SYSTEM

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Include GENERAL CONDITIONS and applicable parts of Division 1 as part of this Section.

1.02 WORK TO BE DONE

A. Work to be done includes furnishing all labor, materials, equipment and services required to complete all irrigation work indicated on the Drawings, as specified herein, or both.

1. The Point of Connection for the IRRIGATION SYSTEM shall be new or existing water service at back of sidewalk typically or at planned location of backflow enclosure.
2. Connect controller to a 120 volt electrical supply within planned location of lighting control enclosure.

B. The drawings and Specifications must be interpreted and are intended to compliment each other .The contractor shall furnish and install all parts which may be required by the drawings and omitted by the specifications, or vice versa, just as though required by both. Should there appear to be discrepancies or question of intent, the contractor shall refer the matter to the project engineer for decision, and his interpretation shall be final, conclusive and binding.

C. All necessary changes to the drawings to avoid any obstacles shall be made by the contractor with the approval of the project engineer.

D. Trench excavation, backfilling and bedding materials, together with the testing of the completed installation shall be included in this work.

E. The work shall be constructed and finished in every respect in a good, workmanlike and substantial manner, to the full intent and meaning of the drawings and specifications. All parts necessary for the proper and complete execution of the work, whether the same may have been specifically mentioned or not, or indicated on the drawings, shall be done or furnished in a manner corresponding with the rest of the work as if the same were specifically herein described.

1.03 SCOPE

A. Specifications represents a single controller, landscape irrigation system supplied from a municipal source. The system is designed at 20 gallons per minute maximum, minimum 60 psi dynamic pressure and 50 psi sprinkler operating pressure.

1.04 RELATED WORK

A. Carefully examine all of the Contract Documents for requirements that affect the work of this Section.

B. Particular attention is directed to the following Sections that affect the work of this Section.

1. The remainder of Division 2 – Site Work

1.05 ORDINANCES, PERMITS AND FEES

A. This Work under this Section shall comply with all ordinances and regulations of authorities having jurisdiction. Contact the Cambridge Water Works Department Cross Connection Office, phone (617) 349-4778 ,and for water works construction phone (617) 349-4786, to obtain all necessary permits.

B. The contractor shall obtain and pay for any and all permits, tests and certifications required for the execution of Work under this Section .

C. Furnish copies of Permits, Certifications and Approval Notices to the project engineer prior to requesting payment.

D. The contractor shall include in their bid any charges by the Water Department, Utility Company, or other authorities for work done by them and charged to the contractor.

1.06 EXAMINATION OF CONDITIONS

A. The contractor shall fully inform himself of existing conditions on the site before submitting his bid, and shall be fully responsible for carrying out all work required to fully and properly execute the work of the contract, regardless of the conditions encountered in the actual work. No claim for extra compensation or extension of time will be allowed on account of actual conditions inconsistent with those assumed, except those conditions described in the GENERAL CONDITIONS.

1.07 QUALITY ASSURANCE

A. Installer; A firm which has at least five (5) years experience in work of the type and size required by this Section and which is acceptable to the project engineer.

B. References: The contractor must supply three references for work of this type and size with their bid including names and phone numbers of contact person(s).

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

1. American Society for Testing & Materials (ASTM)
2. National Plumbing Code (NPC)
3. National Electric Code (NEC)
4. National Sanitary Foundations (NSF)
5. Underwriters Laboratories, Inc. (UL)
6. Occupational Safety and Health Regulations (OSHA)

1.08 TESTS

A. Pressure: Contractor shall field verify a minimum of 60 psi dynamic pressure before commencement of work. Any deviation shall be reported to project engineer before start of work.

B. Observation: The project engineer will be on site at various times to insure the system is being installed according to the specifications and drawings.

C. Operational Test: After completion of the system, test the operation of entire system and adjust sprinklers as directed by the project engineer. Demonstrate to the project engineer that all irrigated areas are being adequately covered (see Part III, Executions).

1.09 SHOP DRAWINGS

A. The contractor shall provide four (4) copies of product specification sheets on all proposed equipment to be installed to the project engineer for approval. Work on the irrigation system may not commence until product sheets are submitted and approved. Submittals shall be marked up to show proper nozzles, sizes, flows, etc. Equipment to be included:

1. Sprinkler Heads
2. Valves: Manual and Automatic
3. Valve Boxes
4. Controller
5. Rain Shut-off
6. Pipe and Fittings
7. Wire and Connectors
8. Quick Coupling Valves
9. Miscellaneous Materials
10. Controller Enclosure
11. Backflow Prevention Enclosure
12. Backflow Preventor
13. Water Meter

B. The contractor shall maintain complete Record Drawings of the system as the project proceeds. Record Drawings shall specify sprinkler type, pop up height and nozzle for each sprinkler installed. Each valve box location to be referenced by distance from a minimum of two permanent locations in a triangular fashion. Controller, quick coupling valves, sprinklers, pipe and other equipment shall be indicated on the drawings. All wire routing, wire size and splices shall be indicated. Main line pipe and wire route shall have two (2) distinctly different graphic symbols (line types).

1.10 DELIVERY, STORAGE AND HANDLING

A. Store and handle all materials in compliance with manufacturers instructions and recommendations. Protect from all possible damage. Minimize on-site storage.

1.11 GUARANTEE

A. The contractor shall obtain in the owner's name the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in additional to, and not in lieu of, other liabilities which the contractor may have by law.

B. In addition to the manufacturers guarantees the contractor shall warrant the entire irrigation system, both parts and labor for a period of one (1) year from date of acceptance by the City.

C. As part of the one year warranty the contractor shall perform the first year end blowout and spring start-up for the irrigation system.

1.12 COORDINATION

A. The contractor shall at all times coordinate his work closely with the project engineer to avoid misunderstandings and to efficiently bring the project to completion. The contractor shall also coordinate his work with that of his approved sub-contractors.

B. The contractor shall be held responsible for and shall pay for all damage to other work caused by his work, workmen or sub-contractors. Repairing of such damage shall be done by the contractor who installed the work, as directed by the project engineer.

1.13 MAINTENANCE AND OPERATING INSTRUCTIONS

A. Contractor shall include in their Bid an allowance for four (4) hours of instruction of Owner and/or Owner's personnel upon completion of check/test/start-up/adjust operations by a competent operator. (project engineer's office shall be notified at least one (1) week in advance of check/test/start-up/adjust operations).

B. Upon completion of work and prior to application for acceptance and final payment, a minimum of two (2) three ring, hard cover binders titled MAINTENANCE AND OPERATING INSTRUCTIONS FOR THE CITY OF CAMBRIDGE _____(name of park) IRRIGATION SYSTEM, shall be submitted to the project engineer's office. After review and approval, the copies will be forwarded to the owner. Included in the Maintenance and Operating binders shall be:

1. Table of Contents

2. Description of Irrigation System:

   a. One (1) copy of the Record Drawing;
   b. One (1) reproducible copy of the Record Drawing;

3. Listing of Manufacturer's.

4. Manufacturer's data where multiple model, type and size listings are included; clearly and conspicuously indicating those that are pertinent to this installation.

   a. "APPROVED" submittals of all irrigation equipment;
   b. Operation: Including controller instruction manual.
   c. Maintenance: Including complete troubleshooting charts.
   d. Parts list.
   e. Names, addresses and telephone numbers of recommended repair and service

companies.

5. A copy of the suggested "System Operating Schedule" which shall call out the controller program required (zone run time in minutes per day and days per week) in order to provide the desired amount of water to each area under "no-rain" conditions.

6. One (1) copy of the controller valve system wiring diagram.

7. Winterization and spring start-up procedures.

8. Guarantee data.

1.14 PROCEDURE

A. Notify all city departments and/or public utility owners concerned, of the time and location of any work which may affect them. Cooperate and coordinate with them in the protection and/or repairs of any utilities.

B. Provide temporary support, adequate protection and maintenance of all structures, drains, sewers, and other obstructions encountered. Where grade or alignment is obstructed, the obstruction shall be permanently supported, relocated, removed or reconstructed as directed by the project engineer.

PART 2 – PRODUCT

2.01 GENERAL

A. All materials to be incorporated in this system shall be new and without flaws or defects and of quality and performance as specified and meeting the requirements of the system. All material overages at the completion of the installation are the property of the contractor and shall be removed from the site.

2.02 COPPER PIPE AND FITTINGS

A. Copper pipe, 1 ¼" inch for water supply system shall be hard temper, seamless piping, Type K, meeting ASTM B88 without joints.

B. Supply only pipes and fittings that are marked by the manufacturer with the appropriate ASTM designations and pressure ratings and are free from cracks, wrinkles, blisters, dents or other damage.

C. Copper fittings shall be wrought copper solder pattern, meeting ANSI B16.18 and B16.22.

D. Joints shall be soldered with silver solder, ASTM B32, Grade 95TA up to 250 degree using non-corrosive flux. Threaded unions shall be used for connections of pipe to meter and to backflow preventer.

2.03 PVC IRRIGATION PIPE FITTINGS

A. Mainline piping 1 ¼" inch in size shall be PVC, Class 200, Type 1120, SDR 21, Solvent-Weld PVC, conforming to ASTM No. D2241 and D3036 as manufactured by Cresline or equal.

B. Fittings for PVC pipe shall be Schedule 40 solvent weld PVC fittings as manufactured by Dura, Lasco, Spears or equal.

C. All PVC threaded connections in and out of valves shall be made using Schedule 80 toe nipples and Schedule 40 couplers or socket fittings. Schedule 40 threads will not be approved for installation.

D. PVC solvent shall be NSF approved, for Type I and Type II PVC pipe, and Schedule 40 fittings. Cement is to meet ASTM D2564 and FF493 for potable water pipes. PVC solvent cement shall be Rectorseal Gold, or equal, and shall be used in conjunction with the appropriate primer.

E. All nipples to be schedule 80 PVC.

F. Supply only pipes and fittings that are marked by the manufacturer with the appropriate standard designations and pressure ratings free from cracks, wrinkles, dents or other damage.

2.04 POLYETHYLENE IRRGATION PIPE AND FITTINGS

A. Lateral pipe in size 1¼" inch and below as indicated on the Drawings shall be polyethylene (PE-3408) pipe, NSF approved, SDR 15, Type III, Grade 3, Class C conforming to ASTM D2239, with a minimum pressure rating of 100 psi as manufactured by Oil Creek or equal.

B. Fittings for polyethylene pipe shall insert PVC or Nylon type fitting. Fittings shall conform to NSF standards and be attached with two (2) Oetiker or equal dog eared stainless steel clamps on each barb. Fittings shall be per ASTM D2609 as manufactured by Dura, Lasco, Spears or equal.

2.05 SPRINKLERS

A. **Small Sprinklers:** 1800 Series spray mist heads for small turf areas and planting beds shall be installed. Spacing: 3 to 20 feet (0,9 to 6,1 m). Pressure: 15 to 70 psi (1,0 to 4,8 bar). Flow-by: 0 at 8 psi (0,6 bar) or greater; 0.10 gpm (0,02 m3/h; 0,006 l/s) otherwise. Dimensions: ½" (15/21) NPT female threaded inlet. Models and height: 1802, 1803,1804,1806,1812. Exposed surface diameter: 2-1/4" (5,7 cm). Small sprinklers shall be manufactured by Rainbird, or an approved equal.

B. **Large Sprinklers:** PGP Hunter Rotary Sprinklers for large turf areas shall be installed. Integral rubber cover. 12 standard or 7 low-angle nozzles for virtually any task. 40 to 360 degrees adjustable arc or full-circle versions. Water lubricated gear drive. Variable stator, keeps rotation speed consistent regardless of nozzle size or pressure. Large dirty water screen feature to prevent nozzle clogging.

C. **Large Sprinklers:** I-20 Hunter Rotary Sprinklers for large turf areas shall be installed as required. Integral rubber cover. Choice of 22 different nozzles, allows sprinkler to be custom fitted to all spacings from 18' to 47'. Flo-Stop Control: Allows stoppage of flow through individual head while remainder of system is running. Easy arc adjustment (40 to 360

degrees), at the top of sprinkler. Water lubricated gear drive. Extra strong spring. Drain check valve for up to 10'feet elevation change.

2.06 ELECTRIC CONTROL VALVES

A. Electric control valves (one inch, at locations indicated on Drawing) remote control shall be diaphragm type, fiberglass body plastic valves with flow control and 150 psi pressure rating as manufactured by Toro, 254 Series or equal, 24v Electric.

2.07 VALVE BOXES

A. Single electric valves, quick coupling valves and isolation ball valves shall be installed in 10" inch round valve boxes with metal detection and bolt down covers where indicated on the drawings as manufactured by Carson, Model 910 or equal.

B. Multiple electric valves (two or three) shall be installed in 12" inch standard valve boxes with metal detection and bolt down covers where indicated on the drawings as manufactured by Carson, Model 1419-12 or equal.

C. Valve box extensions shall be provided as required.

2.08 CONTROLLER

A. The controller shall be as manufactured by Rainbird, ESP-LX Plus and Lxi- Plus Series, 6, 8, 12, 16, 20, 24 Stations ,or equal. Number of zones as required to fit scope and layout of project. Dimensions: 9-1/2"x10-1/4"x4-38". Station timing: 0 to 12 hours for all stations (0 to 16 hours with water budgeting); 0 to 120 minutes selectable in 1-minute increments; above 120 minutes selectable in 10-minute increments. Automatic starts: 6 starts per day for each program, available on the quarter hour (total of 24 start times). Independent programming schedule options: Odd day watering ; Even day watering; Cyclical (1 to 31 days, variable per program); Custom (weekly schedule variable per program). Input required: 117 VAC +- 10%, 50/60 Hz (International models 230 VAC+- 10% 50/60Hz). Output: 26.5 VAC, 1.5A (1.25A on ESP-LXi+). Diagnostic circuit breaker skips and indicates stations with overloaded circuits and continues to run operable stations. Overload, backup fuse: 1.5A SLO-BLO (1.25A SLO-BLO) on ESP- LXi+). Battery backup: 9V Ni-MH rechargeable battery (included) for programming under battery power and maintaining program current time and date during power outages. Station Capacity: Up to two 24 VAC, 7VA solenoid valves per station plus a master valve or pump start relay. Terminal strips for up to #12UF wire. Electrical surge protection: Primary input side has built-in MOV (metal oxide varistor) to protect microcircuitry; output side has one built-in MOV for each valve station.

B. Keys shall be turned over to project engineer.

2.09 RAIN SHUT-OFF

A. Rain shut-off shall be plastic in construction with adjustable interruption point and attached mounting bracket. Rain shut-off shall be Mini-Click II as manufactured by Hunter Industries or equal. Location of rain shut-off to be coordinated with project engineer in the field.

2.10 CONTROLLER ENCLOSURE

A. Controller shall be housed in either lighting controller enclosure or in its own enclosure as required. Refer to drawings. Enclosure to conform to the following: The enclosure shall be a cast aluminum street light control cabinet Cat. No. SL-MF-CAMB as manufactured by Spec Lines, Inc. 343C Main Street, Sandown, NH, Phone: (603) 887-551, or approved equal. The cabinet finish shall be painted with three stage iron phosphate coating and forced air dried. Finish coat to be zinc chromate primer followed by a baked alkali enamel. Color to be black. Color to be applied prior to shipment by the manufacturer.

B. Characteristics of the streetlight control cabinet:

1. Made from .125 thick aluminum type 5052-h32.

2. Vertical mounting channels welded interior enclosure walls to provide adjustable brackets for rigid mount of backflow preventer.

3. Door opening to have rolled up lip at top and flanged lips on all four sides.

4. Enclosure to have a screened air exhaust opening under roof overhang.

5. All exterior seams are to be continuously welded.

6. All external hardware is stainless steel. All internal hardware is either stainless steel or cadmium plated steel, Type II, Class I.

7. Raised letters cast integral with door (0.025" inch) "Street Light Control City of Cambridge".

Enclosure Doors shall be:

8. Equipped with three point latching mechanism with nylon rollers at top and bottom.

9. Doro handle to be ¾" inch diameter stainless steel with provisions for padlocking and shall open to the right.

10. Main door sealed with closed cell neoprene gasket.

11. Main door has heavy gauge continuous hinge with ¼" inch diameter stainless steel hinge pin. Hinge is secured with ¼-20" inch stainless steel carriage bolts and stainless steel nylock nuts.

2.11 GROUNDING

A. Controller shall be grounded minimum to two 5/8" inch x 10' foot copper grounding rods, spaced 125' apart with #6 bare copper wire. Connect wire to grounding rod with cadweld connector.

2.12 WIRE

A. All valve control and common wire shall be minimum #14, single strand, solid copper, 600v, UL Listed, polyethylene jacketed, direct burial and shall meet all state and local codes for

this service. Individual wires must be used for each zone valve. Common wire shall be white in color. White color shall be used for common wire only. Control wire for lawn areas shall be red in color. Control wires for planting areas shall be orange in color. Extra power wires for future use shall be blue in color.

B. In ground wire connections shall be UL Listed, Paige DBM, 3M DBY-6 or DBR-6 splice kits. All wire splices shall be made in valve boxes, at controller, or at valves.

C. Wire type and method of installation shall be in accordance with local codes for NEC Class II circuits of 30 volt a.c. or less.

2.13 PIPE SLEEVES UDNER PAVEMENTS & WALKS

A. Sleeves shall be installed for all irrigation pipe under non-soil areas and where indicated on the Drawings. Minimum sleeve size shall be 3" inch. PVC plastic, minimum Class 160 water pipe shall be used.

2.14 SWING JOINTS

A. Spray and rotary sprinklers shall be installed on 2-ell, thick wall, highly flexible polyethylene swing pipe assembly as per details, minimum length 6" inches, maximum length 18" inches. Barbed ells shall be threaded, not push on type.

B. Quick couplers to be installed on one inch brass swing joints in valve boxes as per detail. Minimum swing joint length to be 12" inches. Stabilize quick coupler with LEEMCO, or equal LS-120 quick coupler stabilizer.

2.15 QUICK COUPLING VALVES

A. The valve body shall be industrial-strength brass quick-coupling valves for convenient water access with a working pressure of 5 to 125 psi (0,4 to 8,6 bar). Flow: 10 to GPM (2,3 to 28,4m3/h;0,63 to 7,88 l/s).

B. Red brass construction for long life and rugged performance.

C. The valve body construction shall be such that the coupler seal washer may be removed from the top for cleaning or replacement without disassembling any other parts of the valve.Yellow thermoplastic cover for durability. Optional locking covers required. Metal cover on model 7 only.

D. One or two piece body design for easy servicing.

E. Contractor shall provide two (2) keys for quick couplers, two (2) one inch x one inch swivel hose ells and two (2) cover keys for quick coupling valves.

F. Quick coupling valves, keys and swivels shall be as manufactured by Rainbird, or an approved equal.

2.16 ISOLATION VALVES

A. Isolation valves in line sizes at locations as indicated on the Drawings shall be of bronze construction, US manufacturer, ¾ port minimum, 600 WOG with steel cross handle and chrome plated ball. Ball valves to be as manufactured by Apollo, 70-100 Series or equal.

2.17 WATER METER

A. Contractor shall provide a Neptune water meter as approved by City of Cambridge Water Department. Meter shall read in cubic feet only (size as required).

2.18 BACKFLOW PREVENTER

A. Contractor shall provide a reduced pressure zone assembly (size as required), Watts Series 909 as approved by the City of Cambridge cross connection office.

B. Contractor shall provide a pressure reducing valve (size as required), set at 50 psi, Watts Series U5B as approved by the City of Cambridge Cross Connection Office.

2.19 BACKFLOW ENCLOSURE

A. The backflow enclosure shall be of a vandal and weather resistant nature manufactured entirely of marine grade aluminum alloy 5052-H32, with a wall thickness of one eighth 1/8" inch. The mounting base shall be manufactured entirely of stainless steel, and power coated black. The main housing shall be of solid sheet construction punched on the side with a rectangular pattern for viewing backflow operation. The length of the enclosure shall be expandable to allow for site adjustment. The enclosure shall have a mounting lip on one end and a locking mechanism on the other end. The mounting base shall be submerged into the concrete a minimum of two 2" inches, and position the enclosure two and one half ½" inches above the concrete for drainage purposes. The locking mechanism shall be of the full release type which allows for complete removal of the enclosure from its mounting base with-out the use of tools. The handle controlling the locking mechanism shall be concealed within the surface of the enclosure and provide for a padlock. The backflow enclosure shall be as manufactured by Strong Box, Model SBBC-45 AL, 43" inches L x 28 ½" inches H x 14" inches W or approved equal. Where a slightly larger cabinet is required use Strong Box Model SBBC-60ALHP high profile enclosure, 57" inches L x 38.5" inches H x 21" inches W, or approved equal. Where a slightly larger cabinet is required use strong box model SBBC-60 ALHP high profile enclosure 57" inches L x 38.5" inches H x 21" inches W, or approved equal.

2.20 CRUSHED STONE

A. Crushed stone shall be as specified in SECTION: EARTHWORK

1. Crushed stone shall be used under valve boxes and below all sprinklers.

2.21 SAND

A. Sand used for backfilling of trenches; under, around and over PVC lines shall be as specified in SECTION: EARTHWORK.

2.22 SPARE PARTS

A. In addition to all materials needed for installation the contractor shall provide for in their bid the following spare parts:
(1) Devils Fork 30" inch valve wrench.
(2) **Each type** sprinkler installed.
(1) Valve diaphragms for **each size** valve installed.
(2) Sets of spare keys for controller.

PART 3 – EXECUTION

3.01 GENERAL

A. Examine all contract documents applying to this Section noting any discrepancies and bringing same to the attention of the project engineer for timely resolution.

B. Make all field measurements necessary for the work noting the relationship of the irrigation work to the other trades. Coordinate with other trades (landscaping and other site work trades). Project shall be laid out essentially as indicated on the Irrigation Plans, making minor adjustment for variations in the planting arrangement. Major changes shall be reviewed with the Owner's Representative prior to proceeding.

C. At all times, protect existing irrigation, landscaping, paving, structures, walls, footings, etc. from damage. Any inadvertent damage to the work of another trade shall be reported at once.

3.02 INSTALLTION OF PIPE AND FITTINGS

A. Using proper width trencher chain excavate a straight and true trench to a depth of $\pm$ 2" inch of pipe invert elevation.

B. Loam encountered within the limits of trench excavation for irrigation mains and branch lines shall be carefully removed to the lines and depths as shown on the Drawings and stockpiled for subsequent replacement in the upper 6" inches of the trench from which it is excavated. Such removal and replacement of the quantities of loam shall be considered incidental to the irrigation system and no additional compensation will be allowed. Therefore, all lawn and ground cover plants shall be restored to original growth and versatility.

C. Pipe shall be laid on undisturbed trench bottom provided suitable base is available – no rock larger than one inch or sharp edges; if not, excavate to 2" inches below pipe invert and provide sand base or crushed stone upon which to lay pipe.

D. Backfilling shall be accomplished as follows: the first 10" inch of backfill material shall contain no foreign matter and no rock larger than one inch in diameter. Carefully place material around pipe and wire and tamp in place. Remainder of backfill shall be laid-up in six 6" inch (maximum) lifts and tamped to compaction with mechanical equipment matching adjacent undisturbed area. Frozen material shall not be used for backfill.

E. Make all solvent-weld joints in strict accordance with manufacturer's recommendations, making certain not to apply an excess of primer or solvent, and wiping off excess solvent from each connection. Allow connections to set minimum 24 hours before pulling or pressure is applied to the system.

F. Provide for expansion and contraction as recommended. Wire shall be laid in same trench as mainline and at pipe invert (see Wire Installation).

G. Mainline pipe shall have minimum 16" inches of COVER (excavate to invert as required by pipe size).

H. Lateral pipe shall have minimum 12" inches of COVER (excavate to invert as required by pipe size).

I. Cut plastic pipe with hand saw or pipe-cutting tool, removing al burrs at cut ends. All pipe cuts are to be square and true. Bevel cut end as required to conform to Manufacturer's Specifications.

J. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being place in the trench. At times, when installation of the piping is not in progress, the open end(s) of the pipe shall be closed by a watertight plug or other means. All piping which cannot temporarily be joined shall be sealed to make as watertight as possible. This provision shall apply during the lunch hour as well as overnight. Pipe not to be installed that day shall not be laid out. Should water enter the trench during or after installation of the piping, no additional piping may be installed or backfilled until all water is removed from the trench. Pipe shall not be installed when water is in the trench, when precipitation is occurring, or when the ambient temperature is at 35 F or below. PVC pipe shall be snaked in the trench to accommodate for expansion and contraction due to changes in temperature.

K. In installing irrigation pipe the Contractor shall route the pipe as necessary to prevent damage to tree roots. Where trenching must occur near trees, the Contractor shall provide proper root pruning and sealing methods to all roots one inch and larger.

L. Throughout the guarantee period it will be the responsibility of the Contractor to refill any trenches that have settled due to incomplete compaction.

M. Pulling of pipe will be allowed provided soil is suitable and specified depth of bury can be maintained.

3.03 SLEEVING INSTALLTION

A. Sleeving shall be used wherever wire or piping is going under a non-soil area, generally where indicated on the Drawings. No cutting and patching will be permitted.

B. If finished pavement is in place, the Contractor shall bore under the pavement for sleeving installation using personnel experienced in the procedure. Contractor shall be responsible for all damage to finished paving due to improper boring.

3.04 SPRINKLER INSTALLATION

A. All sprinklers shall be mounted on swing pipe with barbed ells. Minimum swing pipe length –6" inches; maximum –18" inches.

B. Adjust sprinkler zone pressure with flo-control on valve.

C. Install sprinklers as per details.

3.05 ISOLATION VALVE INSTALLATION

A. Install isolation valves on mainline per detail where indicated on the Drawings. Install all isolation valves on a level crushed stone base so that they can be easily opened or closed with the appropriate valve wrench. Install specified valve box over each isolation valve.

3.06 VALVE BOX INSTALLATION

A. Furnish and install a valve access box for each electric valve, quick coupling valve, isolation valve, valve manifold and wire splice.

B. All valve access boxes shall be installed **on** a minimum 4" inch crushed stone base. Finish elevation of all boxes shall be at grade. All crushed stone to be supplied by the Contractor and installed before valve box.

3.07 ELECTRIC VALVE INSTALLATION

A. Electric valves shall be installed on a level crushed stone base. Grade of bases shall be consistent throughout the project so that finish grades fall within the limits of work. Valves shall be set plump with adjusting handle and all bolts, screws and wiring accessible through the valve box opening.

3.08 WIRING INSTALLATION

A. Wiring shall be installed along with the main line. Multiple wire bundles shall be cinched together at maximum 12' foot centers using plastic cable cinches and shall be laid beside, and at the same invert as, the irrigation lines. Sufficient slack for expansion and contraction shall be maintained and wiring shall at no point be installed tightly. Provide an additional 8" inches to 12" inches slack at all changes of direction. Wiring in valve boxes shall be a sufficient length to allow the valve solenoid, splice, and all connections to be brought above grade for servicing. This additional slack shall be coiled for neatness in the valve box. Each valve shall have a separate wire back to the controller.

B. All wire shall be laid in trenches and shall be carefully back-filled to avoid any damage to the wire insulation or wire conductors themselves. In areas of unsuitable material, the trench shall have a 2" inch layer of sand or stone dust on the bottom before the wires are laid into the trench and back-filled. The wires shall have a minimum of 12" inches of cover. Wire not to be installed that day shall not be laid out.

C. An expansion curl shall be provided within 6" inches of each wire connection to a solenoid, and at least every 100 feet of wire length on runs more than 100 feet in length. Expansion curls can be formed by wrapping five (5) turns of wire around a one inch diameter or larger pipe and then withdrawing the pipe.

D. Provide a common ground wire of white color. No white color shall be used for power wire. Control wire shall be red for turf zones and orange for planting zones. Blue shall be used for extra power wires where indicated on the Drawings.

E. Service wiring in connection with Drawings and local codes for 24-volt service. All in-ground wire connections shall be waterproofed with Paige DBM, 3M DBY-6 or 3M DBR-6 splice kits. All splices shall be made in valve boxes (wire runs requiring splices between valve locations shall be provided in splice box-valve box shall be used). Splice locations shall be shown on the Record Drawings.

F. Contractor to provide a complete wiring diagram showing wire routing for the connections between the controller and valves.

G. Provide extra wires coiled neatly in valve box where indicated on the Drawings. Clearly mark all spare wire in controller enclosure as to their location in the field.

H. All above ground wiring shall be installed in conduit.

3.09 CONTROLLER INSTALLATION

A. Contractor to mount controller in existing light control enclosure on Grozier Street. Contractor to wire valves into controller and set program.

B. Hard wire controller to building 120 volt electrical supply.

3.10 RAIN SHUT OFF INSTALLATION

A. Install rain shut-off on park fence. Coordinator final location of rain shut-off with Owner's Representative.

B. Wire rain shut off to controller.

3.11 QUICK COUPLING VALVE INSTALLATION

A. Provide quick coupling valves where indicated on the Drawings.

B. Quick couplers to be mounted on one inch brass swing joints. Minimum swing joint length to be 12" inches.

3.12 BACKFLOW PREVENTION WATER SUPPLY CABINET INSTALLATION

A. Install water meter with remote read device, water pressure reducing valve set for 50 psi and reduced pressure backflow preventer in water supply cabinet as per details. Meter and backflow installation shall be in accordance with City of Cambridge standards.

B. Install backflow preventer cabinet on concrete base using minimum 2000 pound concrete mixture and #4 steel rebar. Concrete pad sizes shall be 53" inches in length, 30" inches wide and 6" inches deep. Provide PVC sleeves through bases for water supply line entrances and exits.

C. Cabinets shall be anchor bolted to the bases.

D. Pipe hangers shall be used in cabinets as needed to support piping, meters and backflow prevention devices. Copper piping shall not be used to support equipment. See details.

3.13 CONTROLLER ENCLOSURE INSTALLATION (NOT APPLICABLE – USE EXISTING CABINET)

A. Controller enclosure cabinet shall be installed on reinforced concrete base of minimum 28" inches long x 16" inches wide x 6" inches deep, poured in place. Prefabricated controller bases shall not be approved for installation. Contractor to use template to install poured-in-place "J" bolts to fasten cabinet base.

B. Per controller install minimum two (2), 2" inch PVC conduit sweep ells and spool pieces through controller pad for valve wiring. Install two (2), 1" inch PVC conduit sweep ell and spool piece through controller pad for power wire and #6 bare copper wire. Maintain required depth of bury in and out of pad.

C. Controller power wire(s) and #6 bare copper wire shall be brought to the exterior through separate sleeves in the support pad.

D. Irrigation contractor shall furnish and install all control and other irrigation related wiring; as well as all 120 volt service to controllers.

E. All above-ground wire, other than in controller enclosures, shall be in conduit.

F. Grounding rods shall be installed to their full length.

3.14 CHECK/TEST/START-UP/ADJUST

A. The following work shall be accomplished in the presence of the Owner's maintenance personnel.

B. Flushing: After all piping, valves and sprinkler bodies are in place and connected, but prior to installation of sprinkler internals, flush piping under a full head of water.

C. Leakage test: test all lines for leaks under operating pressure. Repair all leaks and re-test.

D. Coverage test: perform a coverage test in the presence of the Owner's Representative (notify Owner's Representative at lest seven (7) days in advance of scheduled coverage test). Representative will determine if the water coverage is complete and adequate. Readjust sprinklers and/or sprinkler locations as necessary or directed to achieve proper coverage. Owner's Representative will determine if the water dispersion is complete and adequate. All testing shall be at the expense of the Contractor.

3.15 CLEANING AND ADJUSTING

A. At the completion of the work, all parts of the installation shall be thoroughly cleaned. All equipment pipe, valves and fittings shall be cleaned of grease, metal cuttings and sludge which may have accumulated by the operation of the system for testing.

B. Adjust sprinkler heads, valve boxes, and quick coupling valves to grade as required, so that they will not be damaged by mowing operations.

C. Continue sprinkler coverage adjustment as required by settlement, etc., throughout the guarantee period.

D. Each control zone shall be operated for a minimum of 5 minutes and all sprinklers, checked for consistency of delivering water. Adjustments shall be made to equipment which is not consistent to the point that they match the manufacturer's standards. All sprinklers, valves, timing devices or other mechanical or electrical components, which fail to meet these standards shall be rejected, replaced and tested until they meet the manufacturer's standards.

3.16 WATER SUPPLY EQUIPMENT

A. Install all water piping, meeting, and backflow preventer as per details and in accordance with City of Cambridge Cross Connection and Water Department requirements in enclosure.

B. Threaded unions shall be used to disconnect backflow preventer and water meter.

C. Contractor shall be responsible for initial testing and certification of backflow preventer installation by the City of Cambridge.

3.17 ACCEPTANCE AND OPERATION BY OWNER

A. Upon completion of the work and acceptance by the Owner, the Contractor shall be responsible for the training of the Owner's Representative(s) in the operation of the system (provide minimum 7 days written notice in advance of test). The Contractor shall furnish, in addition to the Record Drawings and operational manuals copies of all available, specification sheets and catalog sheets to the Owner's personnel responsible for the operation of the irrigation system. The Contractor shall guarantee all parts and labor for a minimum period of one (1) year from date of acceptance.

3.18 CLEAN UP

A. Upon completion of all installation work, Contractor shall remove all leftover materials and equipment from the site in a safe and legal manner.

END OF SECTION

SECTION 23

FENCING

PART 1 GENERAL

1.01 SCOPE OF WORK

Where shown on the drawings or as required to complete the work of this contract, furnish and install fencing of the various types indicated below.

A. Furnish all labor, materials, equipment and incidentals necessary to install the various types of fencing and gates specified herein, where shown on the drawings and as required to complete the work of this contract.

1.02 RELATED WORK NOT INCLUDED

A. Earth excavation and backfill is included in Section 11.

B. Concrete is included in Section 29.

C. Removal of existing fencing is included in Section 10.

1.03 SUBMITTALS

A. Submit to the Engineer as provided in Section 5, shop drawings showing layout and details of construction and erection of the various types of fencing, gates, stair and ramp railings, backstops, hockey goals and accessories as required for this project.

B. Where shown on the drawings and as required to complete the work of this contract, submit samples to the Engineer of the following:

1. **Chain Link Fence Type A, B:** Samples of all posts, rails, fabric, ties, privacy slats, and all other accessories for chain link fencing and/or backstops. Manufacturer's data and certification of compliance with specified chain link fence material and P.V.C. coating by the thermal fusion process.

2. **Steel Fence:** Samples of all posts, rails, pickets, end caps, gate latch and all other accessories for steel picket fence.

3. **Steel Pipe Gate:** Samples of all steel pipe posts, rails, sleeves and all other accessories for steel pipe barrier gates.

4. **Cedar Fence Type A, B:**

5. **Granite Post and Wood Rail Fence:** Samples of granite, cedar rails, connecting hardware and stain product data and color samples.

6. **Granite and Brick Pillar for Use with Steel Fencing:** Shop drawings of granite cap and base, brick sample.

7. **Removeable Outfield Fence:** Samples of outfield fence materials.

8. **Steel handrails:**

1.04 DEFINITIONS

A. All references to "chain link fence" refers to a complete fence including post, rails, fabric, concrete footings, braces and all other required accessories.

B. All references to P.V.C. coated posts, rails, bracing, fabric and other fence accessories throughout this specification shall mean the thermal fusion process by Anchor Fence Company, or equal.

PART 2: PRODUCTS

2.01 TYPE A, B CHAINLINK FENCE

CHAINLINK FENCE AND BACKSTOPS

A. General

Where shown on the drawings or as required to complete the work of this contract furnish and install chain link fencing. Fencing and accessories shall conform to Federal Specifications RR-F-191 J/GEN and its associated detailed specifications noted below. Chain link fencing and accessories shall be manufactured by Anchor Fence, Inc. 6500 Eastern Avenue, Baltimore, MD 21224; Phone: (800) 638-4944, (617) 729-6010; by Security Fence Manufacturing and Supply Co. Inc. 4300 Baltimore, Maryland 20710, Phone: (301) 927-4080, Fax: (301) 927-0368, or approved equal. All chain link fence components shall be coated with polyvinyl chloride (P.V.C.). Color shall be black. P.V.C. shall be thermal fusion boned to metal components.

B. Fabric

The chain link fabric shall conform to Federal Specifications RR-F-191/1C. The chain link fabric shall be Type IV. The fabric shall be 9 gage (.148") inch or 6 gage (.192") inch core wire galvanized in conformance with ASTM A641, and woven after P.V.C coating in a 2", 1¾", 1¼ ", 1",5/8",1/2",3/8" inch square inch mesh opening as required.

Backstop fabric shall be 10' foot. high #6 gage core wire P.V.C. coated fabric on the bottom tier. The backstop canopy and upper 8' foot tier shall be #9 gage core wire P.V.C. coated fabric by 2" inch mesh fabric. The height of the fabric shall be as detailed. Top and bottom selvages shall be knuckled. Fabric shall be fastened to intermediate posts at approximately 12" inch intervals and to top, bottom and center rails at 12" inch intervals with 6 gage (.192") inch core wire ties with P.V.C. coating. The fabric shall be securely fastened to all terminal, corner gate posts and to all backstop framework with ¼"x3/4" inch stretcher bars with heavy No. 11 gage presses steel bands spaced approximately 12" inch apart and furnished with fasteners. All bands, wires and tension bars shall conform to Federal Specification RR-F-191/4C. The following minimum break-load for the fabric shall apply:

#9 gage core (.148" inch) - 1,200 lbs.
#6 gage core (.192" inch) - 1,800 lbs.

Fabric shall be installed on park side of posts and rail framework typically. Fabric shall be installed on ball court side of posts and rail framework typically.

C. Posts, Rails and Braces

Post, rails and braces shall conform to Federal Specifications RR-F-191/3C and be fabricated of Class I (round steel sections), Grade A (hot-dipped galvanized), seamless steel pipe, in accordance with ASTM A120 (Schedule 40) and P.V.C. coated by the thermal fusion process to match fabric, and be of the following sizes:

	Corner & Terminal Posts	Line Posts	Top, Bottom & Middle Rails
4' High Fence:	2.875" (5.79 lbs/ft) O.D.	2.375" (3.65 lbs/ft) O.D.	1.625" (2.27 lbs/ft) O.D.
6' High Fence:	2.875" (5.79 lbs/ft) O.D.	2.375" (3.65 lbs/ft) O.D.	1.625" (2.27 lbs/ft) O.D.
8' High Fence:	2.875" (5.79 lbs/ft) O.D.	2.375" (3.65 lbs/ft) O.D.	1.625" (2.27 lbs/ft) O.D.
10' High Fence:	4.00" (9.10 lbs/ft) O.D.	2.875" (5.79 lbs/ft) O.D.	1.625" (2.27 lbs/ft) O.D.
12' High Fence: at 6' & 3' ht.	6-5/8" O.D. Sch. 40	2.875" (5.79 lbs/ft) O.D.	1.625" (2.27 lbs/ft) O.D. middle rail
16' High Fence: middle rails at 8' & 4' ht.	6-5/8" O.D. Sch. 40	4.00" (9.11 lbs/ft) O.D.	1.625" (2.27 lbs/ft) O.D.
Backstop:	4.00" (9.11 lbs/ft) O.D.	4.00" (9.11 lbs/ft) O.D.	1.625" (2.27 lbs/ft) O.D.
Backstop canopy arms and framework:	2.00" (2.72 lbs/ft) O.D.		
Backstop nylon netting canopy extension: on the drawings.	6-5/8" O.D. Sch 40	Two (2) required for suspension of nylon netting canopy extension above home place, as shown	

All chain link fences and backstop shall be fitted with a bottom rail, unless otherwise indicated post spacing shall be 8'ft. or 6'ft. on center as shown on the drawings.

D. Gates

Where shown on the drawings and as required to complete the work of this contract furnish and install single and double leaf square frame swing gates, as manufactured by Anchor Fence, Inc., or equal, in openings as shown on the drawings, shall conform to the following specifications. Gate frames shall be constructed of 2" inch square galvanized members weighing 2.60 lbs./LF or 2" inch square aluminum members, alloy 6063-T6, weighing .94 lbs./LF. Galvanized or aluminum members shall be vinyl coated by the thermal fusion process having a coating thickness of 10-15 mils. All frames shall be welded to form a rigid panel. Internal bracing, when required shall be 1-¼" inch square. All gates regardless of height shall have a 2" inch square center rail. The fabric shall be attached to the frame on all four sides by means of hook bolts and tension rods. All gates shall be equipped with galvanized steel hinges and latch. Double gates shall be equipped with a drop bar and gate hold backs. (Movable fittings, such as hinges and latches shall be field coated with a vinyl coating specially prepared for this purpose. Drop bar and gate hold backs to be installed with concrete footing as recommended by the manufacturer.

Post for swing gates shall be as follows:

Gate Leaf Single Width	Gate Support & Gate Latch Post Sizes
less than 6'	4" (9.10lbs/ft) O.D. Sch.40
6'-12'	6-5/8" O.D. Sch.40

Each post shall be of sufficient length to allow for a depth of approximately 4' below ground level. Gate fabric shall be of the type, mesh, gage, color and selvage as that specified above for fabric.

E. Gate Hardware

Hinges, latches, steps and keepers shall be hot-dipped galvanized in accordance with ASTM A153, and be P.V.C. coated to match fabric. Hinges shall be pressed steel or malleable iron, sized to suit gate, non-lift-off type, and offset to permit 90 degree gate opening. Provide 1 pair of hinges for each leaf. Each hinge to be welded to gate support post, cleaned and field coated after installation with two coats minimum of an approved liquid P.V.C. patching compound. All gates shall be equipped closure latches positioned at the top of gate and out of reach of children. All gates shall open into recreation area unless directed otherwise by Project Engineer. Double leaf chain link gate shall be sized as indicated on the drawings. Gate stops to be installed as directed by Project Engineer to limit gate openings to 90 degree sweep.

F. Accessories

Accessories shall conform to Federal Specification RR-F-191/4C, shall be hot-dipped galvanized in accordance with ASTM A123 or A153 and shall be P.V.C. coated by the thermal fusion process to match fabric. In addition to ties and clips, brace bands, tension bands and bars, and truss rods (all of which are described herein before), accessories shall include the following:

1. Post caps shall be malleable iron suitable for use with specific posts. All caps to be tack welded to posts, cleaned and field coated with two coats minimum of an approved liquid P.V.C. patching compound.

2. Rail and brace end or other suitable means of connection.

3. Rail sleeves to allow for expansion and contraction of the rails.

4. Tension cables for backstop shall be 3/8" inch diameter galvanized 7 strand steel cable conforming to ASTM Designation A475, common grade. Accessories such as turn buckles, thimbles, hooks, eyes and other fasteners shall be compatible for the required use.

5. Nylon netting for use with backstops shall be supplied by Darjames Deniers Inc., Custom Net Fabrications, East Hill Road, Box 480 Jeffersonville, N.Y. 12748, Phone: 914.482-3876, or approved equal.

G. PVC Thermal Bonded Coating for Chain link Fences

Coating for chain link fabric shall be Class 2 b P.V.C. as defined by ASTM F668. Meet all requirements therein for thickness, physical properties, testing, and other applicable provisions for the coating. Fabric shall be P.V.C. coated with a 7 mil thick maximum coating by the thermal fusion process by Anchor Fence, Inc., or equal. Post, rails and appurtenances shall be P.V.C. coated 10 to 15 mils thick by the thermal fusion process. Bolts, nuts, gate latches, hinges and field welded post end caps, shall be cleaned as required and field coated after installation with two coats minimum of an approved liquid P.V.C. patching compound compatible with and of same quality as all other P.V.C. coatings. All 6 gauge steel core tie wires to be P.V.C. coated by the thermal fusion process.

H. Privacy Slats for Chain link Fences

Vinyl slats shall be P.D.S. privacy decorative slats manufactured by Pexco Company, 764 South Athol Road, P.O. Box 659 Athol, MA 01331; Phone: (800) 755-7528, (978) 249-5343; Fax: (978) 249-5727, or approved equal. Color: Black.

Privacy slat height and type, sized as required, to fit existing, or pre-woven into steel fabric. Where possible select pre woven industrial/commercial grade P.D.S. slats FIN 2000, or Industrial style. Vinyl slats shall have a ten (10) year warranty against fading and breakage from
normal use.

2.02 TYPE B CHAINLINK FENCE

A. Scope of Work

Labor, materials, and equipment required to furnish and install chain link fence and gates as indicated on the drawings or as specified herein. Acceptable manufacturers: U.S. Steel Corp., Anchor Fence Company, or approved equal.

B. Shop Drawings

Provide shop drawings.

C. Fabric

The base metal of the fabric shall be a good commercial quality of steel wire of the gauge specified. The gauge of the core wire not including PVC coating shall be not less than 11, 9, or 6 gauge as required. Chain link fabric shall be galvanized in accordance with ASTM A-392, woven in a 1", 1-1/4", 1-3/4" or 2" mesh. Standard 9 gauge fabric shall have min. breaking strength of1290 pounds. Both selvages shall be twisted and knuckled. To prevent easy removal and for other security reasons, fabric shall be attached to all line posts and horizontal rails with stainless steel "HI SECURITY" locks shot into place with the appropriate gun and power charge at intervals not exceeding 15" on posts and 24" on horizontal rails.

D. Pvc Thermal Bonded Coating for Chain link Fences

Coating for chain link fabric shall be Class 2 b P.V.C. as defined by ASTM F668. Meet all requirements therein for thickness, physical properties, testing, and other applicable provisions for the coating. Fabric shall be P.V.C. coated with a 7 mil thick maximum coating by the thermal fusion process by Anchor Fence, Inc., or equal. Post, rails and appurtenances shall be P.V.C. coated 10 to 15 mils thick by the thermal fusion process. Bolts, nuts, gate latches, hinges and field welded post end caps, shall be cleaned as required and field coated after installation with two coats minimum of an approved liquid P.V.C. patching compound compatible with and of same quality as all other P.V.C. coatings.

E. Materials

Unless otherwise indicated, fabric height shall be as shown on the drawings or as

specified herein.

F. Posts

Intermediate or line posts shall be 1-1/2" square tube steel weighing 2.49 lbs./lin ft. for fences 5'ft. high or less. Intermediate posts for fences 6'ft. or higher shall be 2"inch square tube steel 3.07 lbs./lin.ft. Terminal, end or corner posts shall be 2-1/2" square tube steel weighing at least 3.98 pounds per lineal foot and shall have moisture proof post caps with acorn type design. Posts for swing gates shall be in accordance with the following schedule: Leaf width up to 8'-0" shall be 2-1/2" inch square; 3.98 lbs./ft. Leaf width 8'-1" to 12'-0" shall be 3" inch square; 4.38 lbs./ft. Posts to be spaced 10'ft. maximum on center unless otherwise specified in the bid item herein; and/or as shown on the drawings.

G. Rails

Top rail shall be 1-1/2" square tube steel galvanized weighing 1.60 pounds per lineal foot. Top and bottom rail is required. Brace rails to be located at all terminal and gate posts and equipped with a 3/8" diameter truss rod and turnbuckle. Fences 8'ft. high or more shall have a continuous center brace rail.

H. Fittings

All fence and gate fittings shall be galvanized malleable cast iron or pressed steel. Fabric shall be secured to all terminal posts with 5/16" inch Hook bolts, specifically designed for that purpose.

I. Gates

Swing gates shall be fabricated from 2" inch square aluminum tubing with welded corners. Fabric shall be fastened to the frame on all four sides by means of "J" bolts and 5/16" tension rods as recommended by the manufacturer. All gate equipment shall include a gate stop; padlocking device (through frame, fulcrum latch). For fixed leaf of Pairs-shall include a plunger bar or cane bolt; a plunger bar catch in concrete base; a hold open stop in concrete base. The free leaf gate shall include a latch fork; a padlock.

J. Concrete Footings

Concrete footing for fencing shall be 12"diameter by 36" inch depth footing; hole diameter at top and bottom shall be same or slightly wider at bottom. Use 3500 PSI concrete at 28 days. Crown top of footing to shed water when top of footings exposed.

2.03 STEEL PIPE GATE

A. Where shown on the drawings and as required to complete the work of this contract, furnish in locations shown on the drawings steel pipe posts as required. Steel pipe posts, rails, sleeves and pipe sections for steel pipe gate shall conform to ASTM A120-54 requirements. Rail and post sections shall be Schedule 40 otherwise specified on the drawings. No used or open seam material will be permitted.

B. Standard cast steel caps, and fittings shall match steel pipe sizes and shall be suitable for welding to standard steel pipe.

C. Entire steel pipe gate assembly shall be hot dipped galvanized after fabrication in accordance with ASTM 123. and ASTM A153. Clean, prime and paint pipe gate black (2 coats), as specified in Section 24. After thoroughly dry apply reflective sheeting to steel pipe gates as shown on the drawings.

D. Contractor shall furnish locks, keyed alike for all steel pipe gates. Locks shall be Master Lock, or equal, approved by the Engineer. Provide a total of six keys per lock to the Owners.

Provide gate stops as detailed and at the locations shown on the drawings.

2.04 STEEL FENCE TYPE A

Where shown on the drawings and as required to complete the work of this contract.

A. Steel picket gate and fencing 42" inches in height as manufactured by Sweeney Fence Company, 233 Bedford Street, Whitman, MA 02382; Phone: (800) 427-3385, Fax: (617) 447-4388, or approved equal.

B. Top rail shall be a 2"x½" inch flat bar stock. Intermediate and bottom rails shall be 2" x ½" steel channel. Bottom rail to rest 3"inches above finished grade. Intermediate rail to be punched to accept insertion of pickets.

C. Intermediate pickets to be 5/8"x 5/8" inches solid square with pickets welded to underside of top rail and top of bottom rail, as shown on drawings. All welds are to be full, continuous and then ground smooth. Pickets shall be spaced 4-1/8" inches on center. The maximum allowable space between the interior surface of intermediate pickets and between posts and adjacent pickets shall be 3 ½" inches.

D. Post caps for 2"square line posts shall be either flat steel 2-1/2"square x ¾" thick welded to top of post or cast iron pyramidal end caps, as required. Post caps for 3" square terminal and gate posts shall be flat steel 3"square x 3/4"thick welded to top of post or cast iron pyramidal end caps, as required.

E. Fence posts to be 2"x2"x¼" inch square steel tube, with ¼" inch .250 wall thickness (7.10 lbs. per foot). Posts to be spaced and positioned (6') six foot or (8') eight foot on center and as indicated on the contract drawings to achieve the desired curved and straight layout. Gate and end posts shall be 3"x3"x¼" inch wall thickness. Posts to be imbedded 12" inches into a 12" inch diameter sono tube formed concrete footing as shown on the drawings. All four (4) vertical edges of posts have a (1/4") one-quarter inch radius typically.

F. Sections of fencing shall be welded to posts at top and bottom rails. Touch up all welds with matching exterior black.

G. Curved sections of ornamental steel fence to be constructed as stated above. The height of curved sections to vary as detailed between 48" inches and 66" inches. The radius of curved fence sections as shown on the drawings. Curved sections of fence to connect to granite or granite and brick pillars with stainless steel fasteners (3 per pillar required) approved by the Engineer.

H. Gates to be constructed similarly as described above. In addition the vertical sides and bottom of each gate section shall be 2"x½" inch flat bar stock. Gate posts shall be 3"x3"x¼" inch square steel tube. Each gate section to attach to gate support post by means of (2) two heavy-duty gate hinges. Gates shall open inward (into children's play area). Gate latch shall consist of a simple heavy-duty swivel "U" type latch located just below the intermediate rail on gate section. Double gates to be equipped with locking drop bar assembly with ground sleeve set into concrete. Stop bars shall be provided as detailed. Submit shop drawing of gates for approval prior to fabrication.

I. Any touch up painting in the field required shall be cleaned and painted as specified in Section 24.

2.05 STEEL FENCE TYPE B

A. Provide all Custom Site Amenities required for Fencing, item work as shown on the Drawings and specified herein.

B. Work under this Section shall include, but is not limited to the following:

1. 100 Linear feet Custom Fencing with (1)- 4'ft. wide single gate, (1) 8'ft. wide double gate, and (1) 12'ft. wide double gate.

Shall be manufactured by: AZA 1556 West Main Street, Riverhead, NY 11901 631.325.1484 conforming to the drawings and specifications of: PlayArtDesign PO Box 733 Speonk,. NY 11972 631.513.0769 btplayartdesign@gmail.com

OR

An equivalent fence, and gates, as specified herein, shall be manufactured by: Custom Fabricaton, Inc. Harpursville, N.Y. Phone: (607) 693-3223, Fax: (607) 693-3226, www.CustomFabricationInc.com

OR

An equivalent fence, and gates, as specified herein, shall be manufactured by: The Steel Yard, Inc. 27 Sims Avenue, Providence RI 02909; Phone: (401) 273 7101, Fax: (401) 273 7105, www.thesteelyard.org Contact Person: Howie Sneider.

C. Shop Drawings: Submit shop drawings for approval by Owner's Representative before any work is begun. Contractor shall call attention, in writing, on the shop drawings, to any deviation from the specifications. Contractor shall provide the Owner with a copy of all Approved Drawings. Prior to fabrication, the Contractor shall return to the Manufacturer a set of approved shop drawings and specifications. Contractor shall provide to Owner a Certificate of Installation certifying that the items under Work have been properly installed as per manufacturer's instructions certified by supplier of equipment.

D. Quality Assurance: The fencing specified herein and indicated on the drawings shall be manufactured by a firm who can furnish supporting evidence of experience to perform this work and who has regularly been engaged in Site Amenities manufacture on a full-time basis. Qualifications of the installer shall be subject to the review of the Project Engineer. The manufacturer of fencing shall maintain and have in effect at the time of completed installation an insurance policy covering completed operations (Product Liability) with a minimum limit of $1,000,000.00 (One Million Dollars) for each occurrence. A representative of the manufacturer shall be available for consultation during the installation of the equipment.It is the responsibility of the manufacturer to indicate on the shop drawings in writing any and all variations from the following specifications, standards, and codes which shall hereby form a part of this specification

1. Latest edition of the Handbook for Public Playground Safety of the US Consumer Product Safety Commission.

2. Military Specifications for Thermal Galvanizing: latest edition SSPC-SP-5, SSPC-SP-10 Structural Steel Painting Council DOD-Std 2138 (SH) Department of Defense ASTM-D-4417

3. Standards for Welding: American Welding Society (AWS), latest edition.

4. Standards for Structural Steel: American Steel Institute, latest edition.

5. American Society for Testing Materials, latest edition, Standards A-120, VA 569, and A-500 and F 1292 and F 1487.

6. Standard Steel Composition.

7. Society of American Engineers.

E. Finishes: All shall be finished as described herein or as per specification:

1. Welding: Welding shall be in complete accordance with the standards of the American Welding Society. All welds shall be ground smooth. No field welding shall be permitted.

2. Galvanizing: All welded steel components shall be fully assembled prior to galvanizing. After fabrication, all steel shall be shot blasted to a white metal finish. The cleaned surface shall have an angular surface profile of 2.0 to 4.0 mils. After shot blasting, all steel shall be galvanized by the Zinc Rich Powder Process. The Zinc Rich Powder coating is to be applied to a thickness of 2 mils & cured at 392° F for 2 minutes minimum. The coating shall be firmly adhered in and free of spots, lumps or blisters.

3. Powder Coating: The Powder Coating shall be applied to the Zinc Rich prepared surface in such a manner that the coating will not peel off. The coating shall be TGIC-Polyester Powder applied to the Zinc coated steel via the Powder Coating Process. The Powder Coating shall be applied at a film thickness of 4 to 6 mils. The Powder Coating shall conform to the following ASTM Designations: Adhesion D 3359-B Pencil Hardness (H-2H) D 3363 Flexibility D 522 (Mod)Impact Resistance D 2794 (Mod) Abrasion Resistance D 4060 (Mod) Salt Spray Resistance B 117Humidity Resistance D 2247

F. Materials:

1. Posts: Posts shall be fabricated from 11 Ga. X 3" Square Steel Box Tube. Steel shall conform to ASTM Designation A 500, Grade B. Post Caps shall be 4" Dia. Steel Spheres and shall be welded to the applicable Posts. Posts shall be cut to the length required for proper installation.

2. Framing: Panel Framing: Shall be ½" x 3" Steel Flat Bar. Steel shall conform to ASTM Designation A 500, Grade B.

3. Pickets: Shall be 5/8" x 5/8" Steel Rod, Straight or Wavy.

4. Hardware: All bolts, Nuts, Washers, Hinges, Latches, Cane Bolts shall be 18-8, 304, or 316 Stainless Steel.

2.06 STEEL FENCE TYPE C

Furnish and install the required quantities of TYPE C 4'ft. high, 6'ft. high, 8'ft. high, 10'ft. high, also 8'ft. high double steel mesh panel "Eco" steel mesh fencing, and single or double door gates, as detailed, and as shown on the plan.

A. Steel mesh fencing as per manufactured by Metaltech Omega Fence Company, 1735 St.-Elzear West Lavai, QC H7L 3N6 Canada, Phone: (450) 681-6440; Fax: (450) 681-7905; Contact Person: Pati Roccoprocco66@verizon.net, or approved equal.

B. Rails

4'ft. high steel mesh fence to have 1" square tubing welded to top and bottom of panel typically.

C. Panels

Welded double wire panels shall be 200mm x 50mm mesh with factory applied powder coated finish. Color: black.

D. Posts

Posts shall be 3"x3" 11 gauge steel square tube with plain flat aluminum post cap, typically.

E. Connecting brackets, plates, carriage bolts, nuts, washers, gate hinges, latch, drop bar mechanism, and all other appurtenances shall be Metaltech Omega quality, or equal.

F. Gates

To be constructed similarly as described above, with 1.5"(38mm) 16 gauge square galv. steel tube top and bottom framework, and 2" (50mm) side framework, welded typically. Each gate section to attach to gate support post by means of (2) two heavy-duty standard or spring gate hinges as required. Gates shall open inward (into children's play area). Double gates to be equipped with locking drop bar assembly with ground sleeve set into concrete. Stop bars shall be provided as detailed. Submit shop drawing of gates for approval prior to fabrication.

G. Any touch up painting in the field required shall be cleaned and painted as specified in Section 24.

2.06 STEEL HAND RAIL

A. Where shown on the drawings or as required to complete the work of this contract furnish and install stair or ramp railings. Railings shall be manufactured by Sweezey Fence Company, 233 Bedford Street, Whitman, MA 02382; Phone: (800) 427-3385, Fax: (617) 447-4388, or approved equal.

B. Posts shall be 1-½" inch diameter sch. 40 steel pipe, and 5/8" diameter solid round steel bar, as detailed. Rails shall be 1-1/2" inch sch. 40 steel pipe, as detailed. Radius end pieces, for 1-1/2" rails shall also be formed using 1-1/2"inch diameter sch. 40 steel pipe, as detailed.Posts to be set in 12"inch diameter x 3'-6"inch depth concrete footings.

C. Prime and paint hand rails with an approved exterior black in conformance with Section
24 Site Improvements, herein. Field verify all steel railing dimensions prior to fabrication. Submit shop drawings to Project Engineer for approval.

2.07 STEEL FENCE PAINTING

A. All new ornamental steel picket fence shall receive surface cleaning, galvanizing and surface smoothing after galvanizing. Under the requirements of this specification, all cleaning, galvanizing and color finishing work required, shall be performed by the galvanizing Contractor within his own plant and as follows:

1. Following fabrication of metal fencing, steel shall be thoroughly cleaned of all dirt, oil, residue or foreign substance and than hot dip galvanized in complete compliance with ASTM A123, A153, and/or A386.without irregularities. Following galvanizing, each steel item shall receive surface grinding to remove lumps, sags or spikes resultant from the galvanizing process. The finished surface following grinding shall be hand smooth and without irregularities. Take care not to

damage the galvanized surface coating.

2. Color finishing work - Following galvanizing and additional surface smoothing, each steel item shall be color finished as required and as described below. All painting materials shall be equal to those manufactured by the Tnemac Company, Inc., Cook Paint and Varnish Company, Valspar Company, Koppers, or the Carboline Tnemac products (unless otherwise noted) and Tnemac recommendations for application. No brand other than those named will be considered for approval unless the bran and type of paint proposed for each item in the following schedule together with sufficient data substantiated by certified tests conducted at no expense to the Owner, to submitted to the Engineer in writing for approval within 30 days after the signing of the Agreement. The type and number of tests performed shall be subject to the Engineer's approval.

3. Prior to applying coating, all hot dip galvanized material shall be thoroughly cleaned in accordance with the Steel Structures Painting Council Standard, SSPC SP-1.

4. All coating of hot dip galvanized material shall be carried out by the galvanizer in his own plant within 30 minutes of 60 degrees Fahrenheit for the primer coat and 60 degrees Fahrenheit for the catalyzed aliphatic urethane top coat. At no time should any material be applied without checking the relative humidity and dew point in accordance with the coating manufacturer's instruction. The primer shall be applied by airless or conventional spray to a thickness of 3.0 mils, minimum, DFT. The primer shall be applied in one or two coats as is necessary to achieve the required thickness. The top coat material shall be applied to a thickness of 1.5 or 2.5 mils, DFT. The top coat shall be factory applied by airless or conventional spray.

5. The primer coat shall be a two component polyamide epoxy primer applied over a clean dry hot-dip galvanized steel, by the galvanizer, at his own facility, within 12 hours of galvanizing. The primer shall be applied under the following conditions:

Minimum Temperatures -	Air 60 degrees Fahrenheit
	Steel 60 degrees Fahrenheit
	Coating Material 60 degrees Fahrenheit
	Humidity 70 degrees Fahrenheit maximum
	Dew Point Not within 50 degrees Fahrenheit

To facilitate curing of the primed materials, it shall be dried in a force-cure booth capable of reaching a temperature of 150 degrees Fahrenheit. The primer coat shall have color of light blue.

6. The top coat to be used shall be a specifically formulated two component catalyzed aliphatic urethane. The top coat shall be factory applied by airless or conventional spray, in a single coating, with a thickness of 1.5 to 2.5 miles, DFT. The top coat shall be applied over clean dry primed steel by the galvanizer, under

the following conditions:

Minimum Temperatures -	Air 60 degrees Fahrenheit Steel 60 degrees Fahrenheit Coating Material 60 degrees Fahrenheit Humidity 70 degrees Fahrenheit maximum Dew Point not within 50 degrees

To facilitate curing of the top coat, it shall be dried in a force-cure drying booth capable of reaching a temperature of 150 degrees Fahrenheit. The top coat shall be black in color.

7. The final coating shall be tested for proper wet film thickness during application by using an appropriate wet film thickness gage (Nordsen or approved equal). Upon curing of the top coat the final mil thickness shall be determined on random areas utilizing a visual testing device similar to the Tooke Gage. Magnetic "pull-off" types of gages will not be permitted. Adhesion shall be tested on random samples in conformance with Federal Specifications TT-C-490B Paragraph 4.2.8. The galvanizer shall supply a notarized Certificate of Compliance to the Engineer through the Contractor and maintain a file of pertinent tests regarding this material.

8. Galvanizer shall handle, pack, and ship, in such a manner as to minimize damage to the finish. Upon arrival at job site, it is the Contractor's responsibility to take equal precautions. Since some surface damage is inevitable, suitable touch-up material shall be readily available from the galvanizer for the Contractor's use.

9. Upon acceptance of construction and installation of each unit of fencing, the galvanizer shall supply to the Project Engineer the equivalent of one-half pint of touch-up material for each unit installed.

10. The galvanizer shall supply a warranty for each item of galvanized and top coat metal fencing which states that the galvanizing and top coat will protect the steel against 10% or more visible rust for a period of twenty (20 years).

11. Ornamental steel picket fencing to attach to granite or brick and granite pillars with stainless steel fasteners (3 per pillar) as shown on the contract drawings and as approved by the Project Engineer.

2.08 GRANITE AND BRICK PILLAR FOR USE WITH STEEL FENCING

Furnish in the locations shown on the drawings and as required to complete the work of this contract entrance columns.

A. Pyramidal shaped cap stone shall be twenty-four (24") inch square by twelve (12")

inch high stone.

B. Base stone for pillar shall be twenty-four (24") inch square by twelve (12") inch. Base stone to be placed on a forty-two (42") inch diameter by three foot six inch (3'-6") deep concrete footing formed using sono tube.

C. All exposed granite surfaces shall be saw cut with thermal finish. Bottom of cap and base stone to be sawn. All exposed edges to be eased one-quarter (1/4") inch.

D. The bottom of cap and base stone to be predrilled to accept stainless steel support rods. Rods to be five-eighths (5/8") inch diameter by twelve (12") inches long set into one (1") inch diameter by six (6") inch deep hole in granite. Rods to be set into a six (6") inch deep hole in concrete core of pillar supporting cap stone and into concrete footing below base stone.

E. Brick pillars to be twenty (20") inch square columns with a solid concrete core, as shown on the contract drawings. Brick pavers to be "City Hall Pavers" manufactured by Stiles and Hart, Inc., Bridgewater, MA, or approved equal. Pavers for pillars to be hand selected at source by the Engineer. Brick color shall have a color range of medium red to dark red, mixed with dark purple. No orange colored bricks, or bricks which are uniform in size and shape shall be allowed. All joints to be fully mortared using a dark mortar.

F. Submit shop drawings and mortar samples to Project Engineer for approval.

2.09 GRANITE POST AND WOOD FENCE

A. Where shown on the drawings or as required to complete the work of this contract furnish and install post and rail fencing.

B. Granite Post

Woodbury or Kitledge gray. Shall be engineering grade structural granite conforming to ASTM CGIS requirements. Posts shall be dark gray in color free from seams and other structural imperfections or flaws that would impair its structural integrity and of smooth splitting appearance. Natural color characteristics of the deposit are acceptable. Granite posts shall be ten inches 10" square and 56" + or - 1", all four sides and top rock pitched with maximum projections of –½", +1½" inch. 38" inches shall be above grade. Opposite faces of granite posts shall be approximately parallel and adjoining faces shall be approximately at right angles. Posts typically spaced 10' foot on center or closer as shown on drawings. Bottom of posts shall be sawn.

C. Wood Rails

Shall be clear northern cedar best grade free of knots, checking or other

imperfections. Post and rail fence shall have two (2) horizontal rails. Top and bottom rail shall be 4"x4" inch cedar rails set on edge and stained with two (2) coats of Cabots #1844 driftwood gray solid acrylic deck stain (or equal) solid stain for exterior applications, approved by the Project Engineer. All lengthwise edges of wood rails shall be eased. Rails shall be bolted to steel hangers with two (2) one-quarter (¼") inch x one and one half inch (1 ½") inch square headed lag bolts, approved by the Project Engineer.

D. Hardware

Hardware shall be fabricated from steel conforming to ASTM A 307 requirements and galvanized according to ASTM A153 requirements. Steel rail hangers shall be supplied by Fletcher Granite Co., Inc. 275 Groton Road, North Chelmsford, MA 01863: Phone: (978) 251-4031, Fax: (978) 251-8773, or approved equal. Posts to be field drilled for attachment of hangers. Hangers shall consist of a 3"x3"x1½" inch angle 3/16" inch thick with a 1/8" inch thick backing plate welded to angle and (2) two three eighths (3/8") predrilled holes for attachment to granite. Color of hangers shall be black. Hanger anchors to be 3/8" x 1 7/8" inch Hex Sleeve Anchor, approved by Engineer. Drill bit for granite post shall be 3/8" inch with a minimum embedment of 1 ½" inch.

E. Crushed Stone

Shall be twelve (12") inches of ¾" inch compacted crushed stone and six (6") inches of crushed stone around granite post on all four sides.

2.10 REMOVEABLE OUTFIELD FENCING

A. Scope

Includes all labor, materials, equipment, and incidental items necessary to complete the following: Provide and install seasonal outfield fence and post sleeves for use in locations as shown on the plans.

B. Submittals

Submit product data for fence mesh, posts and ground sleeves

C. Materials

Seasonal Outfield Fence shall be Flexible Safety Fencing System with Hi-Impact Posts, Magnetic Locking Ground Sleeve, and Tuff-Net Mesh as manufactured by Carsonite International of Early Branch, SC or approved equal. Posts shall have built in padding with high impact resilience. Post shall lock into ground sleeves with magnetic locking device to

reduce vandalism and unwanted tampering. Netting shall be 4' tall, vandal resistant, knitted polypropylene with banded top and bottom. Wind block shall be 35%. Color to be determined by the Project Engineer. Ground sleeves shall be fitted with caps for off-season protection.

D. Construction Methods

Install fence and ground sleeves per manufacturer's instructions.

2.11 STEEL AND WOOD FENCE

Where shown on the drawings or as required to complete the work of this contract furnish and install 58" high practice "T" fence, as detailed.

A. Posts

Shall be 6" x 6" (5-1/2" x 5-1/2"nominal)white cedar posts with angled cut tops. Pre drill through and partial holes to accept top, middle and bottom steel rails, and saw cut groove to accept and stabilize welded wire mesh. Copper flashing end caps to be fitted to angled post tops and secured.

B. Rails

Shall be 1-5/8" schedule 40 black "permafused" coated steel pipe, as specified herein under Type A chain link fencing.

C. Fabric

48"inch high, 1" x 1"inch square welded wire, galvanized, black PVC coated mesh, 14 gauge, shall be manufactured by Mc Nichols, Company, 33 High Street, Billerica, MA 01862, or approved equal. Mesh shall be attached to rails by #9 gauge steel core blk. PVC coated ties, spaced 12" O.C.

D. Cedar posts

Shall be set into 24" inch diameter hole on a 6" bed of stone, and backfilled with gravel. No concrete or common fill is to be used.

2.12 **CEDAR FENCE TYPE A**

A. Where shown on the drawings or as required to complete the work of this contract furnish and install 6'ft. high, or 8'ft. high Shadowbox style board northern cedar fence, with, manufactured by Walpole Fence Woodworkers, Inc. 168 Lowell Street Wilmington, MA 01887 Phone: 978.658.3373; Fax: 978.658.0975; HYPERLINK "mailto:russ.colligan@walpolewood.net" russ.colligan@walpolewood.net, or

approved equal.

B. The posts

Shall be 5"x 5" square cedar with dado for 2" O.D. galvanized steel pipe inserts and cover boards typically, for mounting of fencing to existing concrete retaining walls. No post caps.

D. Finish

Cedar fence shall be stained by Walpole Fence Woodworkers, using the total immersion process to ensure complete coverage and a quality, long lasting exterior fence finish. Fencing stain shall be Sherwin Williams acrylic latex solid stain, or approved equal.

E. Matching gates

No gates.

F. Footings

Concrete footings, as required shall be 3500 psi, in 28 days, 12" inch diameter x 48" inches, typically.

G. Wall Mounting

2" O.D. galvanized steel pipe inserts shall be core drilled into existing concrete retaining walls, and then cemented into place using "por-rock", or equal. 5"x5" square cedar posts bolted to pipes with galv. hardware typically. Posts spacing shall be 6'ft. O.C. typically.

2.13 CEDAR FENCE TYPE B

A. **Where shown on the drawings or as required to complete the work of this contract furnish and install 4-1/2ft. high modified "Universal" style board, fence with 18" inch "Yorkshire" Topper, northern cedar fence, manufactured by Walpole Outdoors, Inc. 767East Street Walpole, MA 02081 Phone: 978.658.3373; Fax: 978.658.0975; HYPERLINK "mailto:russ.colligan@walpolewood.net" russ.colligan@walpolewood.net, www.walpolewoodworkers.com, or approved equal.**

B. The posts
Shall be 5-1/2"x 5-1/2" square cedar on Walpole lifeguard post bases. Spacing shall be 8'ft. or 6'ft. on center as required. Post caps shall be Westport.

C. The boards
Shall be 1" x 6" shiplap grooved boards.

D. The topper pickets shall be 1-5/8" x 1-5/8" cedar.

D. The Gates
Shall be matching 4'ft.wide straight top single swing gate in cedar with black 16" inch Devonshire latch strap hinge and ring latch.
Shall be matching 8'ft. wide double swing gate in cedar with black Devonshire hardware and ring latch.

E. Wood Materials
Shall be fabricated from carefully graded Select STK Northern White Cedar.

F. Finish
Cedar fence shall be stained by Walpole Fence Woodworkers. Fencing stain shall be a two coat spray process using Sherwin Williams acrylic latex solid stain, or approved equal. Color: to be determined.

G. Gate arbors
Shall be spindle top arched cellular (PVC) arbor 4'wide opening to fit gate. Arbor with lattice side panels. Lattice openings to be determined.

H. Footings
Concrete footings, as required shall be 4000 psi, in 28 days, 12" inch diameter x 48" inches, typically at corner posts. Line posts shall be set with compacted gravel.

PART 3: EXECUTION

3.01 CHAIN LINK FENCE AND GATES

A. Layout all required chainlink fencing in the field as shown on the drawings and obtain the Project Engineer's approval prior to installation.

B. Set all posts to depth on the drawings. After setting and plumbing posts, fill holes with 3,000 psi concrete as specified in Section 29. Pour footings against undisturbed subsoil and onto compacted bottom of void. Allow footing to cure sufficiently before assembly of fencing or backstop. Crown top surface of concrete to shed water. Brace all terminal and corner posts horizontally with sections used for rails. The rails shall extend through all like posts to firm a continuous brace from end to end of each stretch of fence, be securely fastened at the end of each run, and have joints made with expansion sleeve couplings not less

than 6" inch long. Backfill and compact in no greater then 8" inch layers around foundations.

C. All PVC coated surfaces which are damaged shall be repaired as approved using the PVC patching compound specified above. Remove damaged material back to sound coating. Clean substrate as approved. Touch up with three coats of patching compound in accordance with manufacturer's instructions.

D. A continuous bituminous concrete mowing strip on a 6" inch gravel base is required. Mow strip shall extend 6" inches on one or both side of fence.

3.02 CHAINLINK BACKSTOP

A. All framework, rails, posts shall be joined as shown on the drawings. Rails at front of canopy shall be fastened to the framework with fittings and ornamental post caps. At end and corner posts install 3/4" inch by 1/4" inch tension bars and bands. AT all end, corner and line posts install 1/4" inch lugs welded to the pipe frame. These steel lugs shall be attached to receive collar ends bolted onto braces, struts and rails and shall be bolted to framework. All bolt ends shall be peened or prick-punched after tightening.

B. Canopy frame shall be strongly welded at all joints. Struts shall be welded to post and hood frame. After welding repair P.V.C. coating as specified above.

C. Backstop shall be properly stayed horizontally, as shown on the detail with 3/8" inch galvanized steel wire tension cables, complete with necessary turnbuckles, hooks, eyes, bolts, etc. Cables to be fastened around iron thimbles and wire rope clamp.

3.03 STEEL PIPE GATE

A. Posts shall be set plumb. Where multiple posts are involved, a line and grade shall be established and approved by the Construction Supervisor before installation. Posts shall be of sufficient length to achieve the height above grade and setting depths as shown on the drawings.

B. All joints shall be continuously welded and ground smooth before galvanizing. Cap all ends. Fabricate gates to detail. Where field welding is required clean affected surfaces and Field coat with two (2) coats of minimum of black paint as specified herein.

3.04 STEEL FENCING

A. Layout fencing and gates in the field as shown on the drawings and obtain the Project Engineer's approval prior to installation.

B. Pour all concrete footings to depth shown on the drawings. Set all posts into concrete a minimum of 12" inches. Tops of footings to be a minimum of three (3") inches below ground. Concrete footings shall be 4000 psi as specified in Section 29. Crown top surface of concrete to shed water all around 1" inch. Concrete footings and depth to dimension s shown on the drawings.

C. All sections of fencing shall either be bolted to posts or field welded as detailed and as directed by the Project Engineer. Submit attaching carriage bolts, lock washer and nuts to Project Engineer for approval prior to installation.

D. Gate shall open into play area, as directed by the Project Engineer.

3.05 GRANITE AND BRICK PILLAR FOR USE WITH STEEL FENCE

A. Furnish and install brick pillars at the locations shown on the contract drawings and as detailed.

B. Furnish and install forty-two (42") inch diameter concrete footing, using four thousand (3,500) pounds per square inch concrete, three foot-six inch deep. Use sono tube to form footings. Set PVC pipe into wet concrete to receive stainless steel rods.

C. Align and position granite base stone on top of concrete footing. Granite base to be set on a one (1") inch mortar setting bed. Top of base shall be twelve (12") inches above finish grade. Furnish an approved cement grout to set stainless steel rods.

D. Construct eighteen (20") inches by eighteen (20") inches square brick pillar on base using fully mortared joints. Mortar color shall be approved by Project Engineer. Approved steel reinforcement anchors to be placed between brick sources to assure permanent attachment of wall brick to concrete core.

E. Pour cast in place three thousand five hundred (3,500) pounds per square inch concrete core using wall brick enclosure as form. Concrete shall be poured in stages. Concrete to be reinforced with six #5 equally spaced steel rods with #4 hoops spaced at 12" inch intervals as shown on detail. Set PVC sleeved into top of wet concrete to receive granite cap stone stainless steel rods.

F. Align and position granite cap stone on top of pillar on a one (1") inch mortar setting bed. Fill in PVC sleeves with an approved cement grout.

G. Protect and clean all concrete and mortar work as specified herein under Section 29.

H. Steel picket fence to attach to pillars as specified herein.

3.06 GRANITE POST AND WOOD RAIL FENCES

A. Layout all required granite post and double wood rail fencing in the field as shown on the drawings and obtain the Project Engineer's approval prior to installation.

B. Locate and install all posts plumb and true to line and grade as shown on the drawings. Granite posts shall be set 18" inches below grade on twelve (12") inch depth compacted crushed stone base. Crushed stone shall surround post on all sides as detailed.

C. Wood rails to be securely fastened to granite posts with steel hangers. Rails to be positioned with respect to posts as detailed (center of top rail 8" inches from top of post and center of bottom rail 18" inches from center of top rail and 12" inches off finished grade). Field drill 3/8" inch diameter holes to receive hangers. All hangers and hardware shall be painted black in conformance with Section 24.

D. Wood rails shall be set on edge and true to line and grade as shown on the drawings. All members to be accurately cut and fit to the complete satisfaction of the Project Engineer. No wood rails which are warped, checked, or damaged in any manner shall be acceptable. Brush apply two (2) coats of Cabot #1844 driftwood gray solid acrylic deck stain (or equal) solid stain for exterior applications, approved by Engineer. Provide product data and color samples for approval by Engineer.

*END OF SECTION *

SECTION 24

SITE IMPROVEMENTS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, equipment, implements and materials required to furnish, install, construct and perform all site improvements work complete as shown on the drawings and as specified herein.

B. **Where shown on the drawings or as required to complete the work of this Contract, furnish and install the following site furniture.**

1. Home plate and pitcher's plate
2. Play equipment (Type A, B, C, D, E, F, G)
3. Rubber safety surfacing
4. Wood safety surface
5. Foul pole
6. Bleachers
8. Player's bench
9. Park bench with back (Type A, B, C, D, E, F)
10. Bicycle rack
11. Tennis post/net
12. Drinking fountains (Type A, B)
13. Bollards (Type A, B, C)
14. Painting
15. Trash/Recycling receptacle
16. Water Play Equipment (Type A, B)
17. PVC Under drain
18. Flag pole
19. Soccer goal

20. Play Curbing (Type A, B, C)

21. Basketball Backstop and Rim

22. Table with Chairs/ Seating (Type A, B, C, D, E)

23. Loose Play Materials and Sports Equipment

24. Geo textile Fabric

25. Public Art

26. Raised Garden Planters (Type A, B,C)

27. Community Garden Hydrant

28. 4'x7'Storage Shed

29. 8'x10' and 10'x12' Storage Sheds

30. Custom Little Lending Library

31. Recycled Plastic Outdoor Message Board (Weather tight)

1.02 RELATED WORK NOT INCLUDED

A. Earthwork is included in Section 11.

B. Bituminous paving, markings, granite curb are included in Section 14.

C. Water service connections are included in Section 21.

D. Fencing and backstops are included in Section 23.

E. Landscaping is included in Section 25.

F. Loaming and sodding is included in Section 27.

G. Concrete is included in Section 29.

H. Specialty paving is included in Section 15.

I. Submittals are included in Section 5.

1.03 SUBMITTALS

A. Prior to furnishing and installing the materials required by this Section, the contractor shall submit to the Project Engineer for approval the following:

1. Certified shop and fabrication drawings showing all important details of construction and dimensions showing the arrangement of the equipment specified herein.

2. Descriptive literature, bulletins, and/or catalogs of the equipment. Such information shall include painting schedules where applicable.

3. A complete and total bill of materials for all equipment.

4. Warranty certificates as required by these specifications.

5. List of recommended spare parts for play equipment subject to wear and frequent replacement.

6. In the event that it is impossible to conform to certain details of this specification due to the different manufacturing techniques, describe completely all non-conforming aspects.

7. Samples: The following samples shall be submitted where required as part of this Contract.

   a. Samples of any colored rubber safety surfacing.

   b. Sample of all colored side panels, slides, tunnels or other polyethylene components to be used within play structures.

   c. Samples of all play structure decking and connecting hardware, brackets, bolts, steel chain, etc.

   d. Wood resilient safety surfacing material.

8. In addition submit copy of manufacturer's product liability insurance for all manufacturer's of play equipment and warranty on the expected life of construction materials used in the manufacture of play equipment.

9. Submit guarantee from manufacturer stating that all proposed play equipment conforms in all respects to the ASTM Standard Designation F1487-95; to United States Consumer Product Safety Commission (CPSC) Guidelines from their 1991 Public Playground Handbook for Safety; and to the Americans with Disabilities Act (ADA) of 1990, and to the proposed Accessibility Guidelines for Recreational Facilities and Outdoor Developed Areas by the Recreation access Advisory Committee, United States Architectural and Transportation Barriers Compliance Board, July 1994, or most recent editions.

10. Submit confirmation from manufacturer(s) of all installed play equipment stating that this equipment has been installed in accordance with all manufacturers recommendations. Any and all problems noted by manufacturer shall be corrected by contractor prior to acceptance of play equipment by City.

1.04 CLEAN UP

A. Upon completion of work under this section, all excess materials and debris resulting from work under this section which have not previously been cleaned up shall be cleaned up and removed from the site.

PART 2 PRODUCTS

2.01 BALLFIELD HOME PLATES AND PITCHER'S PLATES

A. Where shown on the drawings or as required to complete the work of this Contract, furnish and install home/pitcher plates. Home plate shall be Model No. HXB-74 and Pitcher's plate shall be Model No. PM-72 as manufactured by the Jayfro Corporation, P.O. Box 400, Waterford, CT 06385, or equal.

B. Spikes shall be replaced with threaded galvanized steel rods, 18" inches long, to fit home plate and pitcher's plate. Each rod shall have two galvanized steel nuts and washers.

C. Wood for anchoring the plates shall be 2" inch x 4" inch x 2' feet 0" inch long pressure- preservative treated Southern Yellow Pine.

2.02 PLAY EQUIPMENT **TYPE (A, B, C, D, E, F, G)**

A. **TYPE A** PLAY EQUIPMENT

Where shown on the drawings or as required to complete the work of this Contract, furnish and install at the children's play areas the following equipment manufactured by **Kompan/Big Toys, Inc.**, 717 New Market Street, Olympia, WA 98501; (800) 426-9788;Fax (888)943-6254; Contact: Mr. Jim LeBrun, jimleb@kompan.com

Quantity: Description:

B. **TYPE B** PLAY EQUIPMENT

Where shown on the drawings or as required to complete the work of this Contract, furnish and install the following equipment manufactured equipment by **Landscape Structures, Inc.,** 601 7th Street South, Delano, MN 55328**;** supplied by M.E. O'Brien and Sons, Inc., 93 West Street, Medfield, MA 02052; Phone: (508) 359-4200; Contact: John Taylor; Fax: (508) 359-2817.

Quantity: Description:

C. **TYPE C PLAY EQUIPMENT**

Where shown on the drawings or as required to complete the work of this contract, furnish and install the following equipment supplied by Goric

Marketing Inc., P.O.410205 Cambridge, MA 01721; Phone: (617) 499-3393; Fax: 617-499-3394; Contact: Rick Henke cell#: (774)-289-1533, or approved equal. Goric Marketing supplying equipment including:

Berliner Seilfabrik GmbH and Company D-13407 Berlin-Reinickendorf, Lengeder Str. 4; also 48 Brookfield Oaks Drive, Greenville, SC 29607, USA

Henderson Recreation Ltd., Simcoe, Ontario, Canada;

Eibe Produktion und Vertrieb, Roettingen, Germany;

Conlastic-Conlastic (CON) GmbH, Meerbusch-Buederich, Germany;

Hags AB, Sweden; Fallsbrook Woodworking, Glassville, NB

Lappset Group LTD. Hallite 17 P.O. Box 8146, 96101 Rovan iemi, Finland

Kaiser and Kuhne www.kaiser-kuehne-play.com Germany

Play Ventures, Inc. /Play Wood Plus.com Warminister, PA 18973

Quantity:	**Description:**
1	**SD75 Standard Eibe Pressure Farm Pump #:E5570530, and #:E5570520 base; combined with Ryerson Designs, Inc. custom black locust steps, basins and chutes, as detailed. Includes precast ground vault, 25 gal. with polyethylene tank, piping and connections, all as detailed.**
1	**Kaiser & Kuhne K&K 15'ft. long closed stainless roller tube slide Model #941001253**
1	**Eibe Sand Box With Cover Model #E5590600**
1	**Wood "Toddler Climb and Slide Unit" Model # 17315-0 with slide, 1 stair, 1 cleated incline ramp, handrails. Color of poly slide: custom gray or tan. Manufactured by Play Ventures, Inc.**

D. **TYPE D** PLAY EQUIPMENT

Where shown on the drawings or as required to complete the work of this contract, furnish and install the following equipment designed and drawn by **PlayArtDesign, PO Box 733 Speonk, NY 11972; www.playartdesign.net ,** Phone: (631) 513-0769; Fax: (631) 801-

2748. Contact person: Mr. Bob Thorne, btplayartdesign@gmailcom ,or approved equal; Manufactured by AZA,Inc.

44 Dolphin Way
Riverhead, NY 11901
631.325.1484
idfabrication@verizon.net

Welding shall be in complete accordance with the standards of the American Welding Society. All welds shall be ground smooth. No field welding shall be permitted. Galvanizing: All welded steel components shall be fully assembled prior to galvaniz-ing. After fabrication, all steel shall be shot blasted to a white metal finish. The cleaned surface shall have an angular surface profile of 2.0 to 4.0 mils. After shot blasting, all steel shall be galvanized by the Zinc Rich Powder Process. The Zinc Rich Pow-der coating is to be applied to a thickness of 2 mils & cured at 392□ F for 2 minutes minimum. The coating shall be firmly adhered in and free of spots, lumps or blisters.
The Powder Coating shall be applied to the Zinc Rich prepared sur-face in such a manner that the coating will not peel off. The coating shall be TGIC-Polyester Powder applied to the Zinc coated steel via the Powder Coating Process. The Powder Coating shall be applied at a film thickness of 4 to 6 mils. The Powder Coating shall conform to the following ASTM Designations:

Adhesion D 3359-B
Pencil Hardness (H-2H) D 3363
Flexibility D 522 (Mod)
Impact Resistance D 2794 (Mod)
Abrasion Resistance D 4060 (Mod)
Salt Spray Resistance B 117
Humidity Resistance D 2247

Quantity: **Description:**

E. **TYPE E** PLAY EQUIPMENT

Where shown on the drawings or as required to complete the work of this contract, furnish and install the following equipment supplied by Park Street Playgrounds, Inc.; Phone: (978) 664-0239; Contact person: Margie Salt, msalt@parkstreetplaygrounds.com, or approved equal. Park Street Playgrounds supplying equipment including:

Berliner Seilfabrik GmbH and Company D-13407 Berlin-Reinickendorf, Lengeder Str. 4;

Quantity:	Description:
1	**HodgePodge Single Bay "Mini Cloud 9-Palmeto", group swing manufactured by Berliner Seilfabrick**
1	**"FireBall 2.1", manufactured by Berliner Seilfabrick**

Henderson Recreation Ltd., Simcoe, Ontario, Canada;

Lappset Group LTD. Hallite 17 P.O. Box 8146, 96101 Rovan iemi, Finland

Quantity:	Description:

F. **TYPE F** PLAY EQUIPMENT

Where shown on the drawings or as required to complete the work of this contract, furnish and install the following equipment supplied by JP LaRue, Inc. Phone: (800) 986-3716; Fax: (866) 222-2561; Cell: (401) 744-6901; Contact person: John LaRue, info@jplarue.com, www.big toys.com, or approved equal. John P. LaRue, Inc. supplying equipment including:

Columbia Cascade Big Toys

Quantity:	Description:

G. **TYPE G PLAY EQUIPMENT**

Where shown on the drawings or as required to complete the work of this contract, Furnish and install the following equipment supplied by Ryerson Design, Inc. Play structures shall be manufactured of either black locust, live oak, stripped of bark, and oiled with a non-toxic approved exterior finish. All wood components are to be joined with ½" inch dia. galvanized steel carriage bolts, through bolted, with nuts and washers counter sunken, and plugged with wood dowels. All voids, and checking of wood to be filled with a non-toxic approved filler, sanded and stained to match. Custom play structures shall be manufactured by Ryerson Design, Inc. 12 Upton Street, Cambridge, MA 02139; mitchryersondesign@gmail.com; Phone: 781-391-1231; Fax: 781- 391-4551, or approved equal.

Quantity:	Description:
1	**Ryerson Designs, Inc. "Logs on Hill" Custom black locust climber on slope of hill, as detailed.**
1	**Ryerson Designs, Inc. "Treehouse" Custom ground level enclosure, as detailed.**

1 **Ryerson Designs, Inc. custom black locust steps, basins and chutes, as detailed, combined with Goric, Inc. farm pump and water tank.**

2.03 RUBBER SAFETY SURFACING

POURED-IN-PLACE RUBBER SAFETY SURFACE:

Description: Where shown on the drawings or as required to complete the work of this Contract, furnish and install rubber safety surfacing at the required thickness indicated. All necessary material components and application oversight required to install the Playbound Poured-in-Place System shall be provided. Rubber surface shall be provided by Surface America, Inc. Williamsville, NY; Phone: (800) 999-0555; supplied by M.E. O'Brien and Sons, Inc., 93 West Street, Medfield, MA 02052; Phone: (508) 359-4200, Fax: (508) 359-2817, or equal.

A. Quality Assurance:

1. Qualification:

a. Surface America, Inc. management team shall have marketed this system in the USA for at least eight (8) years.

b. The applicator shall be approved and trained by Surface America, Inc.

2. Design and Detailing:

a. Playbound Poured-in-Place System is utilized in the safety zones around playground equipment as an impact absorbing resilient surface. Each System is designed to meet CPSC, ASTM and ADA requirements.

b. Acceptable substrate and substrate systems are asphalt, concrete, and compacted cursed stone. Other substrates shall be approved by Surface America, Inc.

c. Conditions of all substrates with respect to structural performance shall be evaluated and approved by the applicator prior to applying the Playbound Poured-in-Place System.

B. Submittals:

1. Surface America, Inc. shall submit samples of the Playbound Poured-in-Place System

C. Delivery, Storage and Handling:

1. All materials shall be delivered in good condition in original unopened packages with labels intact.

2. All materials shall be protected from weather and the adhesive shall be stored in temperatures 40°F (4°C) or higher.

D. Job Conditions:

1. At the time of application ambient air temperature shall be 40°F (4°C) or greater and remain so for at least 72 hours after completion.

2. All materials shall be protected from weather and other damage prior to application, during application and while curing.

E. Alternates and Allowances:

1. Systems to be considered equal to Playbound Poured-in-Place shall be approved by the Project Engineer in writing prior to the bid date.

F. General:

1. All material components of the Playbound Poured-in-Place System shall be obtained from Surface America, Inc. or its authorized distributors.

G. Materials:

1. Playbound Poured-in-Place Primer: A single component moisture cured polyurethane primer.

2. Playbound Poured-in-Place Binder: An elastic polyurethane prepolymer with minimal odor, excellent weathering and binding characteristics. Binder shall be 100% MDI based and contain 0% TDI monomers. NOTEA TDI is listed as a carcinogen with OSHA and the IARC. Special handling is required with more than .1% TDI.

3. Playbound Poured-in-Place black SBR: Shall be recycled SBR rubber.

    1. Shall be ground at ambient temperature.

    2. Shall be ground into 3/8" inch shredded strands and contain less than 4% dust. SBR base shall be 0", 1- 5/8", 2" or 2 ½" inches thick as shown on the drawings or as required under the bid items.

    3. Shall be transported in suitable bags to protect from moisture.

4. Playbound poured-in-Place EPDM rubber: Shall be UV stable

    1. Color to be determined.

    2. Top EDPM rubber shall be a minimum of 1/2" inch thick.

    3. Top EDPM rubber shall consist of .5 mm to 1.5 mm fine rubber crumb.

5. Playbound Poured-in-Place System:

1. Shall have been tested for shock attenuation under ASTM F 1292 G-Max and HIC.

2. Shall be non-slip and porous.

3. Shall have Class B fire rating.

6. As required City to provide paper templates for custom designs and shapes as shown on drawings. Where necessary city to provide on site assistance to rubber sub contractor to consult on design layout, placement and color selections.

2.04 RUBBER TILES

A. Furnish and completely install the required number of 500mmx500mm x 2" inch thick recycled rubber granulate tiles, with non toxic P.U. binder, with interlocking pegs, as manufactured by EuroFlexzkraiburgrelastec GMBH Kehlsteinstrase 2 D-84529 Tittmoming, Germany +49 (0) 8683 701-145 od.-156; supplied by Goric Marketing Inc. USA; Phone: (508) 881-0942; Contact person: Rick Henke cell#: (774)-289-1533, Fax: 508-881-0943, or approved equal. Color: to be determined.

2.05 RUBBER LOGS

A. Furnish and completely install the required number of 24 " inch rubber "Palisades" vertical logs including; 1" inch diameter x 25cm ground anchors, and concrete footings; as manufactured by EuroFlex Kraiburg Relastec GMBH Kehlsteinstrase 2 D-84529 Tittmoming, Germany +49 (0) 8683 701-145 od.-156; supplied by Goric Marketing Inc. USA; Phone: (508) 881-0942; Contact person: Rick Henke cell#: (774)-289-1533, Fax: 508-881-0943, or approved equal. Color: shall be grey.

2.06 **WOOD SAFETY SURFACE**

A. Furnish and completely install 12" inch, compacted depth, engineered wood fiber playground safety surface below all play equipment and swings. Wood safety surface shall be installed on one layer of geotextile fabric over a 6" inch gravel sub-surface. Wood safety surface shall be Fibar system, product #301, manufactured by the Fibar Group Inc., Mamaroneck, NY 10543-2650, Phone (800) FIBAR-21 or (914) 835-1511, Fax (914) 835-6975; or Wood Carpet supplied by New England Playground Surfacing P.O. Box 167 Torrington Road, Winsted CT 06098-8100, Phone (800) 888- PLAY; or approved equal.

B. Submit catalogue cut and sample (2) to Project Engineer for approval.

2.07 FOUL POLE

A. Where shown on the drawings or as required to complete the work of this Contract, furnish and install 20'ft. foul pole (2 per ball field), Model No. FP-20U/BBFP-20, manufactured by Jaypro Sports, 976 Hartford, Ct. 06385; Phone: 800.243.0533; Fax: 800.988.3363, or approved equal.

B. Foul line posts shall be schedule 40 3-1/2" O.D. posts, as specified in Section 23, with foul pole welded panel assembly, as detailed. Foul line posts shall be integral with the fence. Footing for foul pole shall be 24" x 58" with ¾" re bar, 4 places per footing, as detailed.

2.08 BLEACHER

A. Bleacher units shall be Model No. NB-0515VPPRF, 5 row x 15 foot non-elevated bleacher with net seating capacity of 50 and a vertical picket guardrail system, and NB-0315APRF, 3 row x 15 foot non-elevated bleacher with net seating capacity of 30 as manufactured by National Recreation Systems, Inc. of Fort Wayne, IN or approved equal.

a. Framework: Prefabricated aluminum angle spaced at 6'-0" intervals joined by means of aluminum angle cross bracing. All understructure components shall consist of a series of frames with standard dimensions of 6" (8" for 5 row units) rise per row, 17" of height of seats above foot plank, and 24" depth of row. Frames shall be aluminum angle, 6061- T6 mill finish (or mechanically equivalent). Each frame shall be unit welded, using the metal inert gas method by qualified welders, under guidelines established by the American Welding Society. Each frame shall consist of vertical, horizontal and diagonal bracing to support the seat and foot planks as specified herein. Bolted or otherwise mechanical fastening of each frame's components will not be accepted. All cross-bracing and horizontal bracing is to be aluminum angle 6061-T6 mill finish (or mechanically equivalent) and placed in number and location to sustain design load. After fabrication all steel is hot dipped galvanized to ASTM A-123 specifications.

b. Seats: Seat plank shall be aluminum alloy 6063-T6 fluted, non-skid surface with decal flat, 2x10" (nominal) with anodized end caps. Cross-section dimensions not to be less than 1.75" high and 9.5" wide. Wall thickness to be .078" (nominal). Aluminum plank shall have a clear anodic coating applied in accordance with AAS Standards AA-M10C22A31.

c. Treads: Foot plank shall be aluminum alloy 6063-T6, mill finish, fluted, non-skid surface with decal flat, 2x10" (nominal) with anodized end caps on rows 2 and up. Foot rest shall consist of two (2) such planks with actual cross-section dimensions of not to be less than 1.75" high and 9.5" wide. Wall thickness to be .078" (nominal). Aluminum foot planks shall have a mill finish.

d. Risers: Vertical riser (5 row unit only) plank shall be provided between seat and foot plank with end caps on rows 4 and up. Plank shall be 2" x10" at top row only and 1" x 6" with a wall thickness nominally of .078 on rows 1-4 fastened by clips.

e. Guardrail: The 5-row unit only shall have a railing that consists of anodized welded aluminum vertical picket panels attached to aluminum support members. Rear rail support member to be aluminum channel. Side rail support member to be aluminum angles. Panels to be shop welded aluminum and anodized in accordance with AAS Standard AA-

M10C223A31 (204R1). Panels shall consist of 1-5/8" O.D. round tube and extruded aluminum 5/8" square, schedule 40 aluminum alloy 6105-T5, clear anodized 204R1, AA-M10C22A31, Class II . Panels shall attach to rail support members by means of 5/16" diameter U-bolts, lock washers, and nuts. Panels shall connect together using internal splice and rivet. End panels shall be terminated using aluminum elbows, and aluminum round tube mechanically fastened.

f. Planks shall have end caps of extruded aluminum alloy 6063-T6 and be clear anodized (204R1) per AAS Standard AA-M10C22A31.

g. All plank connections to the supporting structure shall be with four-way adjustable aluminum clips (6063-T6 alloy), carriage bolts, nuts and lock washers and hex nuts of 5/16" steel. All fasteners shall be hot dipped galvanized.

h. Concrete mounting slab shall be as specified in Section 03300. Minumum concrete foundation options include: (1) a 4" inch thick reinforced concrete slab. (2) a 12" inch wide by 24" inch deep concrete strip foundation under each bleacher frame. (3) sufficient drilled concrete piers to anchor the bleachers.

i. Concrete slab shall be installed on gravel base as shown in drawings.

B. Construction Methods

1. End caps shall be field installed and also be mechanically fastened on the underneath side of each plank with rivets and have smooth edges.

2. Anchor to meet designed wind loads per applicable BOCA codes.

Install bleachers at height as recommended by the manufacturer.

2.09 PLAYERS BENCH

A. Furnish the required number of backless double wide aluminum player's benches as per Drawing number DB22515X/BE-PDB 15'foot length or 21'ft. length, as required; "City of Boston Special 'DB' Bench Assemblies", as manufactured by the National Recreation Systems, Inc. P.O. Box 110487, Fort Wayne IN, 46858-1487; Phone: (219) 482-6023, Fax: (219) 482-7449; supplied by M.E. O'Brien and Sons, Inc., 93 West Street, Medfield, MA 02052-4200; Phone: (508) 349-4200, Fax: (508) 359-2817, or approved equal. Color: anodized bronze/black or powder coated black.

2.10 PARK BENCH (TYPE A, B, C, D, E, F)

Where shown on the drawings or as required to complete the work of this Contract, furnish and install the following types of benches:

A. TYPE A: Furnish the required number of Type A park benches, either 8' foot long, Model No. 58-80, 358 lbs., 6'foot long Model No. 58-60, 296 lbs., 8'foot long backless Model No.92-80, 266 lbs., 6'foot backless Model No. 92-60, 218 lbs., or custom length bench, straight or curved, as detailed, and as shown on plans, support option S-2 or S- 4, as manufactured byDuMor, Inc., Mifflintown, Pennsylvania or equal, complete as shown on the drawings. All 8'feet long benches to have center arm rest. Furnish and install exposed or sub grade concrete base as directed by Project Engineer. Supports shall be cast iron. Seating surface shall be ¼" inch x 1-1/2" inch steel bar and 2-3/8" inch O.D. steel pipe. Finish: Powder coated black.

B. **TYPE B**: Furnish and install the required number of Type B park benches, either 8' foot long, Model No. 94-80, 325 lbs., 6'foot long Model No. 94-60, 260 lbs., 8' and 6'foot long backless equivalents with arm rests, each with two supports, support option S-2 or S-4, as manufactured by DuMor, Inc., Mifflintown, Pennsylvania, or approved equal, complete as shown on the drawings. Furnish and install exposed or sub grade concrete base as directed by Project Engineer. Finish: Powder coated black.

C. **TYPE C**: Furnish and install the required number of Type C park benches; each 8' foot long, Model No. 117-80-2AR, wt. 245 lbs., or each 6' foot long, Model No.117-60-3AR, wt.197 lbs., 8' and 6'foot long backless equivalents with arm rests, support option S-2 or S-4, as manufactured by DuMor Inc., Mifflintown, Pennsylvania, or approved equal complete as shown on the drawings. Furnish and install exposed or sub grade concrete base as directed by Project Engineer. Finish: Powder coated black.

D. **TYPE D:** Furnish and install the required number of Type D park benches; 8' foot long, Model No.98-80, wt. 215 lbs., 6' foot long, Model No.98-62, wt.170 lbs., with arm rests, 2" x 4" nominal IPE wood slats, oiled finish, support option S-2 or S4, as manufactured by DuMor Inc., Mifflintown, Pennsylvania, or approved equal complete as shown on the drawings. Supports cast iron. Bracing: 1-1/16" inch O.D. steel pipe. Fasteners: stainless. Furnish and install exposed or sub grade concrete base as directed by Project Engineer. Finish: Powder coated black.

E. **TYPE E:** Furnish and install the required number of Type E modular seat unit bench groupings: (2) 8' ft." Unit A" straight bench with back, (1) "Unit B" radius bench with back, (1) 45'ft. "Unit D" backless straight and radius bench, (1) "Unit E" radius benches with backs, as detailed herein, and as shown on the plan, with and without backs, with or without arms, straight or curved, or some combination of both straight and curved; Model style "Olympia Nova", manufactured by Erlau Site Furnishings P.O. Box 367 Hiawatha IA 52233; Phone (319) 294-0001; Fax (319) 294-0003; Contact person cindy.kaiser@rudchain.com www.erlau.com or approved equal. Color: to be determined.

Back and seat surfaces made of wire mesh and tubular steel, diameter 1.18". Back and seat surfaces connected with laser-cut formed parts. Bowed seat with knee roll, backrest with plateau top. Tubular steel legs, diameter 2.36", wire mesh .59"x.98". wore gaige/14" (3.5mm). 1-1/4" diameter external tube, all finishes galvanized and RILSAN polyamide coated (min. thickness 350 microns).

F. **TYPE F: Furnish and install the required number of Type F park benches; 6' foot long all steel, Model No.68-102-6-2AR, wt.170 lbs., with arm rests, mounting option S-1 embedment, or S2 surface mount, as required, manufactured by DuMor, Inc., Mifflintown, Pennsylvania, or approved equal complete as shown on the drawings.**

Support frame 3/8" x 2" steel bar, Seat 10 ga. stl. perforated sheet, Bracing 3/4" inch schedule 40 steel pipe, Fasteners stainless. Finish: Powder coated. Color: to be determined.

2.11 **BIKE RACK**

A. **The City of Cambridge will provide the bicycle rack to the contractor. It will be of DERO™ "Bike Hitch, surface-mount", or equivalent. Surface mount racks shall only be used on concrete surfaces that are in good condition and are relatively level. Four 3 inch long, 3/8 inch diameter anchor bolts shall be used to secure the bicycle rack. Two of the nuts shall be tamper resistant, and shall be of "Breakaway Nut" type or "Triple-slot High Security" type, 3/8-16 galvanized steel. The length of the anchor bolt will vary depending on the thickness of pavers with setting bed on concrete sub base. Anchors shall be long enough to penetrate the concrete by three inches.**

CONSTRUCTION METHODS

1. Place the rack in the desired location, being careful to orient the rack in the correct direction as indicated by the spray paint markings on the ground. Mark the holes.
2. Drill four 3/8 inch diameter holes, 3 inches deep
3. Hammer in the anchor bolts
4. Use washers to level the rack as needed.
5. Set the rack in place with four ordinary nuts and tighten.
6. Once the rack is installed, replace two nuts from the bracket (opposite sides from each other) with tamper resistant fasteners. Be sure not to over tighten the tamper resistant nuts.
7. If needed, excess bolt shall be removed with an angle grinder.

The rack shall be vertical with a tolerance of +/- 1 degree. Two magnetic levels affixed to the rack post should be used in the field to ensure this tolerance is met.

BICYCLE RACK –IN GROUND

This specification is for the installation of "post and ring" style bicycle racks intended to be installed "in ground". Where the surface is asphalt, dirt, or turf.

SURFACE MOUNT, CONCRETE

This specification is for the installation of "post and ring" style bicycle racks equipped with a surface mount on a concrete surface.

MATERIALS

The city of Cambridge will provide the bicycle rack to the contractor. It will be of type DERO™ "Bike Hitch, in-ground mount", or equivalent.

CONSTRUCTION METHODS

This construction method is to be used if there is not a concrete layer. Examples of this type of installation include asphalt, dirt, or turf surface or brick surface with no concrete underneath.

A 14 inch diameter cement concrete foundation shall be used, with a minimum depth of 12 inches.

The bicycle rack shall be centered into the hole, ensuring that the top of the rack is 35 inches above the sidewalk surface. Ensure that the rack is horizontal, and is maintained level until the grout has set. The rack shall be vertical with a tolerance of +/- 1 degree. Two magnetic levels affixed to the rack post should be used in the field to ensure this tolerance is met.

2.12 TENNIS POST/NET

A. Where shown on the drawings or as required to complete the work of this Contract, furnish and install tennis posts, Model No. STP-200 square posts (set of two), direct bury, as manufactured by Jaypro Sports Equipment, 976 Hartford Turnpike, Waterford, CT 06385, or approved equal, supplied by M.E. O'Brien and Sons, Inc., Medfield MA. Finish: Powder coated black.

B. Furnish and install tennis net, Model No. TTN-3 Tournament Deluxe Tennis Net, with 3mm braided black polyethylene, quadruple stitched, heavy duty, polyester beb headband with a 3/16" inch vinyl coated steel tension cable, 42'ft. x 42" high, as manufactured by Jaypro Sports Equipment, or approved equal, supplied by M.E. O'brien and Sons, Inc.

C. Furnish and install center strap , Model No. CS-1 2" inch wide adjustable nylon webbing with double snap hook, with A-2 center anchor with concrete footing, as manufactured by Jaypro Sports Equipment, or approved equal, supplied by M.E. O'Brien and Sons, Inc.

2.13 **DRINKING FOUNTAIN (TYPE A, B)**

A. TYPE A: Where shown on the drawings or as necessary to complete the work of this contract, furnish the required number of two bowl, bi level, pedestal mounted drinking fountains, Model No. GSM55 with stainless bowls, and push button operation. Manufactured by Murdock Super Secur, Inc., a Division of Acorn Engineering Company, 15125 Proctor Avenue; P.O. Box 3527, City of Industry, CA 91746; supplied by Markstar P.O. Box 189 La Crosse KS 67548; Phone: (800) 591-9880; Fax: (626)-937-4707, or approved equal. Color: black or stainless, as required. Options such as jug filler, or hose bib, as required.

B. **TYPE B:** Where shown on the drawings or as necessary to complete the work of this contract, furnish the required number of three bowl, tri level, pedestal mounted drinking fountains, Model No. GSQ45 with stainless bowls, and push button operation. Manufactured by Murdock Super Secur, Inc., a Division of Acorn Engineering Company, 15125 Proctor Avenue; P.O. Box 3527, City of Industry, CA 91746; supplied by Markstaar P.O. Box 189 La Crosse KS 67548; Phone: (800) 591-9880; Fax: (626)-937-4707, or approved equal. Color: black or stainless as required. Options such as jug filler, or hose bib, as required.

1. Furnish all labor, material, equipment, tools and transportation required to accomplish the above work. Construct drinking fountain bodies with all required plumbing, and make connections to water and crushed stone drain are or catch basins to make the system operable.

2. All fountain pedestals and arms to have a factory applied finish and shall be primed and painted black as specified in this section.

3. Water service for drinking fountains shall be as specified in Section 21.

4. Pipe for the fountain drains shall be copper, type K seamless pipe.

5. Concrete base is included in Section 29.

6. Anchor bolts shall be as recommended by the manufacturer. Anchor bolts shall be as recommended by the manufacturer. Anchor bolts and nuts shall be hot dipped galvanized.

7. All drinking fountains to be installed with approved shut off gate typically within 5' feet of fountain base. Refer to Section 21.

8. Basin shall be stainless steel.

9. Drinking fountain shall be push button activated with vandal proof recessed button and protective collar.

2.14 STEEL BOLLARDS (TYPE A, B, C)

Where shown on the drawings or as required to complete the work of this Contract, furnish and install the following types of bollards:

A. **TYPE A**: Furnish and install the required number of permanent or removable steel bollards as shown on the drawings.

1. Permanent Bollards:

Pipe for permanent bollards shall be welded and seamless galvanized steel pipe with welded flat steel cap welded to pipe , conforming to ASA Pipe Schedule Forty (40), ASTM A 120.
Size shall be 6" inch outside diameter with 0.258" inch nominal wall thickness.

Bollards shall be set in concrete footings as shown on the drawings.

2. Removable Bollards:

Removable bollards shall be 6"inch O.D. Schedule 40 galvanized steel pipe with flat steel cap welded to pipe. Bollard to have heavy galvanized coil chain links welded to side and tip edge of steel ground sleeve, for padlocking.

Ground sleeve shall be galvanized steel pipe set in concrete footing. Ground sleeve shall be wide enough I.D. to accommodate bollard.

3. Chain for removable bollards shall be 0.218" inch, Grade 43 carbon steel conforming to ASTM A413.

4. Padlocks shall be heavy duty keyed padlocks. Provide one padlock for each removable bollard. Each padlock shall be provided with 3 key. Padlocks shall be keyed alike.

5. All bollards shall be primed and painted black as specified in this Section.

6. White reflective sheeting (pressure sensitive) for bollards shall conform to MADPW, SSHB Section M9.30.2. where required.

B. **TYPE B**: Furnish and install the required number of permanent or removable bollards Model No. M9034 Salem bollard manufactured by Ironsmith Inc., supplied by M.E. O'Brien and Sons, Inc. 93 West Street, Medfield, MA 02052-4200; Phone: (508) 359-4200, or equal. Color: black polyurethane finish.

1. Both permanent and removable bollards manufactured from class 35 gray iron per ASTM A48 - latest revision (approximate weight 160 lbs).

2. Removable bollard has factory supplies steel ground sleeve with steel flange with tab welded to flange of pipe sleeve as detailed.

3. Contractor shall supply approved padlock (one per each removable bollard). Each padlock shall be provided with three (3) keys. All padlocks keyed alike.

C. **TYPE C: Furnish and install the required number of 6" inch diameter steel and aluminum bollards, permanent or removable as required, Design Group:Annapolis, manufactured by Landscapeforms Inc., Kalamazoo, MI, www.landscapeforms.com, nadenep@landscapeforms.com, or equal. Color: to be black.**

1. Both permanent and removable bollards manufactured from structural steel pipe, 6-5/8" diameter, 33" inch high, with an 18" inch galvanized steel socket with self storing cover plate, spun aluminum "cover ring" at grade level, 7-3/4" inch diameter cast aluminum top , and integrated above grade keyed locking mechanism (removable). All removable bollard supplied to the City of Cambridge for this project and all others, shall be keyed alike.

2.15 **PAINT**

A. All painting materials shall be equal to those manufactured by the Tnemec Company, Inc., Cook Paint and Varnish Com., Valspar Co., Koppers, or the Carboline Tnemac products (unless otherwise noted) and Tnemac recommendations for application. No brand other than those names will be considered for approval unless the brand and type of paint proposed for each item in the following schedule together with sufficient data substantiated by certified tests conducted at no expense to the Owner, to demonstrate its equality to the paint(s) named is submitted to the Engineer in writing for approval within thirty (30) days after the signing of the Agreement. The type and number of tests performed shall be subject to the Engineer's approval.

B. Priming shall be done with primers that are guaranteed by the manufacturer to be compatible with the finish paints to be used.

C. No paint containing lead will be allowed. Oil shall be pure boiled linseed oil.

D. Work areas will be designated by the engineer for storage and mixing of all painting materials. Materials shall be in full compliance with the requirements of pertinent codes and fire regulations. Proper containers outside of the buildings shall be provided and used for painting wastes.

E. All colors shall be selected by the Engineer and shall be as required by the respective paragraphs of this Section.

F. The following types of paints by Tnemac Co. have been used as a basis for the paint schedule:

1. Hi-build Epoxoline (Series 66) - polyamide cured epoxy.

2. Endura-Shield - semi-gloss (Series 71) - aliphatic polyurethane.

3. Tnemac-Grip (No. 32-1210) - vinyl wash primer.

G. Furnish the Owner with one unopened gallon can of each type and each color of paint used.

H. Galvanized paint as required shall be equal to that manufactured by Z.R.C. Products, Company, 21 Newport Avenue, Quincy, MA; Phone: (617) 328-6700, or equal.

2.16 **PUBLIC ART**

A. **Project artist to furnish and install the required number of stainless steel sculptural park entry elements, with LED lighting, manufactured by Bland Design LLC, 830 Powderhorn Lane Unit E Jackson, Wyoming 83001, blandhoke@gmail .com**

B. **Sculptural park entry elements shall consist of two installations. The G.C. shall furnish and install two concrete footings (stainless anchor and anchor template shall be provided by artist), and electrical conduit from handhole to both footings. Wiring, and all related electrical control equipment shall be furnished and installed by the City of Cambridge Electrical Dept. (C.E.D.). Fabrication, transport, off loading at the site, and installation on concrete footings, shall be the responsibility of the Project Artist. The contractor shall be responsible for the coordination of other trades, to ensure a successful public art installation.**

C. **The Cambridge Arts Council (C.A.C.) small furnish and install an inconspicuous marker, in vicinity of the public art installation(s), permanently affixed to the work, or anchored to ground, or pavement with a concrete footing. The marker shall conform in size, content, and material to the C.A.C. guidelines for such markers.**

2.17 **TRASH/RECYCLING RECEPTACLE**

Where shown on the drawings or as required to complete the work of this Contract, furnish and install the following types of trash and or recycling receptacles:

TRASH RECEPTACLE:

Furnish the required number of trash receptacles in the locations shown on the drawings, as manufactured by Big Belly Solar Compactor50 Brook Road, Needham MA 02494; Phone: 888.820.0300; sales@bigbellysolar.com, or approved equal. The unit is constructed of galvanized steel sheet metal, with dent- and abrasion-resistant ABS plastic side panels (black-colored side panels are made from 100% post-consumer recycled material).

Exterior finish of the galvanized steel is a polyester TGIC powder-coat, weather-resistant finish. Passed 10-year accelerated salt spray test. Unit is fully weatherized and can be power-washed. Power is supplied by a 19.7" by 23.4" solar photovoltaic (PV) polycrystalline silicon cell module; nominal output is 30 Watts. No external power required. PV panel is covered with a 0.187" thick molded, curved polycarbonate "bubble" to protect against impact and scratches. The PV panel supplies energy to a Pulse Width Modulator, which in turn maintains battery charge. Energy is stored in a sealed, spill-proof 12-Volt battery rated between 18 and 20 amp hours. The battery powers a 1/6-HP DC gear-motor. Low-voltage, 12-Volt system. The motor drives dual ANSI No. 40-sized heavy duty chains. Non-hydraulic system. The chains direct-drive a compaction ram of galvanized steel construction, custom designed to achieve vertical compaction path and deep bin penetration.
Trash is deposited in a customized hopper-door designed mechanically to prevent human or animal access to the compaction area, and to discourage illegal dumping of oversize items. Handle height of 41.6" is compliant with the Americans with Disabilities Act. Hopper is balanced to enable one-handed operation. Trash is collected in a single, leak-proof bin made out of low-density polyethylene plastic (for durability and light weight), designed with low lift-point in mind. Liner bag specification for the bin is 48" wide by 48" high, with a circumference of 96". Bag thickness should be at least 2 mil. Compaction cycles run automatically, triggered by a pair of photo-eye sensors located just above the rim of the inner bin. The sensors monitor trash level and trigger compaction cycles only when the bin is full. Cycle Time: 41 seconds. (Users can deposit trash during cycle—no lock-out.)Fully automated, IC processor-controlled system: Unit operations are controlled and monitored by on-board computer software that:

- Monitors trash compaction density and reports fullness levels
- Monitors battery Voltage and reports low-battery
- Employs software algorithms to cycle components off and on as needed to conserve energy
- Senses open access doors, shutting power to motor Senses and reports operation status and any system faults

Three-color LED status lamps on the front of the unit indicate compacted trash level (using large, easy to read iconic images), machine status, diagnostic codes, and also inform operators when the unit requires collection. Magnetic switch located near LED indicators to trigger manual compaction cycle. Compaction level can be adjusted by 5-position rotary switch to customize compaction level and fullness indicator. Switch located in locked top service access section. Compaction Force: 1250 lbs. maximum. Electronic components are contained within a weather-resistant enclosure located inside the locked top service access section. Both the operating systems and trash compartment are key controlled to prevent unauthorized access. Fully interlocked access doors to ensure the unit will not operate if either of the access doors is open. The unit has concealed holes located inside locked main compartment for bolting down to secure the unit, and also for leveling the unit, facilitating simple installation and creating an attractive finished appearance.

Overall unit dimensions:

- Height: 50.4"
- Width: 26.1"
- Depth: 25.9"
- Weight: approx. 300 lbs.
- Trash Hopper Insertion Opening: 6" x 17"
- Bin Volume: 32 gallons (compacted)

Available as standalone or as part of a kiosk with recycling containers.or approved equal. Color: powder coated black. Drill hole in center of Bottom liner support for anchor, attachment to exposed or 4" concrete sub-grade pad, as required. Submit shop drawing for approval.

RECYCLING RECEPTACLE

Big Belly trash receptacle shall be furnished with either/ or both bottle/can recycling unit and paper recycling unit as required and called for under the bid items herein.

Big Belly trash receptacle with 1 recycling unit, dimensions 50"Wx26"D x 50" H, 470lbs.
Big Belly trash receptacle with 2 recycling units, dimensions 74" x 26"D x 50" H, 620 lbs.

2.18 WATER PLAY EQUIPMENT **TYPE A:**

A. GENERAL:

Where shown on the drawings and as required to complete the work of this Contract furnish all labor, materials and equipment and install completely water play equipment. Work to include but not limited to the following:

-water spray fixtures (inground and/or above ground components specified herein)
-child activation device (in ground and/or above ground bollard)
-programmable computer controller
-underground valve box with internal piping, manifold, manual and automatic valves and electrical wiring
-controller enclosure (either below or above grade as required)
-backflow/metering enclosure (as required)
-pipe and fittings
-electrical conduit and fittings
-drain pipe from valve box to drain structure
-all excavation, backfill and backfill materials
-miscellaneous materials

B. DESCRIPTION

All water play equipment manufactured by Vortex Inc. 5500 Fullum, Suite 204, Montreal Quebec Canada H2G 2H3 contact person: Steve Hamlin; Phone: (514) 948-4899; Fax: (514) 948-0096; supplied locally by M.E. O'Brien and Sons Inc., 93 West Street, Medfield, MA 02052-4200; Phone: (508) 359-4200, Fax: (508) 359-2817, or approved equal.

C. SUBMITTALS:

Submit shop drawings, product data and samples for all water play equipment as required by the Engineer.

D. ACTIVATION BOLLARD (VO2-13-00)

The activation bollard shall be constructed of 6" inch schedule 10 stainless steel 304/304L pipe. The structure shall be mounted on a 3/8" inch x11" inch x11" inch stainless steel 304 base plate and anchored with four (4) ¾" inch x 3" inch x 12" inch stainless steel 304 anchor bolts. The activation cap shall be constructed of rigid high-density polyurethane and be secured using a tamper-resistant system. The polyurethane shall be UV resistant, non-porous and nonflammable. The activator shall operate on 24 VDC with no visible or moving parts

and shall be accessible by removing the polyurethane cap with a special tamper-resistant tool. There shall be a ¾" inch stainless steel internal conduit with a male threaded ¾" inch NPT stainless steel connection. There shall be a male threaded ½" inch NPT stainless steel connection supplied for drainage. All welds shall be polished and non-visible. The structure shall be sandblasted and finished with a polyester powder coat. Color: black or other custom color to be determined.

E. CONTROLLER

The Vortex controller is a pre-programmed computer designed to automate the operation of the spray features in your facility. The unit includes a custom program of a variety of sequences according to the features, volume of water available, and client requirements. To modify the sequences, a memory cartridge is programmed by Vortex technicians and forwarded to the client. The modified programs are down-loaded by inserting the cartridge into the controller.

The controller is equipped with a 7 day 24 hr. microprocessor controlled digital time switch. This time switch can be easily programmed by the maintenance staff to set the operation hours of facility. Individual weekdays can have separate programs or you may have several days operating on the same program. The controller comes with a step by step instruction sheet that is mounted in the control panel for easy reference.

An automatic/manual switch is used to select the operating mode of the controller. In manual mode the features are tuned off and on by individual toggle switches. The automatic mode is selected for normal operation, with the features responding to the activator.

1. Specifications

Power Supply:
The controller requires 120 VAC power supply.

Output to Valves:
The output current to the solenoid valves is 24 VAC

Input from Activator:
The activator opens on 24 VDC supply.

Maximum Number of Outputs
The standard VX01-02 is equipped to accommodate 2 solenoid valves. Additional outputs can be added in sets of eight.

Electrical Enclosure:
The VX01-02 is mounted in a corrosion-resistant, reinforced fiberglass enclosure with quick release latches that can be secured using a padlock.

The controller shall be a UL approved control panel. It shall possess the following components and characteristics.

2. Programmable:
The controller shall be factory programmed with a variety of spray sequences designed according to the requirements of the client. The controller shall be equipped with the flexibility to modify the sequences using a transportable memory

cartridge.

3. Time Switch:
The controller shall be equipped with a 24 hr/7 day programmable digital time switch to set the operational hours of the facility. The time switch shall have the ability to program a different schedule for each day of the week or have several days operate on the same schedule. The time switch shall have a 100 hour battery backup system in case of power failure.

4. Transformer:
The controller shall contain a 120V primary/24V secondary transformer with built in electrostatic shield protection.

5. Selector Switches:
The controller shall have 3 position selector switches for each solenoid valve, the activation device and the time switch. These switches shall be used to select the operational mode of the components (i.e. manual, off and automatic).

6. Enclosure:
The controller shall be equipped with a corrosion-resistant, fiber-reinforced electrical enclosure with NEMA 4X rating. The enclosure shall have stainless steel lockable latches. The selector switches and time switch shall be mounted on a stainless steel face plate.

7. Outputs:
The controller shall have the capability of controlling a maximum of 4 solenoid valves.

8. Inputs:
The controller shall be capable of responding to two separate detecting sources.

F. BELOW GRADE VAULT OR ABOVE GRADE CABINET

1. General:

The below grade vault, Model No. VM01-08 shall be prefabricated underground vault. The above grade cabinet, Model No.
VOR-17XX.XXXX. each containing internal piping, valves and electrical wiring; factory assembled and water pressure tested. The unit shall be equipped with threaded connections for the water inlet, water outlets (for each of the spray features) and drainage outlet. The solenoid valves shall be pre-wired to the controller inside the equipment below grade vault, or above grade cabinet. The contractor shall furnish and install water service from street, to the water inlet, from the water outlets to spray features, and furnish and install a drain line from the vault/cabinet to drainage structure.

2. Below Grade Vault:

The equipment vault enclosure shall consist of a PVC body reinforced with stainless steel angle. The dimensions of the equipment vault shall be 42" inch wide, 48" inch long and 36" inch deep. The access hatch shall be constructed of 1/8" inch thick

SS304 floor plate and reinforced with 1/8" inch x 1 ½' inch x 1 ½" inch angle. All hardware shall be corrosion resistant.

3. Equipment:

The equipment shall be installed with a sufficient number of unions to allow for removal of valves and other components.

The mechanical equipment provided in the valve box shall consist of the following:

(1) Double Backflow Preventer
(1) Pressure Regulator
(1) 3" inch Stainless Steel manifold
(1-10) 1" or 1 ½" inch PVC ball valve
(1-10) 1" or 1 ½" inch Solenoid valve
(1) ¾" inch PVC ball valve for drainage

The manifold shall be constructed of polyvinyl chloride (PVC) schedule 80 piping and fittings as outlined in ASTM D-1784. The pipe shall be as prescribed by ASTM D-1785
for pressure rated piping systems. As manufactured by Chemline Plastics Ltd., or approved equal.

The solenoid valve shall have the following characteristics:

Flow range 1" inch (1 ½")	5 to 40 gpm (30 to 100gpm)
Operational pressure	15-150 psi
Body style	Globe/angle valve
Operating Voltage	24 VAC
Inrush Current	0.4 amps
Holding Current	0.2 amps

Manual flow control
As manufactured by Toro, .252 valve series.

The junction box shall be a NEMA 4x rated enclosures equipped with terminal blocks for electrical
connection to solenoid valves.

G. CONTROLLER ENCLOSURE

Programmable controller shall be housed either in below ground vault or above ground cabinet. Refer to drawings.

H. BACKFLOW/METERING ENCLOSURE:

Where such backflow equipment and enclosure doesn't already exist or is not planned as part of the other irrigation improvements, furnish and install the following equipment as specified. *Refer to Section 21 Water Service Connections.* To include the following:

-backflow device
-pressure reducer valve
-ball type isolation valve

-blow out valves
-meter and remote read wired to exterior of cabinet
- backflow enclosure including concrete base
-all internal copper piping and fittings
-all mounting hardware
-all connections required between water service and valve box manifold and between manifold and water spray heads

(All of the above sized to fit water service and water play systems as designed for particular project. Refer to details.).

I. TESTING / ADJUSTMENT:

All water play spray fixture components shall be pressure tested before backfilling and paving. The Contractor shall ensure all water supply lines are free of debris prior to the "hook up" of any spray fixtures, and the Contractor shall have inspected the entire system in the presence of the Engineer. Water pressure to individual spray fixture components shall be adjusted and secured to the complete satisfaction of the Engineer. The computer shall be pre-programmed with a variety of spray sequences. A factory representative shall be available on-site as required by the Engineer to adjust the water sequences and program at time of installation and for the next three years each spring. The cost of having a factory representative inspect, start up and adjust system for these three years is included in the cost of equipment

J. WATER PIPE:

All water play pipe shall be polyethelene 160 psi capacity pipe and fittings approved by the Engineer

K. WATER PLAY EQUIPMENT TYPE A SCHEDULE:

Quantity: **Model:** **Description:**

OR

An equivalent mechanical (pneumatic operated) activation post and 3 in ground water jets manufactured by Water Splash Inc.Champlain, N.Y. supplied by Premier Park and Play Inc.; Contact Person: Doug Knotts, Phone: (617) 244-3317; Fax: (617) 244-3319, www.premierparkplay.com , and premierpark play@verizon.net

OR

An equivalent mechanical (pneumatic operated) activation post and 3 in ground water jets manufactured by Water Play, Inc. 1451B Ellis Street, Kelowna, BC CANADA V1Y 2A3; Phone: (800) 590-5552, www.waterplay.com , admin@waterplay.com ; supplied by Kompan Inc.; Contact Person: Jim LeBrun jimleb@kompan.com , Phone:(800) 426 9788; Fax: (888) 943-6254.

2.19 WATER PLAY EQUIPMENT **TYPE B**

Where shown on the drawings or as required to complete the work of this contract, furnish and install the following equipment manufactured by Eibe, Inc.; supplied by **Goric Marketing Inc.**, P.O. Box 117, Ashland, MA 01721; Phone: (508) 881-0942; Contact: Rick Henke; Fax: (508) 881-0943, or approved equal.

Quantity: Model: Description:

2.20 POLYVINYL CHLORIDE (PVC) UNDERDRAIN

A. Perforated 4",6",8" or 12"inch O.D. polyvinyl chloride pipe and fittings shall be Type PS-46 PVC or ASTM D3034 (SDR-35) and perforated to ASTM Designation F758. Perforated pipe shall be furnished in lengths of not more than 20' feet. Solid runs of pipe shall be 6"inch O.D. pvc pipe. Flexible perforated pipe shall be used in some applications, as required and as shown on the drawings.

B. Pipe and fittings shall have bell and spigot push-on joints meeting the applicable requirements of ASTM D-3212.

C. Pea stone for underdrain shall be as specified in Section 11.

D. Geo-textile fabric shall be Mirafi 140N as manufactured by Mirafi, Inc. or approved equal.

E. Clean outs to be provided at the end of each run of underdrain in walkway adjacent to sand play areas. Underdrain in ball field shall not have clean outs. Ends to be capped as required. Clean outs to consist of steel street box with lockable cover.

2.21 FLAG POLE

A. Where shown on the drawings or as required to complete the work of this Contract, furnish fiberglass reinforced plastic (F.R.P.) Internal Halyard flagpole Model No. PLP35C, as manufactured by PLP Composite Technologies, Inc. Fitzwilliam, NH 03447, supplied by M.E. O'Brien and Son, Inc., 93 West Street, Medfield, MA 02052-4200; Phone: (508) 359-4200, Fax: (508) 359-23817 or equal, complete and as shown on the drawings.

The flagpole shall have an overall height of 39' feet, with an exposed height of 35' feet. The butt diameter shall be 7" inch and the top diameter 3.25" inch. The flagpole shall be 84 pounds, with a total shipping weight of 142 pounds. Color shall be black.

B. Flagpoles is equipped with a PLP Internal Halyard System which includes a single sheave fiberglass truck, polyester halyard, polyester wire core retaining ring, vinyl covered counterweight, stainless steel and nylon internal cam cleat, and a handhole door with cylinder cam lock. Also included are a gold anodized aluminum ball, fiberglass flash collar, fiberglass ground sleeve and brass swivel snaps with vinyl covers. Supply six (6) sets of keys for lock to City of Cambridge representative.

C. Flagpole furnished with highest quality 5' feet x 8' feet standard size American flag. Submit shop drawing for approval.

2.22 SOCCER GOAL

A. Where shown on the drawings or as required to complete the work of this Contract, furnish the required number of portable soccer goals with nets Model No. CSG-612 Club Goal (6' feet – 6" inches H x 12' feet W x 2' feet B x 5' feet D), 220 lbs. each as manufactured by Jaypro Company, supplied by M.E. O'Brien and Sons, Inc., 93 West Street, Medfield, MA 02052-4200; Phone: (508) 359-4200, Fax: (508) 359-2817, or equal.

B. Goals shall be constructed of 4" inch x 2" inch rectangular all aluminum unpainted. Back support pipes will be 2-3/8" inch O.D. aluminum. Goal posts shall be padded with SPP-72 padding kit manufactured by Jaypro, or equal.

C. Nets shall be 5" inch mesh nets measuring 12' feet wide, 6' feet – 6" inches high, 5' feet at the bottom and 21' feet at the top. Netting shall be 21-thread twisted nylon net, tar-treated, bound all around, white.

D. Goals shall be supplied with galvanized steel spike anchors Model No. SS-18, 5 lbs. manufactured by Jaypro Inc., or equal. Supply two (2) anchors with each goal.

2.23 PLAYGROUND CURBING **(TYPE A, B, C)**

Where shown on the drawings or as required to complete the work of this Contract, furnish and install the following:

A. **TYPE A:** Furnish and install completely 6" inches x 6" inches recycled Durawood plastic lumber manufactured by U.S. Plastics, Inc., 2650 W. Roosevelt Road, Chicago, IL 60608; Phone: (312) 491-2500, supplied by M.E. O'Brien and Sons, Inc., 93 West Street, Medfield, MA 02052; Phone: (508) 359-4200, Fax: (508) 359-2817, or equal.

1. Dimensions of curb to be 6" inches x 6" inches solid core curb manufactured from purified high-density polyethylene (HDPE), prime pigment systems, and selected process additives in ten foot lengths. Weight is approximately 10 pounds per foot for 6" inches x 6" inches dimensional lumber. Compressive strength using ASTM D695 at psi @ .2" inch def. is 2540-2560; @ .4 in def. 3040-3120 and @ .6 inc def. 5130-5350.

2. Curb installation typically to consist of one 6" inches x 6" inches x 8' foot lengths, set on a 12" inches thick x 18" inch base of 3/4" inch crushed stone. Sand box applications may require more stacked timbers with tie backs for stability. Refer to details

3. Furnish and install 1/2" inch x 30" inch long galvanized steel spikes, by through drilling 6" inch x 6" inch timber and driving bars securely into ground. All cuts of 6" inch x 6" inch materials to be precise and tight fitting with no gaps or openings exceeding 1/8" inch typically. Galvanized steel spikes shall be spaced typically 4' feet on center to prevent plastic from warping.

4. 6" inch x 6" inch nominal dimension shall be 5 ½" inch x 5 ½" actual dimension furnished in standard eight (8') feet or other lengths as needed. Color: dark gray.

5. Warped material is unacceptable.

B. **TYPE B:** Furnish and install completely "Tuff Timber" recycled polyethylene curb 4' feet long x 12" inch x 4" inch manufactured by Landscape Structures Inc., supplied by M.E. O'Brien and Sons, Inc., 93 West Street, Medfield, MA 02052; Phone: (508) 359-4200, Fax: (508) 359-2817, or approved equal.

1. Tuff timber curb shall be 100% recycled/reclaimed high-density polyethylene with UV stabilizer added to prevent weathering and fading. Molded in sleeves are provided to hold steel anchor stakes. Color: Dark Brown.

2. Each Tuff Timber weighs 17 lbs.; wall thickness is 3/16" inch and each shall be supplied with all required 30" inch long galvanized steel installation stakes (spaced 3' O.C.). Round headed stakes shall be Model No. 100626A 30" inch x ¾" inch weighing 6 lbs. each.

C. **TYPE C: Where shown on the drawings or as required to complete the work of this contract, furnish and install the following equipment supplied by David Verbeck dba Grassroots Playscapes, 156 Forest Road Hancock, NH 03449, Phone: (978)427-2742; Contact person: David Verbeck, playplanters@gmail.com, or approved equal. Grassroots Playscapes, Inc. supplying equipment including:**

Quantity:	**Description:**
50 linear foot	**8-12" diameter x 24" inch high black locust wood log edging, vertically set with hot dip galvanized lag bolts (2 per log), with all exposed edges beveled, and stained with an approved non toxic weatherproofing finish (2 coats).**

2.24 **BASKETBALL BACKSTOP/RIM/NET**

Where shown on the drawings or as required to complete the work of this Contract, furnish and install the following:

A. **Furnish the required number of basketball backstop and post sets Model No. GP104, GP105, OR GP106A72 (4', 5', 6'ft. extension distance), 6" inch square post outdoor basketball system; with Model No. BB72A38 (42" x 72"acrylic backboard), as required; including Model No. 2000 collegiate breakaway single rim goal. Backstops manufactured by Gared Sports, Inc., Supplied by M.E. O'Brien an Sons Inc., 93 West Street, Medfield MA 02052; Phone: (508) 359-4200, Fax: (508) 359-2817, or approved equal.**

2.25 "BANKSHOT" BASKETBALL BACKSTOP STATIONS

A. Furnish and install the required number of "Bankshot" basketball backstops, and post sets, Model No.# "Three Pac" (3) station system, including five (5) 3" inch square galv. steel posts, and multiple shaped backboards/rims outdoor basketball system. "Bankshot" basketball backstops manufactured by The Bankshot Sports Organization 842B Rockville Pike, Suited 504 Rockville, MD 20852; Phone: (800) 933-0140, (301) 309-0260; Fax: (301) 309-0263; email: info@bankshot.com; www.bankshot.com, or approved equal.

2.26 TABLE and SEATING **(TYPE A, B, C, D, E)**

Where shown on the drawings or as required to complete the work of this Contract, furnish and install the following:

A. **TYPE A:** Furnish and install the required number of 8'foot or 6'ft. tables Model No. 62-821-8, or 62-821-8, supplied with two backless benches Model No. 92-80 or92-60. The 8'foot wheelchair accessible version of this table is Model No. 65-255-68-1/S. Table with recessed game board. Manufactured by DuMor Site Furnishings Inc. supplied by M.E. O'Brien and Sons, Inc., 903 West Street, Medfield, MA 02052; Phone: (508) 359-9200, Fax: (508) 359-2817, or approved equal. Table and benches shall be S-2 surface mount exposed concrete base. Finish: Powder coated black.

B. **TYPE B**: Furnish and install the required number 8'foot or 6'foot tables Model No. 5-053-68-1 or Model No. 65-054 with recessed game board and two backless matching benches. The wheelchair accessible version of this table shall one shorter bench to accommodate a wheelchair. Manufactured by DuMor Site Furnishings Inc. supplied by M.E. O'Brien and Sons, Inc., 903 West Street, Medfield, MA 02052; Phone: (508) 359-9200, Fax: (508) 359-2817, or approved equal. Table and benches shall be S-2 surface mount exposed concrete base. Finish: Powder coated black.

C. **TYPE C:** Furnish and install the required number of 36" square tables Model No. 65-952, pedestal mount, with recessed game board or umbrella hole with internal pole support. S-1 direct bury, or S-4 sub surface mount. Furnish the required number of 21"inch square side tables-Model No. 65-710, S-2 surface mount. Furnish the required number of 27"inch x 29"inch chairs with backs and arm rests, Model No. 65-711, S-2 surface mount. Furnish the required number of 24"inch square chairs with backs, no arm rests, Model No. 65-643-2 (steel seat) or Model No. 66-330-24I (IPEA wood seat). S-2 surface mount to exposed or sub-grade concrete base. Manufactured by DuMor Site Furnishings Inc., supplied by M.E. O'Brien and Sons Inc., 93 West Street, Medfield, MA 02052; Phone: (508) 359-4200, Fax: (508) 359-2817, or approved equal. Finish: shall be powder coated black.

D. **TYPE D:** Furnish and install the required number of Type D 8' foot long tables Model No.66-811-8 with two (2) 8'ft. backless benches; or 6' foot long tables Model No.66-811-6, with two (2) 6'ft. backless benches, all 2" x 4" nominal IPE wood slats, oiled finish, support option S-2 or S-4, as manufactured by DuMor Inc., Mifflintown, Pennsylvania, or approved equal. Furnish and supply a Type D 8'foot long wheelchair accessible tables Model No.66-811-68-I, with two (2) 5'ft. backless benches. Furnish and install the required number Type D 8'ft. long tables Model 66-811-68-I, with no benches, all as required. Supports cast iron. Bracing: 1-1/16" inch O.D. steel pipe. Fasteners: stainless. Furnish and install exposed or sub grade concrete base as directed by Project Engineer. Finish: Powder coated black.

E. **TYPE E: Furnish and install the required number of Type E 50" inch split (bi-level) diameter powder coated steel table Model No. 69-263-3/S-1, with three (3) round stools, direct burial or surface mounting condition; the required number of powder coated perforated steel chairs without arms, Model No. 126-01, with stainless tethering loops and cable, for free standing mounting condition; and the required number of powder coated perforated steel chairs with arms, Model 126-01 AR, with tethering loops and cable, for free standing mounting condition; all manufactured by DuMor Site Furnishings Inc., supplied by M.E. O'Brien and Sons Inc., 93 West Street, Medfield, MA 02052; Phone: (508) 359-4200, Fax: (508) 359-2817, or approved equal. Finish: Custom powder coated colors to be determined.**

2.27 LOOSE PLAY MATERIALS AND SPORTS EQUIPMENT

A. Where shown on the drawings or as required to complete the work of this Contract Contractor shall furnish all of the following loose play materials and sports equipment to be stored within steel storage cabinet. All such materials shall be organized and neatly placed within storage cabinet in a manner acceptable to the Engineer.

B. Furnish the following loose play materials supplied by Flaghouse Inc., 601 Flaghouse Drive, Hasbrouck Heights, NJ 07604; Phone: (800) 793-7900, Fax: (800) 793-7922, or approved equal.

Quantity:

(0) Split Donut 8913T
(0) Rainbow Barrel 7120T
(0) Two Stair Step AAI
(0) Mini Crawl Tunnel Set W11119
(0) 4'x 6' Gym Mats 770460 ROY
(0) Water Noodle Set W8052
(0) Web Handled Parachute #785
(0) Berries Plastic Chairs W19085
(0) Balance Rope 12'ft. L 12188
(0) Set of 4 Vari-Balance Beam W6524

C. Furnish the following loose play materials from2013 Imagination Playground LLC, 5 Union Square West,8th Floor, New York, New York 10003; Phone: (866) 816-8608, or approved equal.

Quantity:

(0) Classic 105 pc Building Set in Two Carts with wheels

D. Furnish the following sports equipment manufactured by Jaypro, Inc., supplied by M.E. O'Brien and Sons, Inc., 93 West Street, Medfield, MA 02052; Phone: (508) 359-4200, Fax: (508) 359-2817, or approved equal.

Quantity:

(0) MP-521OR Multi-purpose game standard with 30" inch base, 487 lbs. each

(0) MPC-5211R center standard with 30" inch base, 244 lbs. each
(0) TBP-275R portable tetherball pole with ball included
(0) PBC-30 base pads, 8 lbs. each.

E. Furnish the following loose play materials from www.GlobalIndustrial.com , Phone: 1(888) 978-7759, or 1 (888) 381-2861; service@globalindustrial.com , or approved equal.

Quantity:

(0) Dairy Milk Crate, 13-1/8" L x 13-1/8" W x 11" H, Black #T9AB649566
(0) 10' x 12' Super Heavy Duty Brown Tarp 8 oz. #T9AB335748

F. Furnish the following loose play materials from Little Tikes 2180 Barlow Road, Hudson, OH 44236, Phone: 1 (800)321-0183, www.LittleTikes.com , or approved equal .

Quantity:

(0) Big Waffle Blocks 18 pc set of blocks #619137.

G. Furnish the following loose play materials from Web Rigging Supply 27W966 Commericial Avenue Lake Barrington, Illinois 60010, Phone: 1 (877) 744-4461, www.WebRiggingSupply.com , or approved equal.

Quantity:

(0) 80096TSPCPFT 1-1/2" Exercise Climbing Rope (each 15'ft. L)

H. Furnish the following loose play materials from www.sprinklerescutcheon.com , or Jared@Argo.com Phone: 1 (866) 309-9899, or approved equal.

Quantity:

(0) Fire Hose 50ft.1.5 Inch SKU: 6510803

I. Furnish the following loose play materials from EquiCross, Inc. 6628 Dormany Road North Plant City, Fl 33565, email: Sales@equicross.us, www.EquiCross.com , Phone: 1 (866) 715-6006, or approved equal.

Quantity:

(0) Rubber Parking Stop with Reflective Tape -6 foot Item#: DH-PB-2 (72"L x 6"D x 4"H, 35 lbs. each)
(0) Metro Cade 40"Barricade A-Frame Design, Double Panel Item#:440-42

(0) Knitted Barrier Polyethylene Fencing BF05 (150'L x 48" H)

J. Furnish the following loose play materials from www.Pentair.com , Pentair Water Pool and Spa, or approved equal.

Quantity:

(0) Item #: RAI-40-2XX Petair 16'ft. L Water Safety Float Line

k. (1) **Item#: 1296730 Athletic Connection Tri-fold temporary backstop. Complete unity with wheels, 2 wings and nets. Assembly required by GC. Manufactured by Athletic Connection .com; supplied by M.E. O'brien and Sons, Inc. 93F West Street P.O. Box 650 Medfield, MA 02052; Phone: (508) 359-4200; attention: Brian Iafolla, Sales Rep.**

2.28 GEO-TEXTILE FABRIC

Where shown on the drawings and as required to complete the work of this Contract furnish and install geo-textile subgrade stabilization fabric for placement over sub-grade between gravel base and resilient wood or sand safety surface, in play areas, shall be Mirafi 600X as manufactured by Mirafi Corp., Charlotte, NC, or approved equal.

Soil filter fabric shall be a high modulus, wove fabric conforming to the following:
a. Grab tensile strength – 300 lbs.
b. Grab Tensile elongation – 35% max.
c. Burst strength – 600 psi
d. Trapezoid tear strength – 120 lbs.
e. Puncture resistance – 130 lbs.

2.29 RAISED GARDEN PLANTERS (TYPE A, B, C)

A. TYPE A: Furnish and install the required number of raised garden planters manufactured and supplied by The Farmstead, Inc. 527 Meetinghouse Road, South Chatham, MA 02659; Gardenraisedbeds.com. The size of raised cedar board planters shall be 8'ft. x 4'ft., either 8", 16", 24" or 32" inches high depending on the number of stacked boards specified. The lumber used shall be Vermont white cedar, rough sawn to a 1-1/4" inch board thickness for greater strength, and mortise and tenon joints. Each planter shall have a top cedar rail on all four sides. Contractor to completely assemble using all manufacturer supplied hardware. After assembly and placement in the final locations, contractor shall furnish and install soil separator filter fabric to the bottom and inside wall (12" inches up walls on all four sides) prior to filling with an clean and 1soil planting mixture, approved by the Project Engineer.

B. **TYPE B:** Furnish and install the required number of raised garden planters manufacturered by Romital Fabrication, 6127 N. Lawndale Ave. Chicago, Illinois 60659; Phone: Dan Mihalka (773) 407.9188; danvlad99@hotmail.com , or approved equal. Size of raised garden planters shall be 10'ft. x 4'ft. x 36" high; or 10'ft. x 4'ft. x 24" high; or modified, as necessary for wheelchair access. Each planter shall have a 2" x 4" clear cedar top rail, without knots, on all four sides, attached to cedar side boards using stainless screws, and having mitred cuts at the corners. The framework shall be 2" x 2" x 3/16" thick tubular steel (4.320 lbs. per ft.), with 1-1/2" x ¼" thick flat bar stock bracing, as detailed. Side walls shall consist of three (3) stacked 2" x 6" knotty cedar boards, positioned into steel frame slots, as detailed. Bottom of planter shall have 2" x 2" x .185 hot dipped galvanized welded wire mesh, overlayed with a 6'ft. wide layer of an approved 1" geo-textile filter fabric, stapled to the cedar side boards. Each planter shall have two (2) steel sleeves on either end, welded to frame/bracing, designed to support a removable vertical trellis, as detailed. Each planter shall be supplied with one (1) 10'ft. length x 6'ft. high trellis frame, consisting of a 20'ft. length of 1-5/8" schedule 40, black pvc coated, chain link fence rail, bent to complete the required 180 degee radius, as detailed. Trellis frame shall be supported in place, by means of two (2)1/4" x 3" galvanized carriage bolts, bolted through steel sleeve and trellis frame, as detailed. Furnish and install 10" square heavy duty black nylon net for

trellis panel. Secure netting 10" on center,with black vinyl ties. Netting and ties shall be approved by the Project Engineer. Each planter shall be supplied with four (4) heavy duty commercial hot dip galvanized/4" dia. rubber wheels (with locking mechanism), approved by the Project Engineer. All welds are to be full and continuous, and all weld ground smooth. All of planter tubular framing, trellis sleeves, steel bracing, and all other steel supports shall be cleaned, primed and powder coated. Color shall be: RAL 6013 "Reed Green", or approved equal.

Furnish and install the required soil for raised planters. Planting soil mix for raised planters shall consist of 70% good horticultural screened loam and 30% compost using "Coast of Maine "compost made from marine plants and animals, (or equal). Submit samples of screened loam and composting additive for approval prior to delivery to the site. Loam and composting material shall be mixed thoroughly with a backhoe on site, and approved in advance by the Project Engineer.

C. **TYPE C: Furnish and install the required number of 2'ft. wide x 4'ft. long, by 29" high northern cedar raised garden planters, Model #8586748 manufactured and supplied by The Gardener's Supply Company 128 Intervale Road, Burlingotn, VT 05401; www.gardeners.com ;Phone: 1 (800) 427-3363, or approved equal. The lumber used shall be Vermont northern cedar, rough sawn to a 1-1/4" inch board thickness for greater strength. Contractor to completely assemble using all manufacturer supplied powder coated aluminum corners, and stainless hardware. After assembly and placement in the final locations, contractor shall furnish and install 10" inches of gravel in bottom for drainage, followed by a soil separator fabric liner over gravel, and inside walls (12" inches up walls on all four sides), then filled with 18" inches of soil planting composting mix. Samples of proposed gravel and soil mix to be submitted in advance for approval by the Cambridge Conservation Commission (CCC). Failure to do so will result in the remvoval and replacement with an approved soil planting composting mix all at the Contractor's expense.**

2.30 COMMUNITY GARDEN HYDRANT

A. **Furnish and install the required number of post hydrants (hose bibs) as required, Model M-NPL75A "STAY OPEN" ¾" freeze resistant, compression type post hydrant, manufactured by Murdock-Super Secur 15125 Proctor Avenue, City of Industry, CA 91746; Phone (800) 453-7465, Fax (626) 855-4860, www.murdock-supersecur.com or approved equal. Depth of bury shall be 3'ft.**

2.31 4'x7'STORAGE SHED

A. Furnish and install the required number of 84" H X 70"W x 57-1/2" D cedar pre stained storage shed , item#: 291330, each with #291332 double arched doors; the required number of matching "bus" shelter #291331 with 4'ft. wide ramp #306220, manufactured by Walpole Woodworkers, Inc. , P.O. Box 151, 767 East Street Walpole, MA 02081; Phone (508)668-2800, or (978) 658-3373, or approved equal. Storage shed/shelter to have Arched double doors with hardware and latch, or open (no doors) with shelter "bus stop" bench within, as detailed and shown on plans. Contractor shall be responsible for assembly of

cedar shed, furnishing and installing a 4" inch thick concrete base, with galvanized anchors.

2.32 8'x10'and 10'x 12' STORAGE SHED

A. Furnish and install the required number of 8'ft. x 10'ft. OR 10'ft. x 12'ft. "Quivett Cape" Building manufactured by Walpole Woodworkers, Inc. , P.O. Box 151, 767 East Street Walpole, MA 02081; Phone (508)668-2800, or (978) 658-3373, or approved equal.

B. All cedar sheds to include plain front, no window, 6' wide bead board double front door, front wall with cedar shingles, sides and rea in standard board and batten siding, 2" x 6" pressure treated floor joists and stabledge flooring, premium wide board pine wall board sheeting, 4'ft. deep storage loft, solid cellular PVC trim boards, and 3 tabl asphalt roof shingles in black. Shed to be supplied with ramp. Sheds to be stained with two (2) coats of an approved stain color.

C. Contractor shall be responsible for furnishing and installing a 4" inch thick concrete slab sized one ft. larger on all sides, and hot dipped galvanized ground anchors.

2.33 CUSTOM WOOD FURNITURE AND SITE AMENITIES

A. Furnish and install the required number of custom black locust wood, natural stone, and steel, park benches, tables, and site amenities, listed below. Park furniture and amenities shall be fabricated using black locust, and live oak, stripped of bark, and oiled with a non-toxic approved exterior finish. All wood components are to be joined with ½" galvanized steel carriage bolts, through bolted, with washers, with nuts and washers counter-sunken, and plugged with wood dowels. Custom furniture and site amenities shall be manufactured by Mitch Ryerson Designs, Inc.12 Upton Street, Cambridge, MA 02139; mitchryerson@gmail.com; phone: 781.391.1231; fax: 781.391.4551, or approved equal.

B. The contractor shall be responsible for installation. However, the on site assembly, adjustment, re-adjustment of wood components shall be performed by Mitch Ryerson Designs, Inc. In the process of assembling this custom wood furniture, park amenities, and structures, the contractor shall be required to provide approximately 15 hours of heavy machinery assistance, to excavate for footings, to transport logs from City storage area to site, to load and off load logs, to place and set log timbers, granite stones and posts, all under the direction of Mitch Ryerson Designs, Inc., and the Project Engineer.

C. The contractor shall furnish and completely install the concrete pads and footings for benches, picnic table, park entry gateway structure, bulletin board-kiosk, log bridge, swing bench; consisting of approximately 6 cubic yards of 3,500 PSI concrete. Concrete pads and footings for custom wood furniture and site amenities to be installed, as detailed, and as directed by the Project Engineer.

D. **Quantity: Model: Description:**

2.34 "BELL TOWER" LENDING LIBARY

A. Work under this Section shall include, but is not limited to the following:

1. One (1) "Bell Tower Lending Library" Model#:BTLL1001

Custom "Bell Tower Lending Library" shall be manufactured by:AZA 1556 West Main Street Riverhead, NY 11901 631.325.1484 conforming to the drawings and specifications of: PlayArtDesign PO Box 733 Speonk,. NY 11972 631.513.0769 btplayartdesign@gmail.com

Bell Tower Lending Library: Frame: Shall be fabricated from 11/2"x 1" x Length, Wood, Ipe, Panels: ½" x Size, Wood, Birch Face Marine Grade Plywood, joined as one unit with Blind Mortise and Tenon joints, glued and screwed.
Window: 3/8"x Shape, Clear Acrylic Plastic, let into Door Frame.
Roof: Shall be fabricated from ½" x Size, Wood, Birch Face Marine Grade Plywood, with Plastic "Slate" Roof Shingles, Color: Dark Gray.
Post: Shall be fabricated from 11ga x 3" x 3" x Length, Box Tube, Steel.
Bell: Shall be Brass Bell.

OR

An equivalent one (1)" Bell Tower Lending Library", as specified herein manufactured by Custom Fabricaton, Inc. Harpursville, N.Y. Phone: (607) 693-3223, Fax: (607) 693-3226, www.CustomFabricationInc.com

OR

An equivalent one (1) "Bell Tower Lending Library", as specified herein manufactured by The Steel Yard, Inc. 27 Sims Avenue, Providence RI 02909; Phone: (401) 273 7101, Fax: (401) 273 7105, www.thesteelyard.org Contact Person: Howie Sneider.

2.35 ARBOR WITH BENCH AND TODDLER SEAT

A. Work under this Section shall include, but is not limited to the following:

1. One (1) Arbor with bench and toddler seat, Model#:ARBB1001

Custom Arbor with bench and toddler seat shall be manufactured by:AZA 1556 West Main Street Riverhead, NY 11901 631.325.1484 conforming to the drawings and specifications of: PlayArtDesign PO Box 733 Speonk,. NY 11972 631.513.0769 btplayartdesign@gmail.com

Posts, Beams, Joists: Posts shall be fabricated from 5" Schedule 40 Pipe, 5.625" OD, Steel, Beams from ¼" x 2"x6" x Length, Rectangular Tube, Steel, Joists from 11ga x 1 ½" x 4" x Length, Rectangular Tube, Steel. Steel shall conform to ASTM Design-tion A 500, Grade B. Plates shall be ¾"x10" x 10" Plate, Steel, Post Extension shall be 4" Schedule 40 Pipe,4 ½" OD by Length, Post Footing shall be 11ga x 10" x 10" Plate welded to Support Posts. Posts shall be cut to the length required for proper in-stallation.

Bench shall be fabricated from 11ga x Size x Shape 3/8" Hole x 9/16" Stag-ger, Perforated Sheet, Steel, 1 ½" Schedule 40 Pipe,17/8" OD x Length, Pipe, Steel, 3/8"x 2 ½" x Length x Shape, Flat, Steel, fabricated and welded as one unit.

Toddler Seat: Seat shall be fabricated from 11ga x Size x Shape 3/8" Hole x 9/16" Stagger, Perforated Sheet, Steel, 5/8" x Length x Shape, Rod, Steel welded as one unit, welded to center of Bench.

Bench and Toddler Seat shall be connected to Arbor Frame with 11ga x 1 ½" x1 ½" x Length Box Tube, Steel with Pivot End, connected to Frame Pivot.

Footing shall be 2" Schedule 40, 2 ½" OD x Length, Pipe, Steel with 3) ½"x12" Anchor, Rod, Steel welded to Footing. Footing connected to Bench with ¼" Nylon covered, Stainless Steel Cable and Connectors. All Footings as per Drawings.
All Hardware shall be Stainless Steel.

2.36 RECYCLED PLASTIC OUTDOOR MESSAGE BOARD

A. Furnish and install the required number of recycled plastic outdoor message boards manufactured by United Visual Products, Inc. SKU: UVP –UVDD4530, supplied by www.schooloutfitters.com .

B. Outdoor message board size: (45"W x 30" H x 5-1/2" D), double door corkboard, weather tight enclosure for posting material out of doors.

PART 3: EXECUTION

3.01 HOME PLATES AND PITCHER'S PLATES

A. Threaded rods shall be substituted for spikes provided with the plates. Rods shall be screwed into the bottom of the plates. Wood anchors shall be attached to the bottom ends of the rods with one nut and washer on each side of the wood anchor. The wood anchor shall be buried as shown on the drawings and backfilled leaving the tops of the plates flush with finished grade.

3.02 PLAY EQUIPMENT (**TYPE A, B, C, D, E**)

A. Layout structure in the field in accordance with the approved shop drawings and obtain Engineer's approval prior to proceeding,

B. Install structural members in concrete footings in accordance with the approved shop drawings, specifications and manufacturer's recommendations.

C. Assemble structures in accordance with the manufacturer's recommendations.

D. Installation shall be done under the supervision of the manufacturer's representative(s) at all times, throughout the installation process so as to complete this work safely, properly, and in a timely manner. The costs to have a manufacturer's representative(s) shall be borne by the Contractor. The Engineer shall be consulted in determining who will do the installation work, and in assuring that this work will be done by qualified, well supervised personnel.

E. The contractor shall erect and maintain a snow fence of sufficient strength and quality to prohibit access into play areas, until the Engineer conducts a safety inspection with a representative from the play equipment manufacturer(s), and approves play equipment for use. The cost of furnishing, installing and maintaining temporary fence, as required by Engineer is responsibility of Contractor.

3.03 RUBBER SAFETY SURFACE

A. POURED IN PLACE RUBBER

Layout rubber safety surface in the field at the locations shown on the drawings and obtain the Engineer's approval before proceeding.

1. Preparation of subgrade: The subgrade shall be brought to the specified lines and grades. All roots and vegetation shall be removed to a depth of at least 12" inch below grade.

2. Soil Sterilant: Soil sterilant shall be uniformly applied over all excavated subgrade areas in accordance with the manufacturer's recommendations, and applied in compliance with all State and Federal environmental regulations. Extreme caution should be exercised.

3. Base construction: A 1 ½" inch bituminous concrete binder course shall be furnished and installed by the Contractor as recommended by the manufacturer.

4. Base perimeter: Where no perimeter abutments exist the bituminous concrete base and rubber safety surface shall be sloped 2'-0" inch below the proposed finish grade of loose play material, as shown on the drawings. Rigid ¼" inch thick by 6" inch steel edging to be installed as shown on the drawings and as directed by the Engineer.

5. Primer: Shall be applied at a rate of 300 square feet per gallon to the substrate or geotextile fabric on the substrate using a short nap roller.

6. SBR Base Mat:

   a. SBR shall be mixed with binder in a ration of 88% SBR to 12% binder by weight to achieve maximum resilience.

   b. Using trowel, SBR/binder mix shall be spread in a consistent density to specified thickness at a rate of 31 lbs. and 13 oz. total weight per cubic foot.

   c. SBR/binder mix shall be allowed to cure (necessary time varies based on temperature and humidity).

7. Primer: Shall be applied at a rate of 300 square feet per gallon to the base mat using a short nap roller.

8. Top Course:

   a. EPDM shall be mixed with binder in a ratio of 82% EPDM rubber to 18% binder by weight to achieve maximum wearability and resilience.

b. Using trowel, EPDM/binder mix shall be spread in a consistent density to ½" inch thickness at a rate of 57 lbs. and 12 oz. total weight per cubic foot.

c. EPDM/binder mix shall be allowed to cure (necessary time varies based on temperature and humidity), a minimum of 24 hours before opening to foot traffic.

9. Contractor shall provide police detail or other persons to keep people off all newly installed rubber surfacing for a minimum of 24 hours and longer as deemed necessary by Engineer until completely dry. The cost of any such detail work shall be included in the installation price.

3.04 FOUL LINE POSTS

A. Install foul line posts in concrete footings, poles to extend 12' feet above finished grade, complete as shown on the drawings and in accordance with the manufacturer's recommendations. Posts shall be painted yellow as specified in this Section. Foul line posts to be integrated into layout of outfield fence.

3.05 BLEACHERS

A. Install bleachers at the locations and to the lines and grades shown on the drawings complete with understructure, seat planks, foot planks and hardware in accordance with the manufacturer's recommendations.

B. Bleacher shall be secured to pavement at four corners with ½" inch coiled galvanized chain set into concrete footing. Top of footing to be 3" inch below finished grade.

3.06 TABLES

A. Install all direct bury tables and seating supports in concrete footings and all surface mounted furniture on exposed or subgrade concrete base as required, at the locations and to the lines and grades shown on the drawings in accordance with the manufacturer's recommendations.

B. Attach table top and seats to supports in accordance with the manufacturer's recommendations.

C. Touch-up paint all hardware and supporting framing as specified in this Section.

3.07 BENCHES / SEATING

A. Install the bench supports in concrete footings, at the location and to the lines and grades shown on the drawings in accordance with the manufacturer's recommendations. Refer to the drawings, details and unit bid items for clarification on whether benches are surface mounted, direct bury or free standing with security cable.

B. Attach bench base support in accordance with the manufacturer's recommendations.

C. Touch up paint all hardware and bench supports as specified in this Section.

3.08 BICYCLE RACK

A. Install the required bike racks in the locations and to the lines and grades shown on the drawings.

B. Bike racks shall be anchored to concrete footings as shown on the drawings.

3.09 DRINKING FOUNTAIN **(TYPE A, B)**

A. Install a 24" inch by 24" inch concrete base, either exposed or sub-grade as directed by Project Engineer.

B. Attach fountain units to concrete bases in accordance with manufacturer's recommendations and connect water supply and drain lines.

C. Run drain line to drainage structure, gravel dry well, loose material play area or planting bed as shown on the drawings.

D. Where pavers are used install concrete base 3" inches below grade.

3.10 BOLLARDS **(TYPE A, B, C)**

A. Furnish and install the required number and types of steel bollards in the locations shown on the drawings and as directed by the Engineer.

B. Concrete for footing is specified in Section 29.

C. All welds shall be full and continuous and all cuts shall be ground smooth.

D. Paint shall be applied as specified in this Section.

E. After paint has thoroughly dried, apply reflective sheeting to bollards as shown on the drawings and as directed by the Project Engineer.

3.11 SURFACE PREPARATION AND PAINTING

A. Preparation of Surfaces

1. All surfaces to be painted shall be prepared as specified herein and shall be dry and clean before painting. Special care shall be given to thoroughly clean exposed metal surfaces to receive polyamide cured epoxy paint of all marks before application of finish.

2. All metal welds, blisters, etc. shall be ground and sanded smooth. All pits and dents shall be filled and all imperfections shall be corrected to provide a smooth surface for painting. All rust, loose scale, oil, tar and asphalt bearing coatings, grease and dirt shall be removed by use of approved solvents, wire brushing, grinding or sanding.

3. Galvanized and aluminum surfaces shall have all oxidation and foreign material removed by approved means before painting.

B. Painting Schedule

1. The following surfaces shall have the types of paint scheduled below applied at the dry films thickness (DFT) in mils per coat noted:

   Galvanized Metals - 1 coat No. 32-1210 (0.4 DFT), 1 coat Series 66 (4.0 DFT), 1 coat Series 71 (1.5 DFT).

C. Painting - General

1. On metal surfaces apply each coat of paint at the rate specified by the manufacturer to achieve the minimum dry film thickness required. If material has thickened or must be diluted for application by spray gun, the coating shall be built up to the same film thickness achieved with undiluted material. One gallon of paint as originally furnished by the manufacturer shall not cover a greater area when applied by spray gun than when applied un-thinned by brush. Deficiencies in film thickness shall be corrected by the application of an additional coat(s).

D. Field Priming

1. Steel members, metal castings, and other metals which are shop primed before delivery at the Site will not require a prime coat on the job. All piping and other bare metals to be painted shall receive one coat of primer before exposure to the weather, and this prime coat shall be the first coat as specified in the painting schedule.

2. Equipment which is specified to receive a baked-on enamel finish or other factory finish shall not be field painted unless the finish has been damaged in transit or during installation. Surfaces that have been shop painted and have been damaged, or where the shop coat or coats of paint have deteriorated, shall be properly cleaned and retouched before any successive painting is done on them in the field. All such painting shall match the original finish as nearly as possible.

3. Equipment shipped with a protective shop painting coat or coats shall be touched up to the satisfaction of the Engineer with primers as recommended by the manufacturer of the finish paint.

E. Field Painting

1. All painting at the Site shall be designated as Field Painting and shall be under the direct and complete control of the Engineer, and only skilled painters and specialist, where required, shall be used on the work.

2. All paint shall be at room temperature before applying and no painting shall be done when the temperature is below 60 deg. F, in dust-laden air, when rain or snow is falling, or until all traces of moisture have completely disappeared from the surface to be painted.

3. Finish surfaces shall not show brush marks or other irregularities.

4. Painting shall be continuous and shall be accomplished in an orderly manner to facilitate inspection. Material subject to weather shall be primed coated as quickly

as possible. Surfaces of exposed members that will be inaccessible after erection shall be cleaned and painted before erection.

5. All painting shall be performed by approved methods with number of coats modified as required to obtain the total dry film thickness specified. Spray painting shall be performed specifically by methods submitted and as approved by the Engineer.

6. All surfaces to be painted as well as the atmosphere in which painting is to be done shall be kept warm and dry by heating and ventilation, if necessary, until each coat of paint has hardened.

   Any defective paint shall be scraped off and repainted in accordance with the Engineer's directions.

7. Before final appearance of the work, all damaged surfaces of paint shall be cleaned and repainted as directed by the Engineer.

3.12 TRASH /RECYLCING RECEPTACLES

A. Install trash and recycling units on 4" inch thick concrete slabs according to manufacturer's recommendations.

3.13 PVC PIPE-PERFORATED (UNDERDRAIN)

A. While stored, pipe shall be adequately supported from below at not more than 3' foot intervals to prevent deformation. Pipe shall not be stacked higher than 6' feet. Pipe and fittings shall be stored in a manner which will keep them at ambient outdoor temperatures. Temporary shading as required to meet this requirement shall be provided. Simple covering of the pipe and fittings which allows temperature buildup when exposed to direct sunlight will not be permitted.

B. All pipe ends shall be square after cutting.

C. No single piece of pipe shall be laid unless it is generally straight. The centerline of the pipe shall not deviate from a straight line drawn between the centers of the openings at the ends of the pipe by more than 1/16" inch per foot of length. If a piece of pipe fails to meet this requirement check for straightness, it shall be rejected and removed from the site. Laying instructions of the manufacturer shall be explicitly followed.

D. All pipe and fittings discovered to be defective after laying shall be removed and replaced with sound pieces.

D. Pipe and fittings shall be installed in accordance with the instructions of the manufacturer, ASTM D2321 and as specified herein. As soon as the excavation is complete to normal grade of the bottom of the trench, place filter fabric in trench. Place specified peastone in bottom of rench and tightly tamp to 6" inch thickness. Lay pipe in trench to line and grade shown on the drawings. Place pipe with perforations at 7 and 5 o'clock position, in relation to the bottom of trench. Continue backfilling with peastone in tamped one foot layers. Lap filter fabric at top of trench.

E. Furnish and install vertical 6"inch diameter cast iron clean outs with cover, as required and shown on the drawings.

3.14 FLAG POLE

A. Install flag pole in location shown on the drawings.

B. Flag pole shall be anchored to concrete footing as shown on the drawings. Concrete as specified in Section 29.

3.15 SOCCER GOALS

A. Assemble portable soccer goals in the field with nets. Provide all necessary anchoring devices to provide a safe and stable structure as recommended by the manufacturer. No soccer or other portable net structure shall be accepted or made available for use to the public, without the Contractor first obtaining the written approval of the Engineer.

3.16 PLAYGROUND CURBING **(TYPE A, B, C)**

A. Furnish and completely install curbing to the lines and grades as shown on the drawings and as directed by the Engineer.

B. All 90 degree angles to be cut carefully and accurately. No warped, discolored or deteriorating pieces shall be incorporated into the work. No lengths less than four (4') feet shall be incorporated into the work.

C. Secure plastic curb with galvanized spikes 3'ft. minimum on center typically.

3.17 BASKETBALL BACKSTOP

A. Furnish and install the required number of backstops complete with rims, poles and concrete footings including all necessary mounting and connecting hardware.

3.18 LOOSE PLAY MATERIALS AND SPORTS EQUIPMENT

A. Furnish, deliver, unpack, and neatly organize all specified loose play materials and sports equipment within the steel storage cabinet, as directed by the Project Engineer.

3.19 WATER PLAY EQUIPMENT **(TYPE A, B, C)**

A. Furnish and completely install the required number of water play spray features (at or above finish grade), one or more child water activators, electrical conduit and system wiring, program-able controller, controller enclosure (all as required), all water piping and fittings, below ground equipment vault (as required), backflow preventer enclosure and equipment, system testing, activation, hook up to City water and electric services and adjustment of system operation. Install equipment as shown on the drawings.

* END OF SECTION *

SECTION 25

LANDSCAPING

PART 1: GENERAL

1.01 GENERAL REQUIREMENTS

A. The other Contract Documents complement the requirements of this Section. The General Requirements apply to this Section and applicable parts thereof shall be included in the work.

B. Work of this Section shall be governed by the Contract Documents. The Contractor shall provide materials, labor, equipment, and services necessary to furnish, deliver, and install all work of this Section as shown on the Drawings, as specified herein, and/or as required by job conditions.

C. All submittals, samples and/or materials, requiring the Engineer's approval, selection, tagging or marking shall be submitted to and/or coordinated with the engineer.

1.02 DESCRIPTION OF WORK

A. General: Where shown on the Drawings or as required to complete the work of this Contract, the Contractor shall provide all materials, labor, equipment and services, and perform all operations in connection with the landscape planting and including but not limited to the following:

1. Soil/Mixture Preparation.
2. Excavations, filling and grading as required for tree pits and trenches, shrub beds and ground cover areas.
3. Selective tree pruning and removal as indicated.
4. Pest control measures.
5. Planting of trees and shrubs.
6. Protection of work and watering.
7. Geotextiles.

B. Related work specified elsewhere:

1. Refer to Section 10 - Demolition and Site Preparation
2. Refer to Section 11 - Earthwork
3. Refer to Section 24 - Site Improvements
4. Refer to Section 21 and 22 - Irrigation and Water Systems
5. Refer to Section 29 - Cast-in-Place Concrete
6. Refer to Section 14 - Bituminous Paving and Granite Work
7. Refer to Section 30 - Electrical

C. Coordination of Related Work

1. Stone and concrete work: Landscape Planting work shall not be started until all other work on the planting areas has been completed and approved by the Engineer.

2. Utilities: The Contractor shall locate all underground utilities and perform work in a manner which will avoid possible damage. Hand excavate as required.

1.03 QUALITY ASSURANCE

A. Installation shall be performed by a Landscape Contractor who has successfully demonstrated competency in the installation of similar quality, schedule requirements and quantity shown for a period of not less than ten (10) years.

B. The planting of all trees will be carried out by a Massachusetts Certified Arborist or Massachusetts Certified Nurseryperson (MCN) or International Society of Arborculture, Certified Arborist (ISA-CA). This person will direct all planting operations for the Contractor and will be on the work site for all planting operations. Names of Massachusetts Certified Arborist (CA) or Massachusetts Certified Nurseryperson (MCN) or International Society of Arborculture, Certified Arborist (ISA-CA) shall be submitted for approval prior to any planting operations.

C. Analysis and tests of materials shall be made in accordance with current methods of the Association of Official Agricultural Chemists. Certified analysis by recognized laboratories shall be submitted by the Contractor to the Landscape Architect for topsoil, humus, fertilizer and materials of similar character. Manufacturer's analysis for Standard Products will be acceptable.

D. The Contractor shall be responsible for all certificates of inspection, to certify materials to be free of disease, insect pests, eggs, larvae, fungi, blight, etc., required by Federal, State and other authorities to accompany shipment of plants. The certificate shall be filed with the Engineer.

E. Plant Materials:

1. All plant materials shall meet standards set by the American Standard for Nursery Stock, American Association of Nurserymen, Washington, D.C.

2. Plant names used in plant list conform to "Standardized Plant Names" published by the American Joint Committee on Horticultural Nomenclature (current edition).

3. The Contractor shall prepare an invoice or a written statement showing the size and grade of materials received or shipped together with the source of origin and the health of the plant materials.

4. The Contractor shall certify and guarantee that all plant materials is true to name and in conformance with these Specifications.

1.04 SUBMITTALS

A. Soils and Soil Management: Contractor shall make the following submittals and perform the following testing program on all on-site soils to be reused as backfill and on all off site borrow soils and material placed on the project. The

cost of all submittals and testing stated below shall be incidental to the work and paid for by the Contractor.

Independent Laboratory and Testing Company. Submit 4 weeks prior to start of excavation, evidence that the Laboratory/testing company is:

a. accredited by the American Associates of the State Highway and Transportation Officials (AASHTO)

b. Has minimum 3 years' experience in sampling, testing and analysis of soil and aggregates, and monitoring field compaction operations.

c. Able to provide 3 references from previous work.

2. Submit to the City and the Engineer grain size analysis curve (ASTM D422) and compaction test results (ASTM D1557) for each proposed source of backfill including suitable on-site soil to be reused as backfill, for review two weeks prior to use of the material. Grain size analysis shall indicate that the backfill material conforms to the gradation requirements specified.

3. Contaminant analysis for off-site borrow materials used. Each material imported shall be accompanied by a certification statement and analytical results. At a minimum, the certification shall state that the point of origin and that the material is free of contaminants. The certification shall include representative sample analysis from each point of origin of backfill to be used on the site. The samples shall be analyzed by a certified laboratory for total metals (EPA priority pollutant metals), volatile organic compounds (EPA Method 8270), petroleum hydrocarbons (EPA method 418.1), and Total PCB's and pesticides (EPA Method 8081 and 8082). On site soils designated as suitable for reuse can be reused as backfill without providing certification required above.

B. Planting soil: At least 30 days prior to ordering materials, the Contractor shall submit to the Owner's Representative representative samples, certifications, manufacturer's literature and certified test results for proposed planting soil.

C. Structural Planting Medium: At least 30 days prior to ordering materials, the Contractor shall submit to the Owner's Representative representative samples, certifications, manufacturer's literature and certified test results for proposed structural planting medium.

D. Names of Massachusetts Certified Arborist (MCA), International Society of Arboriculture Certified Arborist (ISA), or equivalent will be submitted and approved by the City Arborist before any planting occurs.

E. Mycorrhizal Fungal Transplant Inoculant with hydrogel: Submit one (1) sample packet showing composition and analysis for fertilizer, also submit invoices of total purchased material for this contract.

F. Structural Planting Medium: At least 30 days prior to ordering materials, the Contractor shall submit to the Owner's Representative representative

samples, certifications, manufacturer's literature and certified test results for proposed structural planting medium.

G. Fertilizer: Submit one (1) sample packet of fertilizer showing composition and analysis for fertilizer, also submit invoices of total purchased material for this contract.

H. Drip irrigation bag product: Product literature.

I. Planting Mulch: Submit a one- (1) cubic foot sample.

J. Stakes and ties: Product literature and sample.

K. Edging: Product literature and sample.

L. Certify, invoice, and order plants for each shipment grown, free of disease and insect pests. Submit certificates to Engineer.

PART 2: PRODUCTS

2.01 PRODUCT DELIVERY, STORAGE AND HANDLING

A. All packaged materials shall be delivered in unopened bags or containers, each bearing the name, warranty, and trademark of the producer and the composition, analysis and the weight of the material. Store in a manner to prevent wetting, deterioration or any other form of damage.

B. All plant materials shall be delivered in undamaged condition.

1. No damaged or wounded plant root balls or plant containers will be accepted.

2. The Contractor shall remove any such damaged materials promptly from the site.

3. Materials adjacent to refrigeration units in trucks will be marked and identified to the Engineer.

C. All temporary stored plant materials shall be protected from desiccation, evaporation and any other damage.

2.02 PLANTING SOILS

M. Contractor shall provide all planting soil required to complete the planting operation. Planting soil shall be a natural, fertile, friable loam typical of cultivated planting soil of the locality, containing at least 10% and not more than 20% decayed organic matter (humus). Planting soil shall be free of sub-soil, stones greater than one and one-quarter inches, earth clods, sticks, stumps, clay lumps, roots, or other objectionable, extraneous matter or debris. Planting soil shall not be by test either excessively acid or alkaline nor contain toxic substances. Planting soil shall not be delivered or used for planting while in a frozen or muddy condition.

N. Soil for planting trees shall be one of the following sandy loams; "course sandy loam ", "sandy loam", and "fine sandy loam": determined by mechanical analysis (ASTM D 422) and based on the "USDA Classification System" and as defined in this Section. It shall be of uniform composition, without admixture of subsoil. Planting soil for trees shall have the following grain size distribution for material passing the #10 sieve:

Millimeter	Percent Passing by Weight	
	Maximum	Minimum
2	-------	100
1	100	80
0.5	87	67
0.25	78	48
0.10	68	30
0.05	55	22
0.002	7	2

1. Maximum size shall be one and one quarter inches largest dimension. The maximum retained on the #10 sieve shall be 25% by weight of the total sample.
2. The ratio of the particle size for 80% passing (D_{80}) to the particle size for 30% passing (D_{30}) shall be 6.0 or less. ($D_{80}/D_{30} < 6.0$)

O. Name of planting soil supplier and sample to be approved by the Project Engineer.

2.03 FERTILIZER

A. Fertilizer shall be a complete, slow-release, root contact packet, 16-8-16, or equal, that is engineered to stimulate root growth and is a standard product complying with State and Federal Fertilizer Laws.

B. Name of supplier and sample to be approved by the City Arborist.

2.04 WATER

A. Water furnished by the Contractor will be free of ingredients harmful to humans and plant life. The Contractor will supply hoses and other watering equipment required for the work.

B. The Contractor shall be responsible to furnish its own supply of water to the site.

C. Contractor may get water from a City of Cambridge fire hydrant only with the approval of the City's Water Department. The Contractor will be responsible for following all the procedures and requirements set by the Water Department. The Water Department will provide the Contractor with a meter and/or backflow device and will charge the Contractor a fee for the water and meter and/or backflow device. It is the responsibility of the Contractor to obtain this information. The Cambridge Water Department can be reached at 617-349-4025.

D. Watering for trees shall be provided through use of a drip irrigation type bag which shall be approved by the City Arborist.

1. To be constructed of a flexible watertight material
2. Holding capacity of a minimum of 20 gallons
3. Must have opening in top for filling.
4. Must have small holes in bottom that slowly releases water
5. Rate of complete water release must be no quicker than 5 hour following complete fill.

E. Name of drip irrigation bag product, supplier and sample to be approved by the City Arborist.

2.05 MULCH

A. Mulch shall be high quality, shredded or double-ground, premium bark mulch consisting of clean, organic plant material.

B. Shall be uniform in color, a good brown color. The composition of the shredded pine bark material shall not exhibit a noticeable degree of any color change characteristics when wet.

C. The mulch must be free of dirt, insects, disease and extraneous debris that would be harmful to all trees being installed.

D. The shredded pine bark mulch material shall not have an unpleasant odor.

E. Bark Mulch shall be a well-graded material conforming to the following:

1. pH between 4.0 – 8.0
2. Particle size 100% passing a 50mm (2 inch) screen
3. Soluble salt content < 4.0 mmhos/cm

F. Prior to the Contractor ordering shredded pine bark mulch material, the Contractor shall submit to the City Arborist, at the Contractor's expense, one cubic foot sample of the shredded pine bark mulch material. The Contractor shall not order any delivery of the shredded pine bark mulch material until the Contractor's sample has been inspected and approved by the City Arborist.

G. If the City Arborist disapproves of the sample submitted by the Contractor, then the Contractor shall continue at no expense to the City, to obtain other sources of pine bark mulch material as specified until the Contractor's sample of such material, meets with the City Arborist's approval.

2.06 STAKING

A. Stakes will be wood, 10' x 2" x 3" in size, pointed at one end.

B. Tree ties shall be black polyester straps. Both must be approved by the City Arborist.

C. Samples of stakes and tree ties shall be submitted to the City Arborist for approval.

2.07 EDGING

A. For new or expanded tree wells in brick sidewalks, the Contractor shall install edging around the perimeter of the tree well to keep the bricks from displacing.

B. Aluminum edging shall be shop fabricated from aluminum alloy 6063-T6, 3/16 inch thick x 1-5/8 inch or 2-1/4 inch deep, with standard black baked-on acrylic paint finish. Edging shall be furnished in 16-foot lengths.

1. Adjacent sections shall be adjoined using a 4 inch sliding, locking connector of aluminum alloy 6063-T6.
2. Stakes shall be spiral steel spikes with insulating plastic washers 10 inches x 3/8 inch.

C. Name of edging product, supplier and sample to be approved by the City Arborist.

2.08 TREE PLANTING MATERIALS

A. Plant Identification and Standards: The nomenclature used in the plant list generally conforms to that of the current edition of Standardized Plant Names, as adopted by the American Joint Committee on Horticultural Nomenclature. All tree plantings shall conform to the varieties and sizes specified in the Plant List, and to the code of standards set forth in the current edition of American Standard for Nursery Stock. Substitutions will not be permitted without the consent of the City Arborist.

B. Plant List: The Contractor shall supply the plants necessary to complete the work as intended. Where the size of a plant on the Plant List is a variation between a minimum and maximum dimension, the sizes of the plants furnished will be equal to the average of the two dimensions. Where a single dimension is given, this dimension represents the minimum size of the plants to be furnished.

C. General Trees:

1. All plants shall be nursery grown whether balled and burlapped or container grown, under climatic conditions similar to those in Cambridge, Massachusetts. The tree plantings shall be typical of their species and variety. Trees shall be straight, symmetrical with a crown having a persistent main leader, be growing from a single, healthy root system with no girdling roots. All tree plantings shall be sound and healthy free from defects, disfiguring knots, sun scald, and injuries or abrasions of the bark. They shall be free of plant diseases, pests, scale and all forms of infestations, and possess a normal balance between height and spread. Plants shall be matched as closely as possible where uniformity is required.
2. Trees shall be inspected at place of growth by the City Arborist and a representative of the Contractor for conformity in shape, proportion, symmetry, branching habit and character. Unless a tree clump is designated, the trunk of each tree shall be single and straight. Each tree shall be grown from a single un-mutilated crown of roots and shall have main leaders intact. Old abrasions and Pruning wounds over ¾ inch in diameter shall be completely callused over.

3. Tree Limb Structure: All limbs on large trees maturing over 30 feet must originate on the trunk at 7 feet above the top of root ball. Small trees maturing less than 30 feet must have limbs that start no lower than 5 feet. All trees will be selected by the City Arborist.

D. Substitutions: Substitutions will not be permitted. If, however, proof is submitted that a plant(s) is not obtainable or does not meet requirements of Specification, use of nearest equivalent size or variety will be considered. Plants larger than specified may be used at no increase in cost. Proposed substitutions must receive the written approval of the City Arborist. When sources for plants are located by the City Arborist, there will be no substitutions and those sources will be used. The City does not guarantee it will accept substitutions. The City will require that the Contractor try every means possible to obtain the specified trees.

E. Inspections: Plants shall be inspected, selected and tagged at place of growth by the City Arborist with the Contractor. Inspection and approval at the source(s) shall not waive the right of rejection for failure to meet other requirements during progress of work.

2.09 PLANT ROOT BALLS

A. All root balls shall conform to the size requirements specified for the proposed tree species and size at planting identified in the Plant List, and to the code of standards set forth in the current edition of American Standard for Nursery Stock.

B. All tree plantings either balled and burlapped or container grown shall retain root systems as solid units. The diameter and depth of the balls of soil must be sufficient to encompass the fibrous and feeding root system necessary for the healthy development of each tree planting.

C. The tree plantings and root balls shall remain intact as a unit during all operations. No tree planting shall be accepted when the ball of earth surrounding its roots has been badly cracked or broken, either before or during the process of planting.

2.10 PLANT LABELS

A. Plant labels shall be provided by the Contractor for each tree and shall be durable, legible labels, stating the correct tree name and size, in weather resistant ink or embossed process lettering, and can be removed at end of Contract.

2.11 PLANTING SOIL MIXTURE FOR COMMUNITY GARDENS

Furnish and install the required soil for raised planters. Planting soil mix for raised planters shall consist of 70% good horticultural screened loam and 30% compost using "Coast of Maine "compost made from marine plants and animals, (or equal composting product from marine plants and animals). Submit samples of screened loam and composting additive for approval prior to delivery to the site. Loam and composting material shall be mixed thoroughly with a backhoe on site and inspected by the Project Engineer prior to placement into raised planters.

2.09 PLANT TREATMENT PRODUCT

1. Anti-desiccant: shall be Hydrotec-100, supplied by Botanical Security Products Co., 200 Park Avenue, New York, New York 10017, Wilt Pruf NCF supplied by Nursery Specialties Products Inc., Croton Falls, N.Y.; Varnax No. 2 supplied by Vansul & Co., 193 William Street, Englewood, N.J. or approved equal. Anti-desiccant shall be mixed according to the directions.

3. An approved tree paint shall be waterproof, adhesive and elastic, shall possess an antiseptic, free from kerosene, coal tar-creosote or any other material injurious to the life of the trees.

2.10 TREE GUYING

1. Furnish at the locations shown on the drawings and as required to complete the work of this Contract "Duckbill" tree guying kits manufactured by Foresight Inc., supplied by American Arborist Supplies Inc., Fax: (888) 441-8382, or approved equal. Tree support kits are pre-assembled including anchor cable, turnbuckles, tree collars, and wire rope clips. Galvanized steel cable shall be supplied with high visibility white vinyl coating where used in playgrounds or other active recreation situations.

2. Model kit 40 DTS kit shall be used for trees up to three (3") inch caliper. Model 68 DTS kit for trees up to six (6") inch caliper and Model DTS 55 for trees up to ten (10") inch caliper size.

2.11 DEEP ROOT BARRIER

Furnish and install the required number of 36" depth, 8 ml. thick continuous root barrier, manufactured by Deep Root Partners, L.P. 530 Washington Street, San Francisco, CA 94111; info@deeproot.com; Phone: 800.458.7668; Fax: 800.277.7668, or approved equal. The containment barrier should be set at depth of 33", for running bamboo. The top edge of the barrier should extend 3"inches above the existing grade. Root barrier shall be a polyethylene product which is formed from recycled materials. Insert barrier in soil and position 3"inches above soil grade. Sold in rolls of 100'ft. typically. Supplied with connecting hardware for attaching ends together.

PART 3: EXECUTION

3.01 SITE INSPECTION

A. When general construction, sub-grading and drainage work is sufficiently advanced, the Project Engineer shall visit and inspect the site and all conditions thereon, and take into

consideration all such conditions that may affect his work. Do not start planting work until unsatisfactory conditions are corrected.

3.02 PREPARATION OF PLANTING AREAS

A. Sequencing:

1. Do not proceed with excavation of tree medians and pits until the Engineer reviews, adjusts as necessary and gives approval to the layout of the staked medians.
2. Do not proceed with planting installations until the Project Engineer reviews and approves the sub-grades of the gravel and the tree pit sub-grades.

B. Time: The preparation of planting areas and tree pits may begin prior to the specified planting season providing the subgrade has been established and providing that in the judgment of the Project Engineer, the general construction work is sufficiently advanced.

C. Planting Medium Mixture: The Contractor shall prepare soil, the planting mixture, off site and shall deliver and install it in its mixed condition. No soil mixing is to take place at the site.

D. General Cleaning: The Contractor shall remove and dispose of any rock, rubble or other underground obtrusions to a depth necessary to permit proper planting.

E. Planting Beds:

1. Before depositing and spreading the planting bed mixture, the Contractor shall rake the subsoil surface clear of stones, debris and rubbish. The Planting soil shall then be spread, raked, compacted and otherwise manipulated to form, after tamping and settlement, smooth draining areas as shown on the Contract Drawings. The depth of soil mixture after compaction shall be as follows: thirty (30) inches for tree planters, thirty (30) inches deep in shrub and ground cover areas and to be within three (3) inches of final finish grade.
2. After installation of the prepared planting bed mixture and prior to mulching and planting, all planting beds shall be compacted by method of tamping and watering down. Additional planting bed mixture shall be installed as necessary to meet specified grades.

3.03 EXCAVATION OF EXISTING PLANTING BEDS

A. Prior to the excavation of existing planting beds and the driving or placing of stakes or dead-men, etc., the Contractor shall ascertain the location of all electrical cables, conduits and utility lines, so that proper precautions may be taken not to disturb or damage any subsurface improvements. In the event any subsurface improvements are uncovered, the Contractor shall promptly notify the Engineer who shall arrange to relocate the plant material. Failure to follow this procedure places upon the Contractor responsibility of making, at his own expense, all the requisite repairs to damaged utility lines resulting from work hereunder.

B. The Contractor shall excavate existing shrub and tree pits to a depth of thirty-six inches (36") or as necessary to remove all existing plant roots.

C. Disposal: The Contractor shall remove and dispose properly of all excess excavations and unsuitable materials.

D. Liability: The Contractor shall be liable for any damages to property caused by excavation and all other planting operations. All disturbed areas shall be restored to their original condition. All pavements, courts and roads, littered with dirt, stones and other objectionable material due to construction of planting operations shall be thoroughly cleaned each day by the Contractor before leaving the site.

3.04 EDGING

A. Edging shall be installed at perimeter of new and expanded tree pits that abut brick paving. Install edging with the base resting on the base and facing toward the brick paving and sidewalk. Set edging to the required alignment, straight and true and to the required elevation to ensure full paver restraint. Thread spike through insulating washer. Drive spikes into base until spike head firmly wedges washer against flange of aluminum edging.

1. Edging shall be securely staked in required position. Stakes shall be driven every 12 inches in straight runs and into every support section in curved sections.
2. Adjacent lengths shall be attached using manufacturer's standard connections according to manufacturer's published instructions.
3. Edging shall be set plumb and vertical at required line and grade. Straight sections shall not be wavy; curved sections shall be smooth and shall have no kinks or sharp bends.

3.05 TREE PLANTING SEASON

A. Tree planting can occur under normal, favorable weather conditions. Tree planting will not be permitted as determined by the City Arborist under adverse weather conditions such as when the ground is frozen or during extreme heat.

B. The City anticipates the planting work will primarily take place during the Spring and Fall planting seasons. On occasion plantings may take place outside of these times.

1. Spring: April 1st – June 15th
2. Fall: September 15th – November 30th

3.06 TREE PLANT SELECTION

A. The City Landscape Architect or his/her representative will select and tag all specified tree planting material at the nursery locations.

3.07 PLANT MATERIAL HANDLING

A. Plants shall be handled and transported so as to prevent damage of any sort including but not limited to breakage of branches, scraped or bruised trunk, or broken root ball and roots

B. Plants shall be protected during storage, and transportation by watering, covering, as necessary to ensure their continued health and viability.

C. Special care shall be taken to insure that the roots of bare root and balled and burlap trees are not damaged and not allowed to dry out during the course of a work day.

D. Bare root and balled and burlap trees are to be placed on a trailer, truck or other equipment gently and in a manner that does not damage any portion of the tree. Once placed they are to be covered in such a manner that sun light does not shine on the roots of the plant and the branches are protected from wind damage.

E. If it is determined that poor handling and neglect by the Contractor has caused a plant to die or fail to establish the Contractor shall be responsible for the cost of replacing the plant. Costs shall include the cost of purchase, cost to remove dead plant and cost to install new plant. Neglect may result in potential contract termination.

3.08 TREE PLANT DELIVERY

A. The Contractor will inspect and approve all trees at the nursery(ies) prior to pick up. However, this does not alter the right of the City Arborist to inspect and reject unsuitable trees delivered to the planting site.

B. When plants cannot be transported and planted immediately upon being dug they shall be stored and protected from desiccation and extremes in temperature by being heeled-in, watered, and covered.

3.09 TREE PLANT STORAGE

A. Tree plantings shall be delivered to the Contractor's storage site and to the tree planting site in a well-watered and vigorous condition. All unplanted tree plantings shall be protected at all times from sun and drying winds. Care must be taken so as not to damage bark, break branches, or cause injury to the tree.

B. Contractor may, with City Arborist or Golf Course Superintendent permission, utilize the Cambridge Municipal Golf Course as a staging area for all trees furnished and planted under this Contract, unloaded by the Contractor, and cared for by the Contractor until satisfactorily planted.

C. Contractor shall provide the City Arborist with a schedule of tree pick-up. Tree pick-up shall be done prior to 9:00 a.m. at the golf course.

D. All trees shall be stored in an upright position and grouped according to Genus, Species and 'cultivar' or 'variety'. Stored trees shall be mulched (enough to cover 2/3 of the root-ball and heavily watered twice a day to prevent wilt and undue stress to the trees).

E. Bare root and balled and burlap trees are to be removed from the City's holding area on a daily bases. Only the plants that can be planted in the course of a normal work day should be

removed from the holding area.

F. Bare root and balled and burlap trees are held in a woodchip mulch while waiting to be planted and are watered regularly by the Contractor to maintain root health. The Contractor will be expected to remove the trees from this mulch prior to bringing the plants to the planting location. Care shall be taken to not damage any of the roots during the removal process. Damaged roots/ plants will be the responsibility of the Contractor.

G. It is the Contractor's responsibility to determine the best method to insure that the roots of bare root and balled and burlap trees are not damaged and do not dry out during the course of the planting process.

H. It is expected that bare root trees removed from the woodchip mulch will be immediately placed in large plastic bags provided by the City and left in these bags until immediately before installation.

I. At no time shall the roots of bare root and balled and burlap trees be exposed to direct sunlight, wind and drying out. Plants are to be covered immediately after removal from the woodchip mulch and not uncovered until immediately prior to installation. While sitting waiting to be installed plants and associated roots must be covered and protected from light and drying out.

J. Periodically throughout the day the roots of bare root trees are to be misted with water. The frequency for this misting will be determined by the City Arborist based on current weather conditions and plant needs.

3.10 GENERAL TREE PLANTING

A. Prior to tree planting, the City Arborist will supply in writing to the Contractor specified tree planting locations showing the tree selected and approved.

B. Immediately after planting, Contractor shall provide one informational door hanger to residence directly adjacent to new tree planting. Door hangers to be provided by the City of Cambridge.

C. Tree planting areas may need pavement removal as required by the City Arborist. All materials excavated from the tree planting areas and considered detrimental to the growth of the trees, such as an existing tree or stump, sidewalk paving, rocks, sub-soil and debris, shall not be reused for fill or in the planting operation, and must be removed from the site.

D. Any unexpected obstructions at the site that interfere with the tree planting operation will be communicated to the City Arborist to determine a solution before planting occurs.

E. Soil of very poor quality or heavy clay encountered by the Contractor must be reported to the City Arborist for removal and amended as required.

3.11 PLANTING HOLE PREPARATION

A. Remove all soil, where present, from above the root flare to expose the top-most root where it emerges from the trunk, and measure the distance between the top-most root and the bottom of

the root ball or root mass.

B. Hole shall be dug about 10% shallower than this depth and at least three times the width of the ball or in the case of bare root at least one foot further than the longest roots.

C. Planting pits shall be excavated to the full width and length of the surface opening. In lawn areas, the planting area must be dug to the depth of the root-ball and 3 times the width.

D. When planting holes are dug using mechanical means, i.e. backhoe, excavator, auger, etc., and the side walls of the pits become plastered or glazed, the plastered or glazed surface shall be properly scarified.

E. Surplus excavation and unsuitable material from the planting holes shall removed from the site and disposed of per Section 3.13 SOIL AND WASTE MANAGEMENT of this Specification.

F. Upon approval of plant locations and pavement removal (where applicable), excavate existing soils and remove all trees and stumps 5" or under, and any other deleterious materials, as shown on the drawings and as specified herein. The Contractor must haul and legally dispose of excavated material off-site.

G. The tree well will be cut based on the markings on the sidewalk. The dimensions of each tree well will be noted on the planting list given to the Contractor prior to the start of planting. Note: The initial list will not contain 100% of the planting sites for the season. The tree well must be excavated to its full extent. Acceptable material may be put back into tree well and amended as needed with approved planting soil. If excavated material cannot be reused refer to Section 3.13 SOIL AND WASTE MANAGEMENT for instruction.

H. Planting pits will require a minimum of 4' of walking space for sidewalk pedestrian traffic.

I. Planting wells and areas shall be approved by the City Arborist, or designee, before back filling.

J. Tree wells shall be at least 16 square feet, 8'x2' or as directed by the City Arborist.

3.12 SOIL AND WASTE MANAGEMENT

A. For guidelines and policies related to handling and disposal of contaminated soil please refer to the Department of Environmental Protection (DEP) Website at http://www.mass.gov/eea/agencies/massdep/.

B. It is the objective of soil/fill management practices specified here to handle all soil/fill excavated during the course of this contract in a cost-effective manner and in accordance with applicable state and federal regulations. The Contractor shall reuse excavated materials, as approved by the City Arborist, prior to using imported fill in order to reduce the volume of material to be disposed off-site provided the material is geotechnically suitable as backfill and does not result in spreading contamination to other areas or other soil/fill strata.

Excavated soil/fill, which is displaced by planting of trees, may be used as backfill elsewhere on the project provided the soil/fill is geotechnically suitable and does not result in spreading

contamination or degrade the environmental quality at the location of reuse. Imported backfill shall be used only as accepted by the City Arborist.

C. Any soils which exhibit petroleum or chemical odor or visual indications of oil or hazardous materials shall be handled as potentially contaminated soils. Soil which does not have any evidence of contamination can be reused within the *area of excavation*. Soil/fill which is staged and characterized can be reused within the *area of excavation* or elsewhere on site provided the material has equal or less contamination than the point where it is to be reused.

E. Contaminated soil/fill (including petroleum-contaminated soil/fill) which cannot be reused on site shall be delivered within the City to a stockpile location to be determined by the City of Cambridge.

F. Notification Procedures:

1. In the event of an emergency, the Contractor shall contact the following entities at the earliest possible opportunity:

   a. City's designated representatives.
   b. City of Cambridge DPW
   c. City of Cambridge Fire Department
   d. City Arborist
   e. MassDEP

2. The Contractor shall prepare in advance of work activities a notification list, complete with phone numbers, addresses, and contact names for all parties to be notified (including, but not limited to, the parties listed above) in the event of an emergency.

3.13 TREE INSTALLATION

A. Trees shall be plumb, faced to give best appearance, and planted at the center of the planting areas. If the Contractor is unable to install tree at proper grade and/or in center of tree well or designated planting location, the Contractor shall not install tree and contact City Arborist immediately.

B. Trunk flare must be visible and free of adventitious roots.

C. Place the tree in the planting hole so that the top of the root ball where the trunk flare is visible is 1" above the established sidewalk level. If root flare is covered or set significantly higher (or lower) than 1" above sidewalk grade than the Contractor will not be paid for that tree until it is properly adjusted.

D. Any non-degradable materials used in wrapping the root ball must be entirely and carefully removed so as not to disturb the roots. Cut and remove not less than 2/3 of burlap and wire basket from root ball. Carefully cut containers and remove plant balls keeping the root ball intact. All materials cut away from the root balls must be removed from the site. DO NOT PULL WIRES OUT FROM UNDER THE ROOT BALL.

E. Remove top 2/3 of burlap off the root ball. DO NOT PULL BURLAP OUT FROM UNDER THE ROOT BALL. Cut and remove all rope. Remove all non-biodegradable root ball materials, if present.

3.14 FERTILIZING

A. Insert approved slow-release plant packets, number according to the caliper of the tree with the approval of the City Arborist before back-filling.

3.15 BACK-FILLING

A. Carefully backfill by hand the approved topsoil in layers and water each layer thoroughly to fill all voids and allow to settle. Finish back-filling to a depth that finished grade level at settlement will be at established sidewalk level.

1. Fill hole about 1/3 full and gently slice a shovel down into the backfill 15 to 25 times all around the tree. Do NOT step firmly in the backfill soil because this could compact it and restrict root growth. Be careful not to damage the trunk or roots in the process.
2. Water the first third of soil to settle and eliminate air pockets. Backfill the remainder of the tree well in layers not to exceed six 6 inches. Water soil to settle. Fill in any holes or depressions with additional backfill soil. When the hole is filled with soil the root ball should remain approximately 2 inches above the backfill soil. The top of the root ball is not to be covered by the backfill soil.

B. Surround each tree with a shoulder of topsoil to form a temporary saucer, 3 inches deep and equal to the diameter of the planting hole.

3.16 WATERING (INSTALL THROUGH FIRST 30 DAYS)

A. After bringing soil in the tree well to grade and forming the planting saucer, thoroughly soak the tree well by repeatedly filling the tree well with water to the full depth of the saucer, allowing the water to completely percolate into the soil between fillings.

B. At the time of planting judiciously flood plants with water. The Contractor will also include in his base bid costs for watering trees twice a week exclusive of Saturdays, Sundays and holidays for a period of 30 days from the date of planting.

C. Watering shall be provided through use of a drip irrigation bag which shall be furnished by the Contractor and installed immediately on each tree following planting per the manufacturer's instructions.

1. Immediately following the planting of the tree, a drip irrigation bag is to be installed per the manufactures instructions.
2. Drip irrigation bag is to be placed around one of the tree planting stakes and rotated so that the zipper faces away from the trunk of the tree with the stake in the middle of the bag.
3. Drip irrigation bag is to be secured with a zip tie or similar locking device to avoid unwarranted removal
4. At each subsequent watering the drip irrigation bag shall be moved to the

opposite tree stake and the process repeated. This bag rotation shall occur weekly throughout the duration of the first 30 days, and shall continue to occur as specified in Section 3.18.

5. If drip irrigation bag is removed, defective or vandalize, Contractor shall be responsible for installing new drip irrigation bag.

D. The Contractor shall work with the City Arborist to develop a schedule of watering which will be performed showing which plants will be watered during the Guarantee Period.

E. All installed trees that are injured or damaged due to the lack of water, or the use of too much water, shall be the Contractor's responsibility to correct.

3.17 WATERING (1 YEAR GUARANTEE PERIOD)

A. Watering during the Guarantee Period shall be performed as specified in Section 3.17 and shall occur a minimum of once per week (approx. 4x per month) or as acceptable to the City Arborist.

1. Drip irrigation bag is to be placed around one of the tree planting stakes and rotated so that the zipper faces away from the trunk of the tree with the stake in the middle of the bag.
2. Drip irrigation bag is to be secured with a zip tie or similar locking device to avoid unwarranted removal
3. At each subsequent watering the drip irrigation bag shall be moved to the opposite tree stake and the process repeated. This bag rotation shall occur weekly throughout the duration of the Guarantee Period.
4. If drip irrigation bag is removed, defective or vandalize, Contractor shall be responsible for installing new drip irrigation bag.
5. At the end of the watering period the Contractor shall remove all irrigation bags and deliver them neatly stacked to the Public Works Department for winter storage.

C. The Contractor shall work with the City Arborist to develop a schedule of watering which will be performed showing which plants will be watered during the Guarantee Period.

D. Watering shall be provided from May 15 through November 15 at the discretion of the City Arborist.

E. All installed trees that are injured or damaged due to the lack of water, or the use of too much water, shall be the Contractor's responsibility to correct.

3.18 MULCHING

A. Apply a three inch layer of mulch (after settlement) around plants. This area shall be at six feet in diameter around the trunk of the plant, unless otherwise specified by the City Arborist.

B. Mulch shall not come in contact with the trunk of the plant or the root flare. Mulch should be

two to three inches from the trunk.

C. Place mulch immediately after planting. No planting areas shall be left for any longer than thirty minutes without mulch. No mulch material shall be applied prior to the initial watering of plant.

D. From time to time the City may require additional mulch at various tree locations and existing planting beds citywide. Mulch is to be applied as outlined in this section.

E. When the City opts to mulch existing trees and planting beds the Contractor is to remove all existing unwanted vegetation (i.e. weeds) and debris.

3.19 STAKING

A. Stake, guy and anchor immediately after planting of each tree. Equally space stakes and set parallel to structures, contours, paving or curbs. Set plants plumb and hold in position until the soil has been tamped solidly around the ball and/or roots. Place stakes to depth indicated and fasten to tree with approved strapping, with appropriate knot.

B. Any stake or strap that becomes displaced or broken shall be reset or replaced promptly.

C. Staking shall be of uniform height after being driven at an angle one foot below bottom of tree well and drawn vertical. Place stakes to avoid root damage and at reasonable and proper distance from trunk to prevent movement of tree and root system; tension on stakes and guy wires to be equal and at a slight angle away from tree.

No. of Stakes	Size	Length Tree Size
2	2" x 3" x 8'	From 1" caliper up to and including 3-1/2" caliper

D. Stakes for supporting trees shall be of uniform size, 2" x 3" x 8', capable of standing in the ground at least two years.

3.20 PRUNING

A. Prune only badly bruised, broken, or crossing limbs.

3.21 CLEAN UP

A. Removal and Disposal of Tree and Woody Vegetation Debris

1. The Contractor shall be responsible for the immediate removal of all debris resulting from the work at each job site. Each job site is to be left in a condition equal or better than that which existed prior to the execution of work order. The Contractor shall be solely responsible for disposal of all tree debris.

2. The City reserves the right to retain all debris, chips and wood from work completed on City of Cambridge trees at no cost to the City. The City reserves the right to use this material in any way it sees fit.

B. Restoration of work areas and cleanup

1. All areas damaged during the process of the work shall be the responsibility of the Contractor and who shall restore the disturbed and damaged areas to a condition satisfactory to the City Arborist. This may include, but not be limited to tilling, grading, paving, fertilizing, mulching, etc.
2. The Contractor shall also be responsible for any other damage caused by his or her process of work operations and shall dispose of all rubbish, excess soil, etc., as directed by the City Arborist, all of which shall be done at no expense to the City of Cambridge.

3.22 CONTAINER PLANTING: GROUND COVERS

A. Layout: The Contractor shall stake out plant massing outlines and place all plant containers for review and approval by the Engineer.

B. Digging: The Contractor shall lay mulch dressing aside and dig appropriately sized holes for each container plant.

C. Setting: The Contractor shall remove the plant from its container, spread its roots slightly and set it in the center of its hole. All plants shall be plumb and straight and at such level, that after settlement, a normal or natural relationship of the crown of the plant with the ground surface will be established.

D. Tamping: After proper plant placement, the Contractor shall hand tamp the soil and replace mulch around base of plant.

3.15 PROVISIONAL ACCEPTANCE

A. At the time the Contractor completes the planting work, they shall request an inspection in writing for provisional acceptance of their work from the Project Engineer. The Project Engineer shall inspect the work (materials and installation) and if all is in accord with the Contract Drawings and Specifications give provisional acceptance to the completed work. The Contractor shall make request for provisional acceptance, at the end of the ten (10) week maintenance period. After any necessary corrective work has been completed, the Project Engineer will certify in writing the provisional acceptance of the plantings.

3.16 GUARANTEE (1 Year)

A. Replacement: The Contractor shall replace in accordance with the Contract plans and specifications any planted trees and shrubs that are dead or**, in the sole opinion of the City Landscape Architect**, or his/her representative, are in an unhealthy or unsightly condition, and/or have lost their natural shape due to dead branches, excessive pruning, inadequate or improper maintenance, or other causes, **within the period of one (1) year after final acceptance.** The cost of replacement shall be included in the unit prices bid for the various items of the Contract. Where planting material has been deemed vandalized, Contractor shall

remove vandalized plant material, including stakes, burlap and wire. Earth will be leveled and new topsoil ground cover and/or appropriate paving material added by the Contractor at the direction of the Project Engineer to eliminate any hazardous conditions.

3.17 FINAL ACCEPTANCE

A. At the end of the guarantee period, a final inspection shall be arranged and made by the Owner and the Contractor. At the time all trees deemed stable will have the guying removed and disposed of. If all the work is found acceptable a final acceptance shall be issued by the Project Engineer.

B. If at the final inspection the work is found unacceptable the Contractor shall make all corrections to the unacceptable part of the work at no additional cost to the Owner and until a new final inspection can be made and the work accepted by the Project Engineer. The Project Engineer will certify in writing the final acceptance of the plantings.

* END OF SECTION *

SECTION 26

MISCELLANEOUS WORK AND CLEANUP

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required to do the miscellaneous work not specified in other sections but obviously necessary for the proper completion of the work as shown on the Drawings.

B. When applicable the Contractor will perform the work in accordance with other sections of this Specification. When no applicable specification exists the Contractor shall perform the work in accordance with the best modern practice and/or as directed by the Engineer.

C. The work of this Section included, but is not limited to, the following:

1. Crossing and Relocating Existing Utilities

2. Restoring of Driveways, Fences and Curbing

3. Cleaning Up

4. Incidental Work

1.02 CROSSING AND RELOCATING EXISTING UTILITIES

A. This item includes any extra work required in crossing drains, gas mains, water mains, and water services and other utilities. This work shall include but is not limited to the following: bracing, hand excavation and backfill (except screened gravel), and any other work required for crossing the utility or obstruction not included for payment in other items of this specification. Notification of Utility Companies shall be as specified in Section 3.

B. In locations where existing utilities cannot be crossed without interfering with the construction of the work as shown on the Drawings, the Contractor shall remove and relocate the utility as directed by the Engineer or cooperate with the Utility Companies concerned if they relocate their own utility.

C. At pipe crossings, and where designated by the Engineer, the Contractor shall furnish and place screened gravel bedding so that the existing utility or pipe is firmly supported for its entire exposed length. The bedding shall extend to the mid-diameter of the pipe crossed. Payment for screened gravel at pipe crossings will be made according to the unit price bid established in the Proposal.

1.03 RESTORING OF DRIVEWAYS, AND FENCES

A. Existing public and private driveways, walkways, other paved surfaces, and granite curbing disturbed by the construction shall be replaced. Paved drives shall be repaved to the limits and thicknesses existing prior to construction. Disturbed walkways shall be repaved to the limits established by the Engineer. Disturbed granite curb shall be reset in accordance with these specifications.

B. Fences in the vicinity of the work shall be protected from damage under this item. If damaged, fences shall be replaced with new fencing and the work shall be satisfactory to the Engineer.

1.04 CLEANING UP

A. The Contractor shall remove all construction materials, excess excavation, building, equipment and other debris remaining on the job as a result of construction operations and shall restore the site of work to a neat and orderly condition.

B. The Contractor shall remove all trash, paper, cans, bottles, litter, etc. from the site whether it was generated by his work crew or not throughout the length of the contract.

1.05 INCIDENTAL WORK

A. Do all incidental work not otherwise specified, but obviously necessary to the proper completion of the Contract as specified and as shown on the Drawings.

* END OF SECTION *

SECTION 27

LOAMING AND SODDING

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required, provide erosion control, and place loam, finish grade, apply lime and fertilizer, place and maintain all sodded areas as shown on the Drawings and as specified herein, including all areas disturbed by the Contractor.

1.02 RELATED WORK NOT INCLUDED

A. Site preparation including clearing, grubbing and stripping is included in Section 10.

B. Earthwork including excavation, backfill, fill, and grading including the stockpiling of topsoil for use as fill is included in Section 11.

C. Sedimentation and erosion control is included in Section 12.

D. Landscaping is included in Section 25.

1.03 SAMPLES AND APPROVAL OF MATERIAL

A. Samples of all materials shall be submitted for inspection and acceptance upon Engineer's request.

PART 2: PRODUCTS

2.01 MATERIALS

A. Sandy Loam

1. Sandy loam shall consist of natural topsoil, free from subsoil, obtained from an area which has never been stripped. It shall be removed to a depth of 1-ft or less is subsoil is encountered. Topsoil shall be of uniform quality free of hard clods, stiff clay, hardpan, sods, partially disintegrated stone, lime, cement, ashes, slag, concrete, tar residues, tarred paper, boards, chips, sticks, or any other undesirable material.

2. The topsoil shall be classified as a sandy loam by the USDA textural classification system determined by sieve and pipette or hydrometer analysis. Sandy loam contains either 20 percent clay or less, and the percentage of silt twice the percentage of clay exceeds 30, and 52 percent or more sand; or less than 7 percent clay, less then 50 percent silt, and between 43 percent and 53% sand by weight. The sand fraction shall consist of coarse sand (between 1 and 0.1 mm in diameter). No more than 3 percent of the soil shall be gravel (>1 mm <1 in. in diameter).

3. The topsoil shall contain between 2 percent and 8 percent organic matter by weight determined by loss of ignition of moisture free samples dried 100 degrees C. To adjust organic matter content, the soil may be amended, prior to site delivery, by the addition of composted leaf mold or peat moss. Use of organic amendments is acceptable only if random soil sampling indicates thorough incorporation.

4. The topsoil reaction (pH) shall be between 5.5 and 6.5.

5. Topsoil shall be graded within the following limits:

Sieve Size	Percent Finer by Weight
1"inch	100
¼" inch	97
No. 100	40-60

6. The topsoil brought to the Site shall meet all specification requirements. No mixing or amending of topsoil on the Site will be permitted.

7. The topsoil shall not be handled or moved when in a wet or frozen condition.

8. Topsoil structure shall not be destroyed through excessive and unnecessary handling or compaction. Inappropriate handling leading to the compaction or deterioration of soil structure will result in rejection of topsoil for use.

9. Water infiltration capacity of compacted topsoil shall be 4" to 10" inches per hour. The infiltration rates will permit most rainfalls to percolate through the soil profile and maintain a reasonably dry playing field. Infiltration rates greater than 10" inch per hour associated with droughty soil is unacceptable.

10. To assure topsoil fulfills specified requirements regarding water and infiltration, textural analysis, organic matter content, pH and fertility samples shall be provided by the Contractor as follows:

    a. Contractor shall provide on 20 lb sample of topsoil to Engineer from each site that will be used as a topsoil borrow area in accordance with the provisions of Section 5. Samples shall be submitted at least 15 days prior to beginning stripping operations or 3 weeks prior to commencing topsoiling operations on the Site; whichever is greater.

    b. At least 3 weeks prior to anticipated start of topsoiling operations, a one pint sample of topsoil material for each site from which topsoil is to be stripped shall be delivered by the Engineer to A&L Eastern Agricultural Laboratories, 7621 Whitepine Road, Richard, VA 23237; Phone: (804) 743-9401 for analysis by test methods S1A, S2, particle size analysis and lead content. The exact amount of sand to be blended with the topsoil to achieve the desired water infiltration rates shall be determined by submitting samples to an approved soil analysis laboratory for testing. Copies of test results shall be provided to the Contractor.

c. Based on test results, the topsoil shall be identified as acceptable, acceptable with certain fertilizer and limestone applications or unacceptable by the Engineer. If the topsoil is found acceptable, the fertilizer and limestone requirements will be as specified or as recommended by the Engineer. If the topsoil is found unacceptable, the Contractor shall be responsible for identifying another source of topsoil and shall incur expenses associates with testing additional samples. All topsoil incorporated into the Site shall match the samples provided to the Engineer for testing.

B. Fertilizer shall be commercial mixed free following granules or pelleted fertilizer, 10-20-10 (N-P205-K20) grade for lawn and 5-10-10 for wetland areas. Fertilizer shall be delivered to the Site in original unopened containers each showing the manufacturer's guaranteed analysis conforming to applicable state fertilizer laws. At least 40 percent of the nitrogen in the fertilizer used shall be in slowly available (organic) form.

C. Lime shall be ground agricultural limestone containing not less than 85 percent calcium and magnesium carbonates and be ground to such fineness that at least 50 percent shall pass a 100-mesh sieve and at least 90 percent shall pass a 20-mesh sieve.

D. Sod for Lawn Areas

1. Sod shall be as grown by an established sod grower, Tuckahoe Turf Farms, Inc., Canton, MA; Phone: (617) 828-0800, or equal, as approved by the Engineer and shall consist of the following grasses:

Rye/Fescue/Bluegrass Mix:

Tara Pernnial Ryegrass	20%
Jamestown Fine Fescue	10%
Jamestown II Fine Fescue	5%
Victory Fine Fescue	15%
America Kentucky Bluegrass	20%
Challenger Kentucky Bluegrass	15%
Touchdown Kentucky Bluegrass	15%
	100%

2. Sod shall be vigorous, well rooted, healthy turf, free from insect pests, disease, weeds, other grasses, stones, bare spots, burned spots and any other harmful or deleterious matter. Sod shall be machine stripped at a uniform soil thickness of approximately (1") one inch and not less than ¾" inch. The measurement for thickness shall not include top growth and thatch and shall be determined at the time of cutting in the field. Contractor shall notify Engineer of sod grower and grass type prior to delivery to Site for review and approval.

3. Individual pieces of sod shall be cut to the supplier's standard width and length. Maximum allowable deviation from standard widths and lengths shall be plus or minus ½" inch on width and plus or minus 5 percent on length. Broken rolls or torn or uneven rolls shall not be acceptable.

4. Standard size sections of sod shall be strong enough to support their own weight and retain their size and shape when suspended vertically from a grasp on the upper 10 percent of the section.

5. Sod shall not be harvested or transplanted when moisture content (excessively dry or wet) may adversely affect its survival.

6. Sod shall be harvested, delivered and transplanted within a period of 36 hours unless a suitable preservation method is approved by the Engineer prior to delivery. Sod not transplanted within this period shall be inspected and approved by the Engineer prior to its installation.

7. Before stripping, sod shall be mowed uniformly at a height of (1") one inch to 2-1/2" inch.

8. Sod to be fertilized and pre treated with an approved herbicide and pesticide prior to shipment and installation at site.

PART 3: EXECUTION

3.01 APPLICATION

A. Unless otherwise shown on the Drawings, sandy loam shall be placed to a minimum compacted depth of 6" inch on all parts of the Site not covered with structures, pavement, or existing woodland.

B. For all areas to be sodded:

1. Lime shall be applied at the rate determined by the soil test to bring topsoil pH to a range of 6.0 to 7.0.

2. Fertilizer (10-20-10) shall be applied at the rate determined by the soil test or at 30 pounds per 1000 square feet.

C. If possible, limestone shall be applied two to three months before the application of fertilizer. Limestone may not be mixed with fertilizer for application and shall be applied a minimum of two weeks prior to fertilizer application.

D. After the topsoil is placed and before it is raked to true lines and rolled, limestone shall be spread evenly over the loam surface and thoroughly incorporated by heavy raking to at least one half the depth of topsoil.

E. The application of fertilizer may be performed hydraulically. The Contractor is responsible for cleaning all structures and paved areas of unwanted deposits of the mixture.

3.02 INSTALLATION

A. Previously established grades, as shown on the Drawings shall be maintained in a true and even condition.

B. Subgrade shall be prepared by tilling prior to placement of topsoil to obtain a more satisfactory bond between the two layers. Tillage operations shall be across the slope. Tillage shall not take place on slopes steeper than 2 horizontal to 1 vertical or where tillage equipment cannot be operated. Tillage shall be accomplished by disking or harrowing to a depth of 9" inch parallel to contours. Tillage shall not be performed when the subgrade is frozen, excessively wet, extremely dry or in other conditions which would not permit tillage. The subgrade shall be raked and all rubbish, sticks, roots and stones larger than 2" inch shall be removed. Subgrade surfaces shall be raked or otherwise loosened immediately prior to being covered with loam.

C. Topsoil shall be placed over approved areas to a depth sufficiently greater than required so that after natural settlement and light rolling, the complete work will conform to the lines, grades, and elevations shown on the Drawings. No loam shall be spread in water or while frozen or muddy.

D. After topsoil has been spread, it shall be carefully prepared by scarifying or harrowing and hand raking. All stiff clods, lumps, roots, litter and other foreign material shall be removed from the loomed area and disposed of by the Contractor. The areas shall also be free of smaller stones, in excessive quantities, as determine by the Engineer. The whole surface shall then be rolled with a hand roller weighing not more than 100 pounds per foot of width. During the rolling, all depressions caused by settlement of rolling shall be filled with additional loam and the surface shall be regarded and rolled until a smooth and even finished grade is created.

E. Sodding and conditioning shall only be performed during those periods within the seasons which are normal for such work as determined by the weather and locally accepted practice, as approved by the Engineer.

F. Schedules for sodding and fertilizing must be submitted to the Engineer for approval prior to the work. Sodding, as specified herein, shall be accomplished between the period of March 15 to June 1 or August 15 to October 1. Sodding during the period from October 2 to March 14 shall only be undertaken upon approval of the Engineer. Sodding during the period from June 1 to August 14 shall only be performed if irrigation is provided.

G. Sodding shall be done within ten days following soil preparation.

H. During periods of higher than optimal temperature for species being specified and after all unevenness in the soil surface has been corrected, the soil shall be lightly moistened immediately prior to laying the sod.

I. The first row of sod shall be laid in a straight line with subsequent rows placed parallel to and butted tightly against each other. Lateral joints shall be staggered. Contractor shall exercise care to ensure that the sod is not stretched or overlapped and that all joints are butted tight in order to prevent voids.

J. After sodding is completed, the entire area shall be rolled by making 4 passes with a hand rolled weighing not more than 100 lbs. per foot of width. Rolling shall not commence until after sod has had a period to establish itself, not prior to two weeks or later than four weeks.

K. The Contractor shall water sod immediately after transplanting to prevent excessive drying during progress of the work. After rolling, sod shall be thoroughly watered to a depth sufficient that the underside of the new sod pad and soil immediately below the sod are thoroughly wet. The Contractor shall be responsible for having adequate water available at the site prior to, during and after transplanting the sod. Soil on soil pads shall be kept moist at all times. In the absence of adequate rainfall, watering shall be performed daily or as often as necessary after installation and in sufficient quantities to maintain moist soil to a minimum depth of 4" inch. Watering shall be done during the heat of the day to help prevent wilting.

L. In order to prevent unnecessary erosion of newly topsoiled and graded slopes and unnecessary siltation of drainageways, the Contractor shall carry out sodding as soon as he has satisfactorily completed a unit or portion of the project. For the purpose of this project a unit is defined as 10,000 square feet. When protection of newly loomed and graded areas is necessary at a time which is outside of the normal seeding season, the Contractor shall protect those areas by what ever means necessary as approved by the Engineer and shall be responsible for prevention of siltation in the areas beyond the limit of work.

M. When newly graded subgrade areas cannot be topsoiled and sodded because of season or weather conditions and will remain exposed for more than 30 days, the Contractor shall protect those areas against erosion and washouts by temporary mulching as specified in Section 12. Prior to application of topsoil, any such materials applied for erosion control shall be thoroughly incorporated into the subgrade by discing. Fertilizer shall be applied prior to spreading of topsoil.

N. On slopes, the Contractor shall provide against washouts by an approved method. All washouts which occur shall be regarded and resodded at the Contractor's expense until a good sod is established.

3.03 MAINTENANCE AND PROVISIONAL ACCEPTANCE

A. The Contractor shall keep all sodded areas watered, lawn areas mowed and in good condition, and shall maintain all sodded areas in an approved condition until provisional acceptance.

B. The Engineer will inspect all work for provisional acceptance at the end of the ten week maintenance period, upon the written request of the Contractor received at least ten days before the anticipated date of inspection. The maintenance period must occur during the growing season between March 15 and October 1 and shall include a minimum of three mowings.

C. After the inspection has occurred but prior to provisional acceptance, a soil test shall be performed to determine if additional soil fertilization should occur. If necessary additional

fertilizer not to exceed 30 lbs. per 1000 sq ft of 20-10-10 shall be applied as directed by the Engineer.

D. The Contractor shall furnish full and complete written instructions for maintenance of the seeded areas to the Owner at the time of provisional acceptance.

E. The inspection by the Engineer will determine whether maintenance shall continue in any area or manner.

F. After all necessary corrective work and clean-up has been completed, and maintenance instructions have been received by the Owner, the Engineer will certify in writing the provisional acceptance of the lawn areas. The Contractor's responsibility for maintenance of lawns, or parts of lawns shall cease on receipt of provisional acceptance.

3.04 GUARANTEE PERIOD AND FINAL ACCEPTANCE

A. All sodded areas shall be guaranteed by the Contractor for not less than one full year from the time of provisional acceptance.

B. At the end of the guarantee period, inspection will be made by the Engineer upon written request submitted by the Contractor at least ten days before the anticipated date. Sodded areas not demonstrating satisfactory stands as outlined above, as determined by the Engineer, shall be renovated, resodded, and maintained meeting all requirements as specified herein.

C. After all necessary corrective work has been completed, the Engineer shall certify in writing the final acceptance of the sodded areas.

* END OF SECTION *

SECTION 28

PAVEMENT TEXTURING

PART 1: GENERAL

1.01 DESCRIPTION

A. Where shown on the drawings and as required to complete the work of this Contract, furnish and install pavement texturing, color coating and sealant to new bituminous walks, manufactured by "StreetPrint" Integrated Paving Concepts, local agent Kem-Tech, Inc., P.O. Box 521, Concord, MA 01742; Phone: (978) 318-0837, Fax: (978) 318-0834, or approved equal. For a complete list of licensed "StreetPrint" applicators contact Kem-Tech or Integrated Paving Concepts; Phone: (800) 688-5652, Fax: (800) 720-1481.

1.02 DEFINITONS

A. StreetPrint Pavement Texturing comprises methods and products with imprint Hot Mix Asphalt Concrete (HMA) and treat the patterned surface to create the appearance of hand-laid decorative paving products.

1.03 SCOPE OF WORK

A. StreetPrint Pavement Texturing is a finishing system, which treats the surface of Asphalt Concrete (HMA). The performance of StreetPrint will be dependent upon the proper design and construction of the subgrade, base and asphalt upon which StreetPrint is installed. In general, a subgrade, base and asphalt structure which complies with good practice given the expected service conditions for a HMA surface which will not be finished with StreetPrint would also provide an appropriate structure upon which the StreetPrint Pavement Texturing system can be applied.

B. The Scope of Work for the Authorized StreetPrint Applicator shall include items 1.3.4 and 1.3.5 and may include items 1.31, 1.3.2 and/or 1.3.3.

C. The (owner)(contractor) shall engage an experience Geotechnical Engineer to provide recommendations for preparing the subgrade and/or base upon which the pavement structure shall be placed. Refer to The Asphalt Institute Manual Series No. (latest revision) "Thickness Design, Asphalt Pavements for Highways and Streets", or recognized alternative.

D. Were approved standards are not in place the (owner)(contractor) shall engage an experienced Materials or Pavements Engineer to provide recommendations for the pavement structure. The Pavements Engineer shall define the pavement structure, including granular sub-base and base components, which will provide serviceability for the intended design life, having regard for the subgrade support parameter provided by the Geotechnical Engineer. Thickness design shall be undertaken using the Asphalt Institute Method (MS-1), the Shell Pavement Design Manual, or other recognized alternative procedure.

1.3.1 SUBGRADE PREPARATION

A. Supply the install subgrade material including removal and disposal of existing material, as required by the jurisdiction having authority of the Owner's Geotechnical Engineer.

1.3.2 BASE PREPARATION

A. Supply and install base material, including removal and disposal of existing material, as required by the jurisdiction having authority of the Owner's Geotechnical Engineer.

1.3.3 INSTALLATION OF HOT MIX ASPHALT CONCRETE

A. Supply and install Hot Mix Asphalt Concrete as required by the jurisdiction having authority or the Owner's Materials or Pavements Engineer.

1.3.4 IMPRINT OF HOT MIX ASHALT CONCRETE

A. Layout and imprint the pattern into the surface of the HMA as per the specifications.

1.3.5 APPLICATION OF STREETPRINT SURFACING SYSTEM

A. Supply and install "StreetBond Surfacing System" products as per the specifications.

PART II PRODUCTS

2.01 HOT MIX ASPHALT (HMA)

A. The HMA shall conform with the requirements of the state (or other) authority having jurisdiction or shall be specified by the Pavement/Materials Engineer, having regard for annual ambient temperature extremes and type of anticipated traffic. HMA additives are available to produce high performance asphalt. Where the specifier believes this may be necessary to achieve the level of stability required for the application, contact your local Authorized StreetPrint Applicator or Integrated Paving Concepts, Inc. before specifying.

2.02 "STREETBOND" SURFACING SYSTEMS

A. The Owner or Owner's representative shall specify the number of coats of the "StreetBond Surfacing System" which will be installed. Commercial applications exposed to vehicular traffic should receive a minimum of two coats of StreetBond Standard Formula. StreetBond Traffic Formula should be used for commercial applications where vehicular traffic cannot be kept off for a period of not less than 24 hrs., or where extremely high traffic loads will come in contact with the asphalt surface. Two coats of StreetBond Traffic Formula should always be used. Contact your local Authorized StreetPrint Applicator or Integrate Paving Concepts, Inc. before specifying.

2.03 PHYSICAL AND PERFORMANCE PROPERTIES

A. The products used in the surfacing system shall meet the minimum physical and performance properties described in the following "StreetBond Surfacing System" Product Descriptions and Specifications.

A. "STREETBOND SURFACING SYSTEM" PRODUCT DESCRIPTIONS AND SPECIFCATIONS

1. StreetBond Standard Formula: Street Bond Standard Formula is a unique, integrally-colored, cement modified, acrylic polymer surfacing product developed specifically for use over imprinted

asphalt. It has superior adhesion, flexibility and abrasion resistance characteristics as well as color stability, chemical resistance and scrubability. The combination of characteristics required of a StreetPrint application are very demanding and StreetBond Standard Formula has been developed to meet these unique demands. StreetBond Standard Formula is available in eight standard colors: Granite, Slate, Terra Cotta, Brick, Bedrock, Sierra, White & Blue. Custom colors are available for an additional cost. One coat of StreetBond Standard Formula will provide a surface build between 10 – 15 miles. (For physical and performance properties see Tables 1 & 3).

2. StreetBond Traffic Formula: A member of the StreetBond Surfacing System group of projects. StreetBond Traffic Formula is also a unique, integrally-colored, cement modified, acrylic polymer surfacing product with the following special characteristics: faster cure time (to allow for quicker return to service); thicker build (approx. 20 – 25 miles); & larger aggregate gradation. This product is specifically designed for high traffic areas or where vehicular traffic cannot be kept for a period of not less than 24 hrs. StreetBond Traffic Formula is available in two standard colors: Granite & Slate. No custom colors are available at this time. Two coats of StreetBond Traffic (For physical and performance properties see Tables 1 & 3).

3. StreetBond Sealer Concentrate: StreetBond Sealer Concentrate is a breathable high quality, acrylic polymer, clear sealer designed specifically for use with the "StreetBond Surfacing System." When applied over either the StreetBond Standard Formula or StreetBond Traffic Formula, StreetBond Sealer Concentrate provides a breathable sealing membrane, which adds both durability and longevity to the StreetBond products. It is absolutely necessary to seal both StreetBond products with StreetBond Sealear Concentrate. (For physical properties see table 2).

PART 3: EXECUTION

3.01 SUBGRADE PREPARATION

A. Complete in accordance with guidelines and standards specified by the jurisdiction having authority or the Geotechnical Engineer (see Section 1.03 of this Specification).

3.02 ASPHALT CONCRETEW PAVING

A. Complete in accordance with guidelines and standards specified by the jurisdiction having authority or the Materials or Pavements Engineer (see Section 1.03 of this Specification). Where no such authority is in place construction of the HMA shall be in accordance with "Principles of Construction of Hot-Mix Asphalt Pavements" as published by the Asphalt Institute or equivalent. The placement of the asphalt shall be carried out with regard for the imprinting process to avoid visible seams. Contact your Authorized StreetPrint Applicator or Integrate Paving Concepts, Inc. for advice on designing a pattern layout, which allows for an optimal finished appearance.

3.03 SUFACE IMPRINTING

A. The Contractor shall follow procedures detailed in the latest revision of StreetPrint Application Procedures as issued by Integrated Paving Concepts, Inc. The Pattern shall be created in accordance with the design as agreed by the Owner or Owner's representative. Patterning shall begin once the asphalt has reached its final density and while there is still sufficient heat in the asphalt to permit imprinting. Patterning shall be achieved using steel rollers and/or vibratory plates and shall be of consistent depth.

3.04 SURFACING SYSTEM

A. The Contractor shall apply the "StreetBond Surfacing System" as specified in 2.02. The "StreetBond Surfacing System" should never be applied in temperatures below 45 degrees Fahrenheit and rising, or when precipitation can be expected within 24 hours. Installation shall be in accordance with the latest revision of the StreetPrint Application Procedures as issued by Integrated Paving Concepts, Inc. The StreetBond products shall be spray applied and broomed using a broom or brushes to cut in small areas where required. Once the StreetBond products are fully dried StreetBond Sealer Concentrate will be applied as a curing membrane. StreetBond Sealer Concentrate shall be tinted using the resin from the StreetBond products, spray applied and broomed into the surface. Care shall be taken to ensure that the entire surface is covered, including imprinted surfaced. Sufficient masking shall be used to ensure that the surfacing products are applied only where specified.

Table 1

Physical Properties
"StreetBond"

Characteristic	Test Specification	StreetBond Standard Formula	StreetBond Traffic Formula
Solids by Volume (%)	ASTM D-5201	53+/-3 %	53+/-3 %
Solids by Weight (%)	ASTM D-1351	75.5+/-2%	75.5+/-2%
Density (lbs./gal)	ASTM D-1475	14.6+/-0.2 (1.75 gr./l)	14.6+/-0.2 (1.75 gr./l)
Flash Point	ASTM D-3278	>200F (93C)	>200F (93C)
Percent Pigment (by weight including cement)	ASTM D-3723	62+/-2%	62+/-2%
Sheen (85%)	ASTM D-523	<3@85F	<3@85F

Table 2

Physical Properties
"StreetBond Sealer Concentrate"

Characteristic	Test Specification	StreetBond Standard Formula
Solids by Volume (%)	ASTM D-5201	24+/-2
Solids by Weight (%)	ASTM D-1353	27+/-2
Density (lbs./gal)	ASTM D-1475	8.59
Spec. Gravity	ASTM D-1475	1.03
Flash Point	ASTM D-3278	>200F (93C)
VOC Coating	ASTM D-3960	>200
Sheen (85%)	ASTM D-523	<75@85F

Table 3

Physical Properties
"StreetBond Surfacing System"

Characteristic	Test Specification	StreetBond Standard Formula	StreetBond Traffic Formula
Tensile Strength (PSI)	ASTM D-412	>650 PSI	>650 PSI
Flexibility Mandrel (High)	ASTM D-1737	Pass 1" @ 70F	Pass 1" @ 70F
Flexibility Mandrel (low)	ASTM D-1737	Pass 2" @ 0F	Pass 2" @ 0F
Dry Time (to re-coat)	ASTM D-711	1 – 4 Hours	1 – 4 Hours
Dry Time (for traffic) 75F/30%RH	N/A	80% strength @ 2 days	80% strength @ 2 days
Taber Abrasion (H-10)	ASTM D-4060	.18 g/1000 cycles	18 g/1000 cycles
Adhension (PLI) To an Asphalt Subtrate	ASTM D-4640	Cohesive failure of asphalt prior to adhesive failure	Cohesive failure of asphalt prior to adhesive failure
QUV E	ASTM G-53	300 Hours 2.45 CIE units	300 Hours 2.45 CIE units
Hydrophobicity (3 days)	ASTM D-570	<12% wt. Gain	<12% wt. Gain
Shore Hardness	ASTM D-2240	80 D	80 D
Temperature Limits for Service	Dry, cured material	-30F to 160F	-30F to 160F
Surface Build	N/A	10 – 15 mils. (1 coat)	20 – 25 mils. (2 coats)

SECTION 29

CAST-IN-PLACE CONCRETE

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Where shown on the Drawings or as required to complete the work of this Contract, furnished all labor, materials, equipment and incidentals required to perform all concrete work.

1.02 SUBMITTALS

A. Submit to the Engineer as provided in Section 5, shop drawings showing locations of all joints and accessories. Submit full shop drawings and bar schedules for reinforcing steel. Submit technical data on all materials and components. Submit other date specified herein when required.

PART 2: PRODUCTS

2.01 MATERIALS

A. **Concrete: Concrete for sidewalks shall conform to the Standard Specifications, M4.02.00 through M4.02.12 and be 4000 PSI at 28 day test, 3/4 inch coarse aggregate, 610 pounds cement per cubic yard, 7% air entrained (AASHTO - M154), Type A water reducing admixture (AASHTO - M194), 3 to 4 inch slump, and Type II dark-colored by adding 1-1/2 to 2 lbs. of lamp black per cubic yard at the plant.**

The concrete shall contain 1 pound of 100% polypropylene microfiber per cubic yard. Fiber shall be added during batching at the plant to insure uniform distribution. The micro-fiber shall be W.R. Grace micro-fiber or equal and shall be used in accordance with the supplier's specifications.

B. Fine aggregate shall be washed natural sand conforming to ASTM C33.

C. Coarse aggregate shall be well graded crushed stone conforming to ASTM C33, size No.67 unless otherwise directed.

D. Water shall be potable, clean, and free from deleterious amounts of acids, alkalis, oils, or organic matter. Air entrainment shall be 6%.

E. No admixtures shall be used unless approved by the Engineer in writing.

F. Reinforcing steel shall be deformed, intermediate grade, steel bars conforming to ASTM A615 Grade 40. Rail-steel bars will not be permitted in the work.

G. Welded steel wire fabric, as required, shall be sized as shown and be in accordance with ASTM A185.

H. Concrete aggregates which have been shown by test or actual service to produce concrete of the required strength, durability, water tightness and wearing qualities may be used where authorized by the Engineer.

I. Noshrink grout shall be Masterflow 713 by the Master builders Company, Euco N-S by Euclid Chemical Co., Five Star Grout by U.S. Grout Corp., or equal.

J. Pre-formed joint filler shall be non-extruding and resilient pre-formed expansion joint filler, and shall conform to AASHTO M213 requirements for premolded rigid cane fiber board impregnated throughout with asphaltic compound.

K. Joint sealer for use at pavement expansion and control joints shall meet Federal Specifications TT-S-00230C, Type II, Class A, and shall be sealing compound, synthetic rubber base, single component, chemically curing material. Color of sealant shall match the color of the cured concrete. Submit sealant samples to Engineer for approval.

L. Gravel base for concrete walks shall be processed gravel as specified under Section 11 Earthwork.

M. Base and fill material for all other concrete work shall be structural fill (bank run gravel) or other gravel as shown on the Drawings, in conformance with Section 11.

2.02 MIXING CONCRETE

A. Ready-mix concrete shall conform to ASTM C94 and the requirements herein, or as otherwise approved by the Engineer. If ready-mix concrete is to be used, the manufacturer shall furnish a statement to the Engineer for his approval giving the dry proportions to be used, with evidence that these will produce concrete of the quality specified.

B. Concrete shall be mixed until there is a uniform distribution of the materials, and shall be discharged completely before the mixer is recharged. The mixer shall be rotated at a speed recommended by the mixer manufacturer, and mixing shall be continued for at least one and one-half minutes after all the materials are in the mixer. Concrete shall be placed within 1-1/2 hours of the time at which water was first added, otherwise it shall be rejected. Concrete which has been remixed, or re-tempered, or to which an excess amount of water has been added, shall also be rejected.

2.03 FORMS

A. Forms shall be free from roughness and imperfections, substantially watertight and adequately braced and tied to prevent motion when concrete is placed. No wooden spreader will be allowed in the concrete.

B. Wire ties will not be allowed. Metal ties or anchorages which are required within the forms shall be so constructed that the metal work can be removed for a depth of at least (1") one inch from the surface of the concrete without injury to such surface by spilling or otherwise.

Forms shall be thoroughly cleaned before using and shall be treated with oil, or other approved material.

2.04 ADA DETECTABLE WARNING PANELS FOR WC RAMPS

A. Cast Iron Detctable Tile: The detectable warning strip at concrete pedestrian ramps, raised side street treatments abutting concrete sidewalks, and raised crosswalks abbutting concrete sidewalks shall be the Cast Iron Detectable Warning Plates by East Jordan Iron Works (800-626-4653) or approved equivalent product. The Cast Iron Detectable Plate shall meet all ADA Accessibility Guidelines for Detectable Warnings. Plates should have truncated domes and a slip resistant texture with a coefficient of friction rating greater than 0.80. Warning panels shall be at least 24" deep and 60" wide at the point of crossing.

2.05 **PRECAST CONCRETE RETAINING WALL**

A. **Precast interlocking retaining wall blocks, self locking both horizontal and vertically shall be manufactured by ReCon Retaining Wall Systems 7600 West 27th Street, Suite 229, St. Louis Park, MN 55426; www.reconwalls.com; supplied by Shea Concrete Products, Inc. , 87 Haverhill Road Amesbury, MA 01913; Phone: 978-388-1509; Fax: 978-388-6959; Contact Person: Larry Cutts Sales Representative, or approved equal.**

B. **Precast interlocking concrete block sizes: Top, Full, Base, Corner, and Top Corner Blocks: 48"L x 16"H x 24" W. Concrete shall be a minimum of 4,000 p.s.i. air-entrained concrete.**

C. **Base, Full and Top blocks finish shall be "Rustic" rock finish, on one exposed face. Corner, and Top Corner blocks to have rock finish on two exposed faces.**

D. **All walls shall have a Rustic finish pre cast concrete wall cap stone with planting soil mix and vines, as detailed, and as shown in the plans.**

PART 3: EXECUTION

3.01 REINFORCING STEEL

A. Reinforcement shall be accurately fabricated to the dimensions shown. Stirrups and tie bars shall be bent around a pin having a diameter not less than two times the minimum thickness of the bar. Bends for other bars shall be made around a pin having a diameter not less than six times the minimum thickness for bars larger than (1") one inch, in which case the bends shall be made around a pin of 8-bar diameters. All bars shall be bent cold.

B. Reinforcement shall be shipped to the work with bars of the same size and shape fastened in bundles with metal identification tags giving size and mark securely wired on. The identification tags shall be labelled with the same designation as shown on submitted bar schedules and shop drawings.

C. All bars shall be stored off the ground and shall be protected from moisture and be kept free from dirt, oil, or injurious coatings.

D. Unless otherwise shown, splices in reinforcement shall be lapped not less than 24 diameters. All bar splices shall be staggered wherever possible. When splicing bars of different diameters, the length of lap is based on the larger bar.

E. Splices in welded wire fabric shall be lapped not less than 1-1/2 courses or 12" inches, whichever is greater. Wire fabric splices shall be tied together with wire ties spaced no more than 24" inches on center.

F. Before being placed in position, reinforcement shall be thoroughly cleaned of loose mill and rust scale, dirt, and other coatings, including ice, that reduce or destroy bond. Where there is delay in depositing concrete after reinforcement is in place, bars shall be reinspected and cleaned when necessary.

G. Reinforcement which is to be exposed for a considerable length of time after being placed shall be painted with a heavy coat of cement grout, if required.

H. In no case shall any reinforcing steel be covered with concrete until the amount and position of the reinforcements have been checked by the Engineer and his permission given to proceed with the concreting.

3.02 PLACING CONCRETE

A. Reinforcement, where required shall be accurately placed in exact positions shown, shall be secured against displacement with annealed iron wire ties or suitable clips at intersections, and shall have a clear space of 2" inch between the steel and face of forms unless otherwise indicated. Wire ties passing through the forms for the purpose of holding the steel in proper position will not be allowed. Concrete blocks with wire ties cast therein may be used where approved by the Engineer for the purpose of maintaining the clearance between reinforcement and forms. Reinforcing bars shall be free from rust, scale, dirt, grease and injurious contaminants.

B. No concrete shall be placed until forms and method of placement have been approved by the Engineer. Before depositing concrete, all debris, foreign matter, dirt and water shall be removed from the forms. The surface of concrete previously placed, such as manhole base or horizontal construction joint, shall be cleaned and brushed with cement paste. Concrete shall not be placed in water or submerged within 24 hours after placing, nor shall running water be permitted to flow over the surface of fresh concrete within four days after its placing.

C. High frequency mechanical vibrators shall be used to the extent necessary to obtain proper consolidation of the concrete. Care shall be taken to avoid segregation of aggregates by excessive vibration. Concrete adjacent to forms and around pipe stubs shall be carefully spaded or rodded.

D. No concrete shall be mixed or placed during freezing weather without explicit permission. When placing concrete when air temperature is below 40 degrees Fahrenheit, the water, sand, and gravel shall be heated so that the temperature of the concrete will be at least 50 degrees Fahrenheit. This temperature shall be maintained for 72 hours after placing. No concrete shall be placed on frozen ground

3.03 CONCRETE ENCASEMENT

A. Concrete encasement shall be placed as shown on the Drawings and as directed by the Engineer. Backfill shall not be placed on the concrete until permitted by the Engineer.

3.04 STRIPPING AND FINISHING CONCRETE

A. Forms shall not be stripped before the concrete has attained a strength of at least 30 percent of the ultimate design strength, except as otherwise specified. This is equivalent to approximately "100 day-degrees" of moist curing.

B. Care shall be exercised to prevent damaging edges or obliterating the lines of chamfers, rustications or corners when removing the forms or doing any other work adjacent thereto.

3.05 CONCRETE PAVING INSTALLATION

A. Preparation:

1. Proof roll the subgrade and so all necessary rolling and compacting to obtain firm, even subgrade surface. Fill and consolidate depressed areas. Remove unacceptable materials, replace with clean fill and compact to 95% of the maximum dry density in accordance with ASTM D698 Standard Proctor Method.

2. Provide a minimum 6" inch depth of compacted processed gravel base and a minimum of 6" inch depth concrete as shown on the Drawings. Compact processed gravel base to 95% of the maximum dry density in accordance with the ASTM D698 Standard Proctor Method.

3. Remove loose material and debris from base surface before placing concrete.

4. Install, align and level forms. Stake and brace forms in place. Maintain following grade and alignment tolerance"

   a. Top form: Maximum 1/8" inch 10'-0"

   b. Vertical face: Maximum 1/4" inch 10'-0"

5. Coat walkway form surfaces in contact with concrete with form releasing agent. Clean forms after each use and coat with form release agent as necessary to assure separation from concrete without damage.

6. Install, set and build-in work furnished under other specification sections. Provide adequate notification for installation of necessary items.

B. Concrete Placement for Pavement:

1. Comply with ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete," and as specified.

2. Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placing and curing. In cold weather, comply with ACI 306, "Recommended Practice for Cold Weather Concreting." In hot weather comply with ACI 306, "Recommended Practice for Hot Weather Concreting."

3. Moisten base to provide a uniform dampened condition at the time the concrete is placed. Verify manhole or other structures are at required finish elevation and alignment before placing concrete.

4. Place and spread concrete to the full depth of the form. Use only square-end shovels or concrete rakes for hand-spreading and consolidating operations to prevent segregation of aggregate.

5. Place concrete in a continuous operation between any expansion joints. Provide construction joints when sections cannot be placed continuously.

6. Place concrete in one course, monolithic construction, for the full width and depth of concrete pavement.

7. Strike-off and bull float concrete after consolidating. Level ridges and fill voids. Check surface with a 10'- 0" inch straight edge. Fill depressions and refloat repaired areas. Darby the concrete surface to provide a smooth level surface ready for finishing.

8. Provide handicapped ramps where indicated to conform to the current specifications as set forth in the Commonwealth of Massachusetts Department of Public Works Standard Specification for Highways and Bridges Section 500, and Commonwealth of Massachusetts Architectural Board.

C. Joints:

1. Construction contraction, expansion and construction joints properly aligned with face perpendicular to concrete surface.

2. Provide tooled contraction joints, sectioned concrete into areas indicated. Tool joints to depth equal to not less than one-fifth (1/5) of the concrete thickness. Hand tool contraction joints in pattern and at spacing indicated on the Drawings. Contraction joints to be 5 ft intervals not to exceed 36 square feet in any one block.

3. Provide standard keyed construction joints where indicated.

4. Provide expansion joints using pre-molded joint filler at concrete work abutting curbs, walls, structures, walks and around other fixed objects.

   a. Locate expansion joints indicated. When not indicated, provide joints at maximum 30' - 0" inch on center. Align expansion joints in butting curbs and walks.

b. Install joint fillers full width and depth of joint. Recess top edge below finished where joint sealants are indicated.

c. Provide joint fillers in single lengths for the full slab width, whenever possible. Fasten joint filler sections together when multiple lengths are required.

d. Protect the top edge of the joint filler during concrete placement.

D. Concrete finishing

1. Perform concrete finishing using mechanical or hand methods as required.

2. Upon completion of floating and after bleed water has disappeared and concrete can sustain foot pressure with nominal indentation, cut concrete away from forms. Work edges with an edging tool. Round edges to a ½" inch radius.

3. Install contraction joints at indicated locations during edging operations.

4. Provide walks with stiff broom finish perpendicular to street curb.

5. **After 28 days, using pressure-spray equipment, the Contractor shall apply a mixture of boiled linseed oil to the new concrete pavement as an anti-spalling seal. The mixture shall consist of 50% double boiled linseed oil and 50% petroleum spirits, AASHTO M-233-79. Upon approval by the Engineer, the Contractor may use other products available on the market in accordance with manufacturer's recommendations (2 applications at right angles to each other are required for complete coverage). The sidewalk shall be swept and cleaned of any debris, gum, etc, and pressure washed, just prior to application of curing linseed oil compound.**

"Don't Dump" Placards: The work of this Section shall also include the installation of Cast Iron or Steel "Don't Dump" placards, where new sidewalks abut existing or proposed catch basins and inlets. The placards will be furnished by the City at no cost to the Contractor, for installation by the Contractor.

Finish Grades: At locations where the Drawings do not indicate proposed sidewalk grades, the grades shall be discussed with the Engineer prior to work, in order to address existing and proposed drainage concerns. The Contractor shall be responsible for ensuring that all new sidewalks areas are graded to drain, either to existing structures, or new structures.

Pedestrian ramps and sidewalks shall be installed in strict conformance with

the layout and grades shown on the Drawings, current Americans with Disabilities Act (ADA) and Massachusetts Architectural Access Board (AAB) regulations; and the applicable details of the Massachusetts Highway Department (MHD) Wheelchair Ramp Standards (latest edition).

The Contractor shall establish grade elevations at all pedestrian ramp and sidewalk locations, and shall set transition lengths according to the tables which are included on the Drawings. The Contractor shall use a digital "Smart Level" to check all sub-base grades for compliance prior to installation of concrete. The Contractor shall not proceed with concrete installation on a sidewalk or ramp that is out of compliance without first contacting the Engineer.

At all pedestrian ramps and driveways, joints and transition sections which define grade changes shall be formed, staked and checked prior to placing cement concrete. All grade changes are to be made at joints. At driveways, a joint shall be located between the sloping portion of the driveway (15% maximum slope), and the level area where pedestrians will cross the driveway (1.5% maximum cross slope).

The broomed finish on pedestrian ramps shall be perpendicular to the direction of the slope.

E. Curing

1. Cure concrete with a non-staining liquid membrane-forming compound, applied in accordance with manufacturer's recommendations, immediately after completing surface finish, or wet cure concrete by application of absorptive mats or fabric kept continuously wet.

F. Joint Sealants

1. Install joint sealants where indicated in accordance with manufacturer's installation instructions. Clean and prime joints. Remove dirt and loose coating.

2. Apply sealant in continuous beads, without open joints, void or air pockets. Hand tool and finish all joints.

3. Confine materials to joint areas with masking tape or other precautions.

3.06 PRECAST CONCRETE BLOCK RETAINING WALLS

A. **First row of precast interlocking BASE blocks shall be set level on a 2'ft. prepared aggregate base consisting of ¾" inch crushed stone.**

B. **Backfill with an approved washed gravel, surrounded with filter fabric.**

3.07 MISCELLANEOUS WORK

A. All bolts, anchors, miscellaneous metals or other sleeve steel work required to be set in the concrete forms for attachment of masonry, structural, and mechanical equipment shall be set or installed under this Division. The Contractor shall be fully responsible for the setting of such materials, in the forms and shall correct all such not installed in a proper location or manner at his own expense.

* END OF SECTION *

SECTION 30

ELECTRICAL

PART 1: GENERAL

1.01 SCOPE

A. Where shown on the Drawings or as required to complete the work of this Contract, furnish and install all materials under this Section, and without limiting the generality thereof, include all equipment, labor and services required for the furnishing, delivering, installing and testing the principal items of work hereinafter and all items incidental thereto as specified herein.

B. The itemization of work hereinafter specified does not in any way limit the responsibility to perform all work and furnish all the equipment, labor, and materials necessary for completion and satisfaction of operation of the installations described in the Specifications and shown on the Contract Drawings. In addition to the principal and miscellaneous items of work specifically mentioned and/or indicated, to be responsible for furnishing and installing all incidental and collateral materials which constitute essential components of the grade of Electrical Trade Practices and Workmanship acceptable to the Engineer.

1. Raceways, Boxes and Fittings.

2. Grounding Hardware and Connections.

3. Handholes and Covers.

4. Lighting fixtures, poles, bases and concrete footings.

5. Pedestal Control Cabinet and concrete base.

C. Electrical equipment, labor and services provided by the City Electrical Department shall include the following:

1. Lighting Control Equipment.

2. Panelboards.

3. Wiring and Cable.

4. Metering.

5. Service Hook-Up and Testing.

D. The Contractor shall be responsible for removing and delivering any existing park light fixtures determined by the Engineer to be salvageable to a City Electrical Department designated storage location. Existing light poles shall be removed by the Cambridge Public Works Department. The Contractor is responsible for coordinating the removal of light poles and footings with the City Electrical Department and Public Works Department.

Existing conduit encountered which interferes with the installation of proposed site improvements shall be removed by the Contractor at his/her expense.

1.02 RELATED WORK NOT INCLUDED

A. Excavation and backfilling, including gravel or sand bedding for underground electrical work is included in Sections 10-28.

B. Concrete work including pole footings, is included in Section 29.

C. Examine all Contract Drawings and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.03 DEFINITIONS

A. The following related items are included herein and shall mean:

1. Standard Specifications: Commonwealth of Massachusetts, Department of Public Works, Standard Specifications for Highways and Bridges latest edition.

2. ASTM: American Society for Testing and Materials.

3. AASHTO: American Association of State Highway and Transportation Officials.

B. The Contractor means specifically the Electrical Contractor working under this Section of the Specifications.

C. Furnish and install - means to supply, erect, install and connect up, complete for regular operation, the particular referred to, unless otherwise specified. "Piping" includes in addition to pipe, all fittings, boxes, and other accessories relating to such piping. "Concealed" means hidden from sight as in trenches, embedded into construction, ground or concealed as defined above.

1.04 LAWS, ORDINANCES, CODES AND PERMITS

A. This Contractor shall give all the necessary notices, obtain all permits, and pay all taxes, fees and other costs in connection with this work; file all necessary plans, prepare all necessary documents and obtain all necessary approvals of state authorities, all local, town, city, or county departments having jurisdiction; obtain all required certificates of inspection for his work. Contact City of Cambridge Electrical Department at Phone: **(617) 349-4925**, Fax: (617) 349-4913 (contact persons – George Fernandes or Stephen Lenkaukas) to obtain all required permits.

B. This Contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus, drawings in addition to Contract drawings and documents, in order to comply with all applicable laws, ordinances, rules and regulations whether or not shown on the drawings and/or specified.

C. All materials furnished and all work installed shall comply with the rules and recommendations of the National Electrical Safety Code (NESC), Massachusetts Electrical Code, National Board of Fire Underwriters, all requirements of the local utility company, recommendations from the fire insurance rating organizations having jurisdiction, and with the requirements of all local, town, city, or county departments having jurisdiction.

D. The Contractor shall furnish all materials in accordance with and perform all work required so that materials and installation shall conform to the following standards, codes and regulations:

1. National Fire Protection Association - Nation Electrical Code.

2. Underwriters Laboratories, Inc. - Standards for Cabinets and Boxes, Service Equipment, and Rubber Covered Wires and Cables.

3. American Nation Standards Institute (ANSI) - Standards.

4. National Electrical Manufacturing Association Standards (NEMA).

5. All applicable State and local codes or ordinances and requirements of the local wire inspector.

6. Requirements of the electrical utility company.

7. Insulated Cable Engineers Association (ICEA) Standards.

8. American Society for Testing and Materials Standards.

9. National Fire Protection Association (NFPA) - Pamphlet No. 31.

10. Department of Public Safety Regulations.

11. Occupational Safety and Health Act Regulations (OSHA).

12. Institute of Electronic and Electrical Engineers Standards.

E. In the event that local inspection or codes require a change in the material design, or involve additional cost to the Owner, any such changes shall be submitted to the Owner's representative for approval before proceeding with the work. The compliance with all local codes and with local wire inspector requirements shall be the direct responsibility of the Contractor.

1.05 APPROVAL OF EQUIPMENT AND MATERIALS

A. As soon as practicable and within thirty (30) calendar days after the date of award of the Contract and before any equipment and materials are purchased, the Contractor shall submit to the Engineer for approval, two (2) copies of complete list of equipment, fixtures and all materials to be incorporated in the work, including manufacturer' catalog numbers. When approved, the Contractor shall provide six (6) or more copies with change necessary for approval, and shall include catalog numbers, cuts, diagrams, detailed dimensional shop

drawings of equipment, brochures of lighting fixtures, wiring diagrams as required, drawings, samples as requested, and such other pertinent descriptive ratings and data as may be required by the Engineer. No consideration will be given to partial lists submitted from time to time on items which are interdependent for proper operations, coordination, etc. Approval of materials will be based on manufacturer's published ratings. Any equipment fixtures, materials listed which, in the opinion of the Engineer, are not in accordance with the Specification requirements, or requirements shown on the Contract Drawings, will be rejected and others shall be submitted. Equipment and materials which are installed by the Contractor without first having been approved by the Engineer shall be removed if installed and/or removed from the work site when so instructed by the Engineer. No payment will be made for unapproved equipment or material or for its installation if the Contractor is ordered to remove such equipment and material.

1.06 MATERIAL SUBSTITUTION

A. Should the Contractor desire to substitute other makes of materials, apparatus or appliances than those mentioned herein or shown on the Contract Drawings, he shall do so in the following manner:

1. Submit a separate alternate proposal and provide a list of the proposed substitutions, manufacture, brand name, catalog number, etc. and state what difference each will make (addition, deduction, no change) in the Contract price. He shall also submit data and certified independent test, if requested, showing the proposed substitutions are equal to the specified types.

2. Where shall substitutions alter the design or space requirements indicated, the Contractor shall include all items of cost for the revised design and construction, including cost of all allied trades involved, and with no extra costs to the Owners.

3. If requested by the Engineer, the Contractor shall furnish and deliver, at his own cost, samples of both the specified and proposed substitute items to the Architect's office.

4. In all cases where proposed substitute items cost less than specified items, the Contract price shall be reduced by an amount not less than the difference in cost between them less ten (10%) percent of this difference. If so requested by the Engineer, the Contractor shall submit data showing quoted prices of specified and proposed substitute items. Acceptance or rejection of proposed substitute items will be the sole responsibility of the Architect. The Contractor shall accept Engineer's decision as final.

1.07 COOPERATION WITH OTHER TRADES

A. The Contractor before starting work shall confer with all other contractors interested in the location of pipes, ducts, pits, trenches or any other apparatus or fixtures to be installed by them and shall select his location so as not to interfere with the work and rights of the other trades. All differences or conflicting conditions shall be brought to the attention of the Engineer for adjustment before commencing work, and any such work or materials placed in position in violation of this clause shall be readjusted at the expense of the Contractor.

B. The work shall be so performed that the program of the entire project, including all other trades, will not be as fast as conditions of the project permit and shall be installed promptly when and as directed.

C. It shall be the Contractor's responsibility to check the Contract Drawings and Specifications of the other trades for their requirements for electrical work and to accomplish the electrical works approved by the Engineer.

E. The Contractor shall not scale Contract Drawings for measurements, but shall verify at the site all levels and measurements necessary for complete fabrications, assembling, and installation of his work. Minor details of the work not specifically shown on the Contract Drawings shall be ascertained by the Contractor at the site of the work and shall be accomplished by him to make a workable system or systems in accordance with the intent of these Specifications.

1. The Contractor shall, before presenting his proposal, visit the site and acquaint himself with all aspects of the work. He shall become familiar with the conditions and circumstances under which he will be required to operate.

1.08 REQUIRED TESTS BEFORE FINAL ACCEPTANCE

A. The Contractor will be required to test the entire system for continuity, grounds, resistance to ground, insulation resistance, before the lighting luminaries are connected. This shall be done by means of a 500 volt megohm meter test which will indicate the insulation resistance of any circuit or group of circuits. When the insulation resistance is less than 100 megohms between insulated conductor and uninsulated ground, the Contractor shall locate the point or points at fault, make proper corrections and then demonstrate by further test the elimination of such fault.

B. With all equipment connected to the wiring system, a functional test shall be performed by the Contractor using the system power in the presence of the Engineer to demonstrate that the system as a whole, and all parts thereof, function as specified or intended herein. Any defective materials or faulty or improper installation shall be permanently corrected by repairs or replacements to be made by the Contractor to the satisfaction of the Engineer.

C. The Contractor shall furnish the Engineer with a report of the megohm meter readings for a permanent project record.

D. All tests and any necessary repairs or replacement which are required to produce a fault free system will be performed at the Contractor's expense.

E. All testing shall be scheduled and coordinated by the Contractor. Notify the Engineer at least one week in advance of conducting tests.

1.09 SAMPLES

A. Submit samples as requested by the Engineer of all electrical materials specified herein in accordance with Section 5, and before ordering materials obtain Engineer's approval.

1.10 SHOP DRAWINGS

A. As specified under Section 5. Prepare and submit Shop Drawings of all equipment, apparatus and other items supplied under this Section of the Specification to the Engineer for approval. No work shall be done until Shop Drawings have been approved.

B. Shop Drawings shall show plans, details, layouts, and job conditions, and relationship to other work.

C. Shop Drawings shall be submitted for the following equipment:

1. Raceways, Boxes and Fittings.

2. Grounding Hardware and Connections.

3. Handholes and Covers.

4. Outdoor Lighting Equipment and Footings.

5. Pedestal Control Cabinet and Base.

D. The manufacturer's name and product designation or catalog numbers shall be submitted for the following material:

1. Raceway, Boxes, Fittings, and Hangers.

E. Prior to submittal, all drawings shall be checked for accuracy and contract requirements. Shop Drawings shall bear the date checked and shall be accompanied by a statement that the drawings have been examined for conformity to Specifications and Drawings. The statement shall also list all discrepancies with the Specifications and Drawings. Shop Drawings not so checked and noted shall be returned.

F. The Engineer's check shall be only for conformance with the design concept of the project and compliance with the Specifications and Drawings. The responsibility of, or the necessity of, furnishing materials and workmanship required by the Specifications and Drawings which may not be indicated on the shop drawings is included under the Work of this Section.

G. The responsibility for all dimensions to be confirmed and correlated at the job site and for coordination of this work with the work of all other trades is also included under the Work of this Section.

H. No material shall be ordered or shop work started until the Engineer's approval of shop drawings is given.

I. Submit complete operations and maintenance data for all equipment furnished under the Section, in accordance with Section 4. The manuals shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, complete parts lists, etc., that are required to instruct operating and maintenance personnel unfamiliar with such equipment.

1.11 COORDINATION DRAWINGS

A. Before materials are purchased or work is begun, this Contractor shall prepare coordination drawings showing the size and location of his equipment and lines.

B. Coordination drawings are for the General Contractor's and the Engineer's use during construction and shall not be construed as replacing any shop, as built or record drawings required elsewhere in this Contract Documents.

1.12 RECORD DRAWINGS

A. As work progresses, legibly record all field changes on a set of project Contract Drawings, hereinafter call the "record drawings".

1.13 GUARANTEE

A. The electrical system or systems, together with the component units as included in this Section of the Specifications, shall be guaranteed for a period of one year from the date of final acceptance thereof against defective materials and workmanship. Upon receipt of notice from the Owner or Engineer of failure of any part of the guaranteed equipment during the guarantee period, the affected part or parts shall be replaced promptly with new parts and at the expense of the Contractor.

1.14 OPERATING INSTRUCTION AND MAINTENANCE MANUALS

A. Provide operating instructions to the Owner's designated representative with respect to operation functions and maintenance procedures for all equipment installed.

B. At the completion of the project, turn over to the Owner two (2) complete manuals containing the following:

1. Complete shop drawings of all equipment.

2. Operation description of system.

C. All information shall be in three-ring loose-leaf binders.

1.15 DELIVERY, STORAGE AND HANDLING

A. Deliver electrical equipment and materials in manufacturer's original undamaged and unopened containers with labels intact and legible.

B. Store and handle electrical equipment and materials to prevent damage and deterioration. Electrical equipment shall not be stored out-of-doors. Store in dry permanent shelters. If any apparatus is damaged, such damage shall be repaired at no additional costs.

C. Provide secure, locked storage for lighting fixtures, controls and similar components that cannot be immediately replaced, to prevent installations delays.

D. Any damage to factory applied paint finish shall be repaired using touch-up paint furnished by the equipment manufacturer.

1.16 PROJECT CONDITIONS

A. Known underground and surface utility lines are indicated on the Contract Drawings.

B. Protect existing trees, and other features designated to remain as part of the final landscape work.

C. Promptly repair damage to adjacent facilities caused by electrical work operations. Cost of repairs at Contractor's expense.

D. Promptly notify the Engineer of unexpected sub-surface conditions.

1.17 SERVICE

A. Power for lighting shall be provided from Commonwealth Electric Company Pole (Location to be verified). Terminate conduit at pole and extend up riser pole and terminate as directed by Engineer. If an underground service is installed conduit shall be installed to the manhole or property line as directed. All conduit installed within the public way must be approved by the Pole and Conduit Commission prior to installation. Service connection and wiring of system by City Electrician.

1.18 CUTTING AND PATCHING

A. All cutting and patching shall be done in a thoroughly workmanlike manner.

B. Patching to be of the same kind of material as was removed.

C. The completed patching work shall restore the surface to its original appearance.

PART II PRODUCTS

2.01 PARK LIGHTS **(TYPE A, B, C,)**

PARK LIGHT TYPE A: All lighting fixtures shall be in accordance with the National Electric Code and shall be constructed in accordance with the latest edition of the Underwriters' Laboratories "Standards of Safety, Electric Lighting Fixtures". All lighting fixtures shall be Underwriters' Laboratories labeled.

Walkway lights and building mounted lights shall be manufactured by BETA/Cree Canada 6889 Rexwood Road, Unit 3 Mississauga, ON, L4V1R2 CANADA (800) 473-1234; (fax) (800) 890-7507; supplied by Omni Lite 263 Winn Street P.O. Box 949 Burlington, MA 01803; Phone: (781) 272-2300 ext. 201; Fax: (781) 272-0759, or approved equal.

1. Model: ***Model #The Edge Round ARE-EDR-5S-R3-04-D-UL-BK-350-43K.*** Furnish and install the required number of single lights with pole, base and concrete footing at the locations shown on the plans. Furnish and install the required number of twin lights with pole, base and concrete footing at the locations shown on the plans.

2. Poles: Furnish and install the required number of walkway light poles and bases manufactured by Valmont Industries (Modified) for 9.25" inch bolt circle: **MOD DS340-R400V130-P2-FPBK-DT12AC-LAB BC**; supplied by Omni Lite 263 Winn Street P.O. Box 949 Burlington MA. 01803; Phone: (718) 272-2300 ext. 201; Fax: (781) 272-0759 ext. 201, or approved equal. Color of poles and pole base covers shall be black.

PARK LIGHT TYPE B PARK FLOOD LIGHT FOR BALL COURTS: General Electric Lighting Systems Inc., or approved equal. Flood lights shall be *GE Powr-Spot ULC floodlight Model #ULGC/O1/M/O/A/2/CO/HDO/P.* supplied by Omni Lite 263 Winn Street P.O. Box 949 Burlington, MA 01803; Phone: (781) 272-2300 ext. 201; Fax: (781) 272-0759, or approved equal. Furnish and install the required number of flood lights, each with shield, bracket arms, mounting equipment, hardware, and concrete base at the locations shown on the drawings. Color of flood lights, shield, bracket arms, and mounting equipment, and hardware, shall be black.

1. Poles: furnish and install the required number of 39'ft. ballcourt light poles manufactured by Valmont Industries; *Model #DS210-900A389-P2.* Color shall be BK black.

2. Bracket Arms: furnish and install the required number of bracket arms for mounting of ball court flood lights to poles manufactured by Valmont Industries; supplied by Omni Lite Inc. Bracket arms to be "bullhorn" type *Model # MD102-030-01* to accommodate flood lights. Color of bracket arms to be black.

PARK LIGHT TYPE C: Furnish and install the required number of park light bollards **Model No. BRM832- 42" inch –CWL-NW-360-UNV-BLP** LED dome top school bollard; 42" inch height; CWL- constant wattage light output; Neutral white LED; 360 degree light coverage; 120v through 277v, 50hz to 60hz input; BLP black finish; manufactured by Philips/Gardco Company 1611 Clovis Barker Road, San Marcos, TX 78666; www.sitelighting.com; supplied by Omnilite Inc.263 Winn St. Burlington, MA 01803; Phone: 781.272.2300; Fax: 781.272.0759; www.omnilite.com, or approved equal.

2.02 LIGHT POLE FOOTINGS

A. Concrete footings for Type A pedestrian light shall be 24" inch diameter by four (4') feet depth; and for Type B Flood light shall be 36" inch diameter by (6') feet depth.

B. Cement concrete to be used for concrete footings shall be as specified under Section 29.

C. Anchor bolts shall be high strength steel as recommended by the manufacturer, three-quarters inch (3/4") diameter by sixteen inches (16") long. Anchor bolts, hexagonal nuts, flat washers, lock washers and all other necessary hardware shall be heavily galvanized.

D. Footing shall have the necessary 1-1/2" diameter rigid steel conduit sweep penetrating pole base and 5/8" diameter by eight foot (8'-0") long copper weld ground rod with Cadwell fitting.

2.03 LIGHTING CONTROLLER ENCLOSURE

A. Cast aluminum street light control cabinet Cat. No. SL-MF-CAMB as manufactured by Spec Lines Inc., 343C Main Street, Sandown NH; Phone: (603) 887-5511, or approved equal.

1. Made from .125 thick aluminum type 5052-h32.

2. Vertical mounting channels welded interior enclosure walls to provide adjustable brackets for rigid mounting of backflow preventer.

3. Door opening to have rolled up lip at top and flanged lips on all four sides.

4. Enclosure to have a screened air exhaust opening under roof overhang.

5. All exterior seams are to be continuously welded.

6. All external hardware is stainless steel. All internal hardware is either stainless steel or cadmium plated steel, Type II, Class 1.

7. Raised letters cast integral with door (0.025" inch) "Street Light Control City of Cambridge".

Enclosure Doors will be:

8. Equipped with three point latching mechanism with nylon rollers at top and bottom.

9. Door handle to be 3/4" inch diameter stainless steel with provisions for padlocking and shall open to the right.

10. Main door sealed with closed cell neoprene gasket.

11. Main door has a heavy gauge continuous hinge with 1/4" inch diameter stainless steel hinge pin. Hinge is secured with 1/4 - 20 stainless steel carriage bolts and stainless steel nylock nuts.

Cabinet Finish will be as follows:

12. Painted enclosures to be treated with three stage iron phosphate coating and forced air dried. Finish coat to be zinc chromate primer followed by a baked alkali enamel. Color to be black. Color to be applied prior to shipment by the manufacturer.

13. Two piece construction base separate from main cabinet.

2.04 HAND HOLES

A. Handholes shall be cement concrete precast units 12"W x 24"L x 33"D municipal standard, built to the lines, grades and dimensions, shown on the Contract Drawings, with design loading per AASHTO-HS20-44 and ACI 318-83. The required number of handholes is as shown on the drawings.

B. Frames and covers for handholes shall be galvanized steel construction, set in full mortar beds true to line and grade. Handhole frames and covers shall be similar and equal to Lebaron Foundry, Inc. Cat. LVC 13 25-2.

C. Standard handholes and with galvanized frames and covers with word "ELECTRIC" in cover, manufactured by Nelson Precast, Inc., 25 Hayward Street, P.O. Box 244, Braintree, MA 02184; Phone: (617) 843-0640, or approved equal.

2.05 RACEWAYS, BOXES AND FITTINGS

A. Rigid Metal Conduit

1. Rigid metal conduit shall be for use under the provisions of N.E.C. Article 346.

2. Rigid steel conduit interior and exterior shall be hot-dipped galvanized after threading and be as manufactured by the Allied Tube and Conduit Corp., Wheatland Tube Co., Triangle PWC Inc., or equal. Rigid steel conduit shall be used for wiring in or on building exterior, where required and where exposed on riser pole. PVC coated rigid steel conduit shall be used for direct burial applications and where shown on the drawings.

3. PVC coated rigid steel conduit shall have a 0.040" inch thick, polyvinyl chloride coating permanently bonded to hot-dipped galvanized steel conduit and an internal phenoli coating, and shall be "Plasti-Bond 2" as manufactured by Robroy industries, Triangle PWC Inc., Perma-Cote Industries, or equal.

B. Boxes and Fittings

1. All boxes and fittings used with PVC coated conduit shall be furnished with a PVC coating bonded to the metal, the same thickness as used on the coated steel conduit.

2. All boxes shall be cast or malleable iron device boxes shall be Type FD. All cast or malleable iron boxes and fittings shall have cadmium-zinc finish with cast covers and stainless steel screws as manufactured by the Crouse-Hinds Co., or equal.

3. Steel elbows and couplings shall be hot-dipped galvanized. Elbows and couplings used with PVC coated conduit shall be furnished with a PVC coating bonded to the steel, the same thickness as used on the coated steel conduit.

4. Conduit hubs shall be manufactured by Myers Electric Products, Inc., Raco Division, Appleton Electric Company, or equal.

5. Conduit sealing bushings shall be O.Z./Gedney Type CSB or equal. Bushings shall be used to seal conduit ends exposed to the weather and at other locations as directed by the Engineer.

6. Terminal boxes, pull boxes and junction boxes shall have NEMA ratings suitable for the location in which they are installed.

2.06 SUPPLEMENTAL STEEL, CHANNEL AND SUPPORTS

A. The Contractor shall furnish and install all supplementary steel, channels and supports required for the proper installation, mounting and support of all equipment within the control cabinet.

B. All supplementary steel, channels, supports and fittings shall be Underwriters Laboratories, Inc. approved, be galvanized steel and be manufactured by Steel City, Unistrut, Power Strut, T.J. Cope or Chalfant, or approved equal

2.07 WIRING

A. All wiring shall be with stranded copper conductors. All wiring and wiring devices to be furnished and completely installed by the Contractor.

B. Wire from service panel board to all pull boxes shall be No. 8 A.W.G. type XHHW or THWN copper. The wire shall include one (1) Black - one (1) Red - one (1) White - one (1) Green for grounding conductor. Wires shall be continuous where practicable. Where splices are made pressure connectors suitable for the purpose shall be used. Wires from the pull box to each light fixture shall be tow No. 10 A.W.G. type XHHW or THWN copper one (1) Black - one (1) White.

C. Wires from utility line pole to electric meter shall be No. 6 THWN copper and No. 6 THWN bond. The wire shall include one (1) Black - one (1) Red - one (1) White - and one (1) Green for grounding conductor.

2.08 GROUNDING SYSTEM

A. All equipment and systems shall be grounded by the Contractor in strict accordance with Article 250 of the National Electrical Code, utility company requirements, and as shown on the Contract Drawings.

B. The grounded neutral of the secondary distribution system shall be supplemented by an equipment grounding system installed so all conductive items in close proximity with electrical circuits operate continuously at ground potential and provide a low impedance path for possible ground fault currents.

C. The system neutral ground and the equipment ground system shall be connected to the common ground bus at the service entrance.

D. All branch circuit raceways shall have a green insulated grounding conductor.

E. Lighting control cabinet and pull boxes shall each have a ground rod 5/8" x 8'. A No. 4 A.W.G. type shall connect each ground rod, and light fixture. All steel conduit where used shall be bonded. The grounding conductor shall be continuous, and where connections are made, pressure connectors suitable for the purpose shall be used.

2.09 PANELBOARDS

A. All panelboards shall be dead front, safety type equipped with single or multi-pole circuit breakers. All panelboards to be furnished and completely installed by the City.

B. Busses may be copper or aluminum. All panelboards shall have a circuit directory card mounted in a frame with plastic cover installed on the inside of the door. All panels shall have a ground bus with a terminal for each branch circuit.

C. Panel board cabinets shall be made of code gauge steel. All panelboards shall be ordered without knock outs. All panel tubs shall be galvanized. Wiring gutters shall not be less than four (4") inches wide.

D. Panel board trim shall be made of code gauge steel. Door shall be equipped with flush catch and lock. All panel board shall be keyed alike.

E. All panelboards shall be of the following type with circuit breaker frame size listed below as a minimum:

1. 12/240 volt, 1 phase, 2 wire. Panel Type B10B. Breaker BA (Bolt on), SYM, INT, capacity 10,000 amps any 240 volts.

2. Panel board types are Westinghouse, Square D, ITE or General Electric or approved equal.

2.10 LIGHTING CONTROL SYSTEM

A. There shall be two methods of lighting control; constant and time clock. All lighting control equipment housed inside control cabinet shall be furnished and installed by the Contractor.

B. All other lighting fixtures shall be circuited to panel board LPC which is contactor controlled. The normally open contactor is controlled via a time clock which is photocell "on" and timed "off". A photocell is to be mounted on a twistlock outlet provided on the top of each lighting fixture. Photo electric control receptacle furnished with each lighting fixture by Contractor.

2.11 ELECTRIC SERVICE

A. Service shall be 120/240 volt, single phase, three wire 60 amp. capacity. Service shall be in rigid steel conduit and shall be terminated in accordance with utility company requirements. Slack cable sufficient to reach transformer terminals and all connectors furnished and installed by the City Electrical Department.

B. Contractor shall furnish and install all conduit (as per electric code) from line side of meter socket to line pole designated by the Cambridge Electric Light Company. In addition

contractor to furnish and install ten (10' feet) stand pipes, with grounding bushing on pole. City Electrician to supply and install cable (#4 minimum C.U.) to extend to the top of pole. This cable to be coiled above stand pipe for connection by Cambridge Electric Light Company.

C. Contractor to furnish and mount meter socket on exterior of pedestal and make load and line side connections. Load side to go to fused main switch or breaker.

D. All electrical equipment housed within lighting control cabinet shall be furnished and installed by the Contractor including the panel board, lighting contractor, time switch, receptacle, electric meter and all other equipment, mounting supports and hardware as necessary to complete the layout and wiring of this electrical control equipment.

2.12 WIRING

A. All wire and wiring devices for exterior lighting system, between control cabinet and pull boxes, between pull boxes and lighting fixtures, between cabinet and utility line pole and for grounding shall be furnished and completely installed by the Contractor.

2.13 EMERGENCY CALL BOX

A. Furnish and install the required number of emergency call boxes at the locations shown on the drawings including concrete footings. Emergency phone shall be ADA compliant, flush mount, Model Gal-Tronics # 297-001/203349; Support stanchion bronze with white lettering, for emergency phone shall be 114" inches height, Model Gal-Tronics # 234/24B953; Beacon/strobe lamp mounts in 234 stanchion, 120 vac fluorescent Model Gal-Tronics # 530FB/147895, supplied by Anixter, Inc., 200 Danton Drive, Methuen, MA. 01844; Contact: Mr.Mark Barrett (978) 682-8870, or approved equal.

PART III EXECUTION

3.01 WORK COORDINATION AND JOB OPERATIONS

A. The electrical equipment and poles shall not be installed without first coordinating the location and installation of same with all other details on all Contract Drawings. Do not cover over or enclose work before obtaining all required inspections, tests, approvals and location records.

B. Furnish to the General Electrical Contractor, and all other Subcontractors, all information relative to the portion of the electrical installation that will affect them, sufficiently in advance, so that they may plan their work and installation accordingly.

C. In case of failure to give proper information as indicated above sufficiently in advance, pay for all back charges for the modification, renovation and relocation of any portion of the work already performed.

D. Obtain from the other trades all information relative to electrical work which the Electrical Subcontractor is to execute in conjunction with the installation of their respective equipment.

3.02 PLANS AND SPECIFICATIONS

A. The Contract Drawings showing layout of the electrical systems indicate the approximate location of poles and equipment. The runs of branch circuits, as shown on the Drawings, are schematic only and are not intended to show the exact routing of the wire. The final determination as to the routing shall be governed by site conditions.

3.03 EXISTING UTILITIES

A. Locate and identify existing underground and overhead services and utilities within and adjacent to the contract limit of work areas. Provide adequate means of protecting utilities and services designated to remain. Repair utilities damaged during site work operations at Contractor's expense.

B. When uncharted or incorrectly charted underground piping or other utilities and services are encountered during work operations, notify the applicable utility company immediately to obtain procedure directions. Cooperate with the applicable utility company in maintaining active services in operation.

3.04 LIGHT FIXTURES, POSTS, BASES AND FOOTINGS

A. The fixtures, posts, bases and footings shall be located as shown on the Contract Drawings. Each fixture shall be a completely finished unit with all components, mounting and/or hanging devices necessary for the proper installation of the particular fixture in its designated location, and shall be completely wired ready for connection to the branch circuit wires.

B. Excavation and backfill for light pole footings as herein before specified in Section 3, EARTHWORK shall be in firm undisturbed or compacted soil. Excavate the holes to the lines and grades on the Contract Drawings.

C. Anchor bolts shall be installed in accordance with the anchor bolt settings determined by a template which the Contractor shall obtain from the manufacturer of the light standard. The bolts shall be threaded for at least five (5") inches from the top with three (2.75") inches of the thread above the concrete surface.

D. The quarter bend conduits for the footings are to be brought into the lighting standard(s) at right angles. As part of this Section the Contractor shall furnish and install all adapters, couplings, etc., necessary to provide continuity of conduit system for the proposed park lighting system.

E. All light fixtures shall be left in a clean condition, free of dirt defects, before acceptance by the Engineer.

3.05 ELECTRIC HANDHOLES

A. The handholes shall be located as shown on the Contract Drawings. Conduit openings shall be made in the field.

3.06 PEDESTAL CONTROL CABINET

A. The control cabinet and base shall be mounted on the reinforced concrete slab as per manufacturers recommendations. The anchor bolts supplied with the control cabinet base shall be installed in accordance with the manufacturer's detail.

B. The ground rod, the neutral, the cabinet, metal conduits and all other metal objects that are to be kept at ground potential shall be connected to the equipment ground terminal strip.

3.07 RACEWAYS, BOXES AND FITTINGS

A. The Conduits shall be located as shown on the Contract Drawings.

B. The minimum cover for conduit shall be 2'-6" below finished grade in paved areas and shall be 24" below finished grade in other locations, unless otherwise permitted by the Engineer. Plastic spacers shall be used to hold raceways in place. Spacers shall provide not less than 2" inches clearance between raceways.

C. All conduit shall be securely joined together by means of approved clamps or screw couplings to make each conduit continuous, complete and watertight. If the clamp coupling assembly is used it shall be completely sealed in four (4") inch cement mortar envelope extending a minimum of six (6") inches beyond the coupling ends. All conduit shall pitch to drain into a handholes at a grade not to be less than three (3") inches in 100 feet of distance. The pitch shall be uniform, with no sags to hold condensation.

D. The inside edge of all metal conduits shall be filed smooth to remove any burrs or sharp edges before being joined. The electrical contractor shall clean all installed conduits with appropriate sized swab or wood mandrels as approved by the Engineer. Where conduits enter or leave all boxes and cabinets, other than those having a threaded hubs, a standard locknut shall be used on the outside, and locknut and busing on the inside thereof. All raceways shall be sealed watertight at all structures.

E. Perform excavating and backfilling as required to install electrical work.

1. Excavate to dimensions and depths indicated or as required for proper installation and completion of the work. Raceway lines shall be installed on six (6") inch bed of compacted sand, with six (6") inches of compacted sand covering conduit.

2. Backfill and compact trenches in accordance with Section 11, using select common fill, compacted in lifts of six (6") inches.

3. Fill, compact and restore to original level condition after settlement.

4. Replace paving, lawn and finished surfaces removed to install electrical work except where new surfaces are provided as part of the work.

5. Remove and dispose of surplus excavated materials and debris from the site at no additional costs to the Owner.

6. Furnish and install red polyethylene warning tape twelve (12") inches below finished grade.

F. The Contractor shall furnish and install within each section of the proposed conduit a pulling rope in one continuous length, from handhole to handhole and from handhole to light standard leaving a four (4') foot coil for each length in each successive handhole for pulling purposed.

G. No conduit smaller than ½" inch electrical trade size shall be used, nor shall any have more than three 90 degree bends in any one run. Pull boxes shall be provided as required or directed.

H. No wire shall be pulled until the conduit system is complete in all details; in the case of concealed work, until all rough plastering or masonry has been completed; in the case of exposed work, until the conduit system has been completed in every detail.

I. The ends of all conduits shall be tightly plugged to exclude dust and moisture while under construction with PVC conduit caps glued in place.

J. Conduit supports shall be spaced at internals of eight (8') foot or less, as required to obtain rigid construction.

K. All conduits on exposed work shall be run at right angles to and parallel with the surrounding wall. No diagonal runs will be allowed. Bends in parallel conduit runs shall be concentric. All conduit shall be run perfectly straight and true.

L. Conduit terminating in gasketed enclosures shall be terminated with conduit hubs.

M. Conduits containing equipment grounding conductors and terminating in sheet steel boxes shall have insulated throat grounding bushings.

N. Conduits shall be installed using threaded fittings. Threadless fittings may be used in isolated instances when approved by the Engineer.

O. Conduit ends exposed to the weather shall be sealed with conduit sealing bushings.

3.08 ELECTRIC SERVICE

A. Each circuit of the distributing systems, shall be tested for insulation resistance after all wiring is pulled and connected, ready for the attachment of ballasts and luminaries.

B. Tests shall be made with "megger" or other instrument capable of measuring accurately the resistance involved while applying 500 volts. Readings shall be taken after the voltage has been applied continuously for one minuet. The insulation resistance between each conductor and ground shall be measured with all other conductors grounded. If resistance of less than 100 megohms is measured, the source of leakage shall be determined and corrections made. After the ballasts and luminaries are connected and ready for use, a similar test between the conductors of each circuit and ground shall be mae and the source of any leakage less than 100 megohms shall be found and corrected.

C. Ground resistance measurements of each ground rod shall be taken and certified by the Contractor. Ground resistance measurements shall be made in normally dry weather, not less

than 48 hours after rainfall, and with the ground under test isolated from other grounds. Maximum resistance shall be 25 ohms.

D. Electrical meter socket shall be located at height as directed by Cambridge Electric and installed by the Contractor.

3.09 GROUNDING

A. Ground all enclosures and non-current carrying metals to equipment ground conductor. Conduit system is to be electrically continuous. All lock nuts shall be cut through enameled or painted surfaces on enclosures. Where enclosures and non-current carrying metals are isolated from the conduit system, use bonding jumpers with approved clamps.

B. Running a separate grounding conductor in the conduit, bond the conductor to the fixture terminal box and to the over-current device enclosure or ground bus.

C. Bond all receptacles to the pole base using a bonding jumper between the pole base and the receptacle ground terminal. Metal to metal contact between the device yoke and the outlet box is not acceptable as a bond for either surface mounted boxes or flush type boxes.

D. Ground pole base by running a #10 bare wire from the pole grounding stud to grounding rod as indicated.

3.10 WIRE AND WIRING

A. The Contractor shall furnish and install all wiring to provide a complete lighting control and power system.

B. Provide conductors continuous from box to box. No joints permitted in the circuit other than in junction boxes.

C. Make joints using pressure type mechanical connectors applied after wires are cleaned and then insulate using two layers of electrical insulation putty covered with two half lapped layers of vinyl plastic electrical tape.

D. Exercise care when installing wire in conduit to prevent damage to conductor insulation. No oils, grease or compounds other than UL approved wire pulling lubricants shall be used for pulling wires in any conductors.

E. Identify colored tape, minimum ½" size, for #8 AWG or larger wire. Wrap twice around wire at the following points:

1. At each terminal;

2. At each conduit entrance;

3. At intervals not more than twelve (12") inches apartment in all boxes, panel tubs with switchboards.

3.11 WIRING DEVICES

A. Install wiring devices where indicated.

B. Ground all receptacles in accordance with the National Electric Code requirements.

3.12 TESTING AND ACCEPTANCE

A. The Contractor shall maintain all lighting until acceptance by the City.

B. Upon completion of the work the Engineer will make final inspection of electrical work. Contractor shall perform tests as necessary to verify system performance, including operation of lights and equipment, continuity of conduit system, grounding resistance and insulation resistances.

C. Provide necessary personnel and testing instruments as required to assist in testing.

D. Submit data taken during tests to the Engineer.

E. Correct unacceptable work.

3.13 CLEANING

A. Clean finished surfaces equipment touch-up scratched or damaged surfaces with matching materials. Repairs of dents and marred finishes shall be acceptable to the Engineer.

B. Brush clean, prime and paint rust spots on any part of the work.

C. Clean interiors of all enclosures. Remove dirt and debris before installing trim or covers.

D. Provide identification on all equipment.

E. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, debris and equipment. Repair damage resulting from electrical system installation.

* END OF SECTION *

SECTION 31

SIGNAGE

PART I GENERAL

1.01 GENERAL REQUIREMENTS and RELATED DOCUMENTS

Where shown on the Drawings or as required to complete the work of this Contract, furnish and install the type and quantity of signs as described under Sign Schedule.

A. Examine all Drawings and all other Sections of the Specifications for related work under other sections for requirements therein affecting the work of this trade.

B. The contract Drawings shall not be scaled for dimensions or any other purpose. If the Contractor feels that necessary dimensions are missing, they shall contact the Engineer for clarification.

1.02 DESCRIPTION OF WORK

A. The work of this Section consists of furnishing, delivery to site, and including complete installation of Exterior information and Traffic Signs, and related items, as indicated on the Drawings and/or specified herein, and includes, but is not limited to the following:

1. 2 ½"inch square steel pvc coated black post and aluminum flag-mounted panel signs with single post, direct burial.

2. Panel signs with silk screened logo, letter text and symbols, including installation as per sign type descriptions.

3. Silk screened letters or symbols, applied to metal surface material as indicated.

4. Ornamental cast aluminum (2pc) sign pole with ball cap and aluminum suspended mounted panel signs with surface mount to concrete footing.

5. Bulletin Board Kiosk structures with optional weather tight cabinet.

B. The work is described in this section of the documents as follows:

Specifications for Signage
Sign Schedule
Layouts for Sign Types
Elevations, Details, Mounting Notes
(Refer to park plans for sign locations)

1.03 SUBMITTALS

A. Follow submitted provisions and procedures in General Conditions of document.

B. Shop Drawings: Shop drawings shall clearly show materials, typographic layouts, sizes, methods, finishes, anchorage, connections, relationship to supporting and adjacent work where applicable, and other details of construction.

1. Submit sample of typical layouts of each sign type for approval of graphic quality, letter forms, symbols, visual correction, and type spacing. The engineer reserves right to reject artwork if it fails to meet standard of quality established in the Documents.

C. Submit list of materials and fastening items to be furnished under this Contract, giving manufacturer'' name and catalog number. Materials and hardware not specified, but necessary to complete function of unit, shall be provided to quality level established.

D. Samples, to be submitted to Engineer, for review and approval:

1. Submit sample of each finish as specified and of each color, on corresponding material, (8" inch x 8" inch minimum size) large enough to be used for comparison during production and representing extreme variation in color and texture of finished work.

2. Submit sample setting and/or alphabet for each font types, for approval.

3. Submit full size template of lettering and spacing for each sign type, for approval.

4. Submit samples of all mounting hardware for attachment of sign panels to posts, fencing and wall mounted.

6. Submit shop drawings of sign posts, ornamental cast iron post end caps, mounting brackets for approval by the Project Engineer.

1.04 COORDINATION

A. The work of this Section shall be coordinated with that of other trades affecting, or affected by, this work, as necessary to assure the steady progress of all work under the contract. Closely coordinate the delivery and installation of this work with the contractor's schedule.

1.05 GUARANTEE

A. In addition to the specific guarantee requirements of City Documents Set, the Contractor shall obtain the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

B. Include manufacturer's written guarantee that all work under this Section shall be free of defects of workmanship of materials and shall meet these specifications all for a period of one year from date of substantial completion of the project.

PART II PRODUCT

2.01 MATERIALS

Signs shall be manufactured by the following fabricators (or equal):

Back Bay Sign Co.
236 Pearl Street
Somerville, MA 02145

Phone: 617-666-5550
Fax: 617-666-9742

Attn: Tony Clayton

Advanced Signing Inc.
4 Industrial Park Road
Medway, MA 02053

Phone: 800-439-4904
Fax: 508-533-2975

Attn: Cheryl C. Joyce

Design Communications
21 Drydock Avenue
Boston, MA 02210

Phone: 617-542-9620
Fax: 617-951-0777

Attn: Thomas Barton

Sunshine Sign Company
122 Worcester Street
North Grafton, MA 01536

Phone: 508-839-5588
Fax: 508-839-9929

Attn: Mary Lovezzola

A. Post and Panel Exterior Signs are typical aluminum non-illuminated, with square posts.

B. All hardware and fasteners are to be electrolytically isolated.

C. Aluminum Material: Structural shapes shall meet ASTM B 308, 6061 Alloy, Extruded Shapes shall meet ASTM B 21, 6063 Alloy, and sheet shall meet ASTM B 209, 1100, 3003, or 5052 Alloy.

D. Aluminum: Prepare material surfaces as appropriate to various materials, for smooth finish application. Finish shall be acrylic polyurethane paint systems by Matthews Paint Co. or equal approved by Engineer.

E. Signs shall be engineered to eliminate buckling, or failure, distortion and other damage. Signs shall be rigid ¼" inch thick with minimum deflection and rotation under stress and shall be able to withstand movement, shear, and torsional loads.

F. Signs shall be designed as structurally self-supporting units. Suspension systems and substructure shall be designed by sign manufacturer.

G. Exposed corners of signs shall be sharp 90-degree corners, not radius-cut, unless otherwise

specified on layout drawings. Exposed edges of sign faces shall be "eased, either sanded and/or ground smooth to eliminate sharp edges.

H. Joints in members shall be internally aligned and shall provide for thermal expansion and contraction. Joints and seams shall be filled and ground smooth so that they are not visible on the exposed areas of the finished sign.

I. All plastic panel sign panels shall be Intecel PW or Intecel pvc sheeting, manufacturered by World-Pak Division, Inteplast Group Ltd., 101Inteplast Blvd., Highway 1593, Lolita, Texas 77971; Phone: 361.874.3760; Fax: 361.874.3984, or approved equal.

2.02 GRAPHIC LAYOUTS, TYPOGRAPHY AND ARTWORK

A. The signage Sub-Contractor shall be responsible for all layouts and artwork, following specifications as shown in the Documents. All typography shall follow sign layouts information provided in the documents.

B. Artwork for complete alphabets, numerals and international symbols to be used as shown on attachment to this section. Typography standards shall be Gerber System fonts as follows:

1. The alphabet for primary text letters only shall be font "Garamond Book".

2. The alphabet for secondary text where indicated, shall be font "Frutiger 65 and Frutiger 55" as shown on sign layout drawings.

3. The alphabet for all parking signs shall be font "Helvetica Condensed" and "Helvetica Condensed Bold".

C. See attached pages of this section for showing of complete alphabet fonts arrow style, and symbols artwork.

D. Artwork for Cambridge City Seal, Park Tree Symbol and Activity Symbols will be provided as digital files, Macintosh format, EPS documents from Rob Steck, Cambridge Community Development Department, 57 Inman Street, Cambridge, MA 02139; Phone: (617) 349-4635, Fax: (617) 349-4669.

2.03 COLOR

A. All paint colors, of various types, as appropriate for various materials and different surfaces will be specified as colors in the Matthews Paint System. All paint finishes shall have satin, non-glare finish, and be coated with clear coat sealer, to maximize UV light impact to colors. All paint equivalent colors are to be submitted as a minimum of 8" inch x 8" inch minimum size, for approval by the Project Engineer. Color references in drawings of this section, are to match the following:

Black = MAP # 78A-1A Jet Black

Red = MAP # 4A-1A Fire Engine Red

Blue (handicap) = MAP / match HC vinyl

Gray - MAP to match PMS #423 C

B. Color as noted in layouts for Sign Types requiring vinyl letters must match exactly to 3M Scotch Series 220 & 280, Premium high performance Vinyl film colors:

White = color # 220-10 White

Red = color # 220-63 Geranium

Handicap Blue = # 220-47 Intense Blue

Reflective White = color # 280-10
Gold = Color #220-131

2.04 DIRECTIONAL and INFORMATION SIGNS

A. Type and Manufacturer: Single panel types for various mounting conditions, as per drawings.

B. Materials: Aluminum panels finished surfaces to be smooth "satin" type, with no apparent grain. All joints should be welded and ground smooth to appear seamless.

C. All metal surfaces to be low-lustre finish, with silk-screened text applied. Edges and all exposed surfaces to be same finish as face, unless noted otherwise.

2.05 SILK–SCREENED TEXT

A. All signage called out as silk-screened shall be industry standards. Signage subcontractor shall be responsible for using the best quality inks appropriate for the various surfaces. The height and color of all letters and symbols shall be called for on the drawings.

2.06 ANCHORS and FASTENERS

A. Provide anchors, fasteners and adhesives as required to secure work in place. Anchors, inserts, fasteners and adhesives shall be compatible with sign materials; shall not result in galvanic action or chemical interaction; and shall have demonstrable and sufficient strength for each intended use. When necessary, isolate with metal or plastic washers.

B. All fasteners shall be painted out to match background field color, or concealed if noted. All fasteners shall be vandal-resistant on all sign types.

C. Fasteners for mounting panel signs to round poles, shall be Type 316 Stainless Steel, E.V.A. Coated Bands (3/4" inch width) standard Black color, #AE436; with Type 316 Stainless Steel Clips #AE456n(3/4" inch width); and Type 1-bolt, Flared Leg Stainless Steel Brack-It #D022; (Recommended install using Bantam tool #CO75) and type as manufactured by Band-It Corporation, Denver, CO. Sign panels shall be screwed with Stainless Steel Bolts to be 5/16" inch - 24 threads x ½" inch Button head cap screws, with Allen heads; isolated with metal and plastic washers

2.07 ORNAMENTAL SIGN POST

Sign post for mounting park identification sign (See custom 24" inch by 28" inch vertical panel sign in Appendix I) shall be Model-Park Avenue Sign Post manufactured by Trystan, Inc., 68 Swan Street, Ayr, Ontario, Canada NOB 1EQ; Phone: (519) 632-7427, Fax: (519) 632-8271, or approved equal. Pole shall be 144" inches high by 2-7/8" inch O.D. Schedule 40 pipe with ASTM a-48-76 cast gray iron base collar and post ball end cap as shown on the drawings. Contact person: Sales representative Peter Graham.

Ornamental cast aluminum signpost bracket for Trystan pole shall support vertical sign panel. Bracket shall attach be attached to sign post by means of 1" x 2" aluminum tube welded to sign post as detailed. Sign panel to be attached to bracket by means of 1" x 2" tube as detailed. In addition sign panel shall have a wind stabilizing bracket at bottom edge of sign panel as detailed. Sign panels to be field attached by means of approved stainless fasteners to be furnished by the signpost and bracket manufacturer.

2.08 FLAG MOUNTED SIGN POST

Square posts for flag mounted sign panels shall be 2 ½" inch square tube by ¼" inch thick by 10' foot – 3" inch long black vinyl coated steel with cast iron ball type end cap. Flag mounted sign panels shall be equipped with manufacturer installed aluminum angle brackets for attachment to posts, with approved stainless steel hardware. Touch up paint all exposed hardware.

2.09 **BULLETIN BOARD-KIOSK**

BULLETIN BOARD-KIOSK

A. **Furnish and install the required number of two (Model #: CBB1001), three, or four sided bulletin boards at the locations shown on the drawings. Where shown on the drawings or as required to complete the work of this contract, furnish and install the following equipment manufactured by IDF, Industrial Design and Fabrication, Inc. PO Box 733 1448-14 Speonk-Riverhead Road, Speonk, NY 11972; Phone: (631)325.1484; Fax: (631) 801.2748, idfabrication@verizon.net, or approved equal.**

B. (1-2) Optional Weather Proof Enclosure as required, shall consist of ¼" clear lexan, stainless steel continuous hinge, weather proofing gasket, ½" marine grade plywood, CWF attached to frame unit with tamper proof hardware. Two (2) cam locks to be supplied, keyed alike.

C. Bulletin board shall consist of: (2-4) Post cap ball: 3" diameter stainless steel. (2-4)Post cap: ½" x 5" x 5". (2-4)Arch frame: 11 ga. x 2" x 2" steel tubular. (2-4) Post cap: ¾" x 7" x 7. (1-4) Color: #220-10 White Letters. Garmond, upper and lower case, as shown, ¼" x 9 ¾" radius steel plate. (1-4) Sign board: ¼" x 37" x 48" perforated steel. (2-4)Sign post: ll ga. x 3" x 3" x 126"structural steel. (1-4) Arched sign frame: ¾" x 2" frame, welded with ¼" perforated steel back.

D. Finish: polyester powder coated black.

E. (2-4) 4000 psi concrete footings shall be 12" diameter x 36"depth.

EXECUTION

A. All tubular steel Posts shall be set square and plumb in concrete footings, to grade required, to assure level installation of the Kiosk. All Posts shall extend 36" below theoretical finished grade, or as indicated on the drawings.

B. The Kiosk shall be installed as per manufacturer's instructions.

C. Contractor shall apply touch-up paint to any and all surfaces chipped or scratched during installation.

D. Contractor shall provide the Owner with Touch-Up Paint, Maintenance Materials and Manufacturer's Installation Instructions.

SIGN INSTALLATION

A. Install all signs level and plumb on properly constructed and inspected foundation and base.

B. Ensure that elevations match approved shop drawings.

C. Protect completed installation from damage until acceptance by the Project Engineer.

D. Exterior post and panel signs shall be installed on footings, as indicated in Drawings, by Sign Contractor. Coordinate with contractor. Field verify all sign locations shown on site drawings with Project Engineer before installation.

E. All in-ground posts for signs must be located by installer and marked with colored stakes in-ground for review and approval by Engineer before commencing footing work.

F. All fence mounted panels with backing plate to be bolted through face of sign and backing plate, using only approved stainless steel mounting hardware. Touch-up paint all exposed hardware.

G. Matching matte finish black paint for touching up all exposed mounting hardware supplied by the sign manufacturer.

2.11 **SIGN SCHEDULE**

C3	**1**	**Play Area Identification Sign (2-5 yrs.) 20"x20"**	**6, on light pole**
N1	**4**	**Regulatory Dog Sign (On Leash/Pick Up) 10"x20"**	**7b, 9 to chain link fence**
N3	**1**	**Regulatory Sign for Dogs (No Dogs Allowed) 10"x20"**	**7b, 9 to chain link fence**

J	**2**	**Park Regulations for Typical Neighborhood Site (Park Rules) 20"x20"**	**7b, 9 to stl. picket fence**
B1	**2**	**2 Sided -Commemorative Park Sign (Park Identity/Directional Sign) 16"x24"**	**3, 5 post mounted**
CS*	**1**	**"Group Seat Swings" Sign 22"x15"** *(Recommended for children age 5-12 No more than 4 children on seat at a time)*	**7b, 9 to chain link fence**
CS*	**2**	**Garden Signs, 22"x15",as detailed**	**7b, 9 to stl. picket fence**

***(Custom Signs)**

Refer to Details in Appendix

* END OF SECTION *

SECTION 32

STRUCTURAL SOIL MATERIAL FOR STREET TREE PLANTINGS

PART I. GENERAL

1.01 DESCRIPTION

The work of this sections consists of preparing and placing and compacting Structural soil materials on a prepared subgrade, where shown on the Drawings or as required to complete the work of this Contract.

1.02 SUBMITTALS

A. Submit soil and stone test analysis reports for the topsoil and the aggregate to be used from an approved soil testing laboratory.

1. The testing laboratories shall have a minimum of 5 years experience with the test protocols of the United States Golf Association - Green Section and the American Association of State Highway and Transportation Officials (AASHTO).

2. Provide a physical analysis of the soil to include the following:
   a. Particle size distribution
   b. pH
   c. Dry bulk density of soil as it is delivered to the mixing plant
   d. Specific gravity
   e. Percent organic content by weight
   f. Nutrient levels including nitrogen, phosphorus, and potassium
   g. Soluble salts in ppm

3. Proved a physical analysis of the stone to include the following:

   a. Particle size distribution
   b. Loose and rodded unit weight
   c. Bulk specific gravity and absorbance
   d. Stone dimension description such as ASTM D 4791

4. All testing will be at the expense of the contractor

C. Submit one pound samples of all topsoil and soil additives in this section. Submit five pound samples of all stone. Samples should be labeled to include the location of the source and the materials.

1.03 DELIVERY, STORAGE AND HANDLING

A. Do not deliver or place materials in frozen condition.

B. Material shall be delivered at or near optimum compaction moisture content as

determined by AASHTO T 99/ASTM D 698. Do not deliver or place materials in an excessively moist condition (beyond two percent above optimum compaction moisture content as determined by AASHTO T99\ASTM D 698).

C. Do not store unprotected from large rainfall events. Do not allow excess water to enter the site prior to compaction (washing of tools, trucks, etc.). If water is introduced into the material after grading, allow material to drain to near optimum compaction moisture content.

NOTE: The previous section may be changed pending further testing to deliver the material dry of optimum and under a wider range of moisture.

PART 2 PRODUCTS

2.01 TOPSOIL

A. Clay loam, friable topsoil containing (unidentified percentage...est. 2 to 5) by weight organic matter; free from subsoil, refuse, roots, stones larger than 0.5 inch, noxious seeds, sticks, brush, litter and other deleterious substances; suitable for the germination of seeds and the support of vegetative growth.

B. Soil texture: Clay loam soil with the following particle size distribution.

Approximate Soil Distribution	
Gravel	Less than 5%
Course to medium sand	Less than %5
Fine sand	5 - 10%
Very fine sand	10 - 30%
Silt	20 - 40%
Clay	25 - 40%

C. Provide a minimum of three particle size analysis tests from samples obtained randomly throughout the source of stock pile of field.

D. The pH value shall be between 6.0 and 7.0.

E. Nutrient levels in pounds per acre:

Nitrogen	(standard soil spec levels)	
Phosphorus (Bray P1)	"	"
Potassium	"	"

F. Maximum soluble salts

2.02 STONE

A. Stone meeting the local DOT size designation equivalent to AASHTO size #4 \ASTM size #4. Preferably a crushed stone.

1. Stone shall be clean and be certified to meet local DOT aggregate soundness requirements for use in road construction.

2. Stone of high angularity will be preferred over washed gravel.

3. Stone dimension aspect ratio should approach 1:1:1 with a maximum of 2:1:1 average length: width: depth

4. Particle size distribution shall meet the local DOT size designation equivalent to AASHTO size #4\ASTM size #4. A singled sized stone near one inch will be preferred to a wider size distribution or smaller single sized stone fitting the general size description.

5. Submit at least three, five pound samples of different aggregate sources and the physical analysis from section 1.02-A-3 for review and selection.

2.03 HYDROGEL

A. Gelscape as manufactured by Amereq Corp., Congers, NY 10920 or approved equal.

NOTE: Only one hydrogel has been tested. It is patented for a good reason. The moisture release qualities and life of the gel in the system meets the system purpose. The material is designed for agricultural use. No substitution is recommended as small changes in hydrogel structure greatly change the material behavior.

2.04 MIXING PROTOCOL

Due to the expenses of equipment and mixing control, mixing in large volumes may be preferred with storage provided. A large mixing plant would be the logical contracted supplier: One who is capable of large concrete mixing or road material production.
It is evident from previous installations and consultations the conventional techniques for mixing standard concrete are not appropriate for this structural soil material. Ground mixing with front-end loaders , roller compacted concrete techniques, or alternative mixing arrangements for standard concrete are currently under investigation.

A. Mixture of soil, stone, and hydrogel, mixed to the following proportion

Component	by units of weight
Stone	100
Soil	16 - 20
Hydrogel	0.03
water	approx. 10

Adjust the water in the mix to bring the final mix up to optimum moisture content for compaction as determined by AASHTO T 99\ASTM D 698. The soil moisture content water contribution at the time of mixing should also be accounted for before selecting the amount of water to add to the mix.

B. Adjust the ratio of the components in accordance with the voids present in the

rodded until weight determination of the stone. If stone sample porosity is near 40% the weight percentage of soil in the mix may increase towards 16%. If the stone sample porosity is near 33% then the weight percentage of soil in the mix should decrease toward 14%.

C. MIXING PROCEDURE

1. Mix the hydrogel and the water to produce a slurry, and wait allow at least four hours for hydration (may be stored for longer periods in bulk processing).

2. Place the stone into the mixing hopper and set into motion

3. Add the water-hydrogel slurry and allow to uniformly wet the stone.

4. Add the soil mix (experience and testing will establish some initial guidelines).

5. Deposit the material

6. Do not over-mix. If the clay begins to pelletize and separate from the stone, discard the batch.

PART 3: EXECUTION

3.01 A. Prepare sample structural mixes for testing and approval.

1. Test the topsoil and stone. Submit the test results and the samples, with their respective analyses for approval. Based on the samples and the analysis, the Contracting Officer and the contractor will jointly determine up to three different mix ratios for each Structural Soil Material to be tested for conformance with the requirements of the specifications

2. The contractor shall prepare the samples of the proposed mix ratio options and obtain test results. Submit the samples of the mixes with the testing results.

3. Develop a standard moisture-density curve per AASHTO T 99 for each proposed mix.

4. If desired, conduct permeability and California bearing ratio (CBR) tests on compacted samples when compacted to peak density. Soaked CBR should be a minimum of 40 at peak standard density. Permeability expectations have not been developed at time of this writing. NOTE: Further testing will establish mixing protocol to assure necessary strength and drainage, eliminating the need to request a CBR or permeability test. They may however, be required by the project engineer.

5. If a volumetric mixing ratio is desired, calibration of measuring containers can be conducted using bulk densities and unit weights of the materials.

6. If nuclear methods for density measurement are to be used to check site compaction, it is advisable to provide testing engineer with a large sample of material for calibration of the tool.

7. The Contracting Officer may request additional Structural Soil Material ratio samples to be tested in the event that further refinement of the mix is necessary.

3.02 MIXING AND TESTING

A. All mixing shall be performed at the contractor's yard using appropriate soil mixing equipment of sufficient capacity and capability to assure quality control. No mixing soils at the project site shall be permitted unless suitable portable equipment is approved by the Contracting Office and the Project Engineer.

B. The contractor shall mix sufficient material in advance of the time needed at the job site to allow for adequate time for testing as required by the progress of the work. Structural Soil Material shall be stored in piles of approximately 400 cubic yards and each pile numbered for identification and testing purposes.

C. If a volumetric system is employed during the mixing process, the bulk density of the soil component shall be checked for every 100 cubic yards of Structural Soil Material mixed to assure a constant stone to soil ratio. If the density changes, the volumetric calibration should be changed accordingly.

D. For each stock pile, not less than two samples of Structural Soil Material weighing not less than ten pounds shall be collected for every 100 cubic yards of material produced. The sample stone-soil ratio will be checked by splitting a know weight of material on a #4 sieve. The percentage of soil should not be greater than 2% from the target ratio. The mean stone-soil ratio for the stock pile will be calculated and included
NOTE: This takes time, and can be run quickly on low organic mixes by pan frying the mix, weighing, washing off the soil over the sieve, pan frying the stone and calculating soil percentage. "Speedy moisture" kits or microwaves could also be used for slightly longer drying times on organic materials, or oven methods which can take up to two days.

E. In the event that the average stone-soil ratio varies significantly from the approved sample, as determined by the Contracting Officer, make adjustments to the mixing ratios and procedures. Re-mix and re-test any lot of soil that fails to meet the correct analysis after the adjustment has been made.

F. After the completion of the mixing and prior to the installation, protect the Structural Soil Material stockpile from rain and mix separation through erosion.

1. Cover the stockpile at all times with tarps or store in a covered structure.

3.03 UNDERGROUND UTILITIES AND SUBSURFACE CONDITIONS

A. Notify the Contracting Officer of any subsurface conditions which will effect the contractor's ability to complete the work.

B. Locate and confirm the location of all underground utilities prior to the start of any excavation

C. Repair any underground utilities or foundations damaged by the contractor during.
the progress of this work. The cost of all repair shall be at the contractor's expense.

3.04 SITE PREPARATION

A. Excavate to the proposed subgrade to depths as shown on the drawings.

B. Confirm that the subgrade is at the proper elevation and compacted as required. Subgrade elevations shall slope parallel to the finished grade and/or toward the surface drain lines as shown on the drawings.

C. Do not proceed with the installation of the Structural Soil Material until all walls, curb footings, and utility work in the area has been installed. Structural elements that are dependent on the Structural Soil Material for support may be postponed until immediately after the installation of the mix.

D. Install subsurface drains, irrigation main lines, lateral lines, and irrigation risers shown on the drawings and as specified prior to installing the Structural Soil Material.

E. Protect adjacent walls, walks, waterproofing, and utilities from damage or staining by soil. Use ½ inch plywood and/or plastic sheeting as directed to cover existing masonry work and other items during the installation of the Structural Soil Material.

1. Clean up any soil or dirt spilled on any paved surface at the end of each working day.

2. Any damage to the paving or architectural work caused by the soils installation contractor shall be repaired by the general contractor at the soils installation contractor's expense.

3.05 INSTALLATION OF THE STRUCTURAL SOIL MATERIAL

A. Install the Structural Soil Materials in six inch lifts to the levels and depths shown on the drawings. Deeper lifts may be used if the installing contractor can present documentation of a deeper effective compaction depth of equipment used on site, and eight inch nuclear density data confirm acceptable compaction of the material.

1. Compact all materials to not less than 95% of peak dry density from a standard AASHTO compaction curve (AASHTO T 99).

2. The site engineer should check the relative compactness of the materials on site in a fashion keeping with regional DOT testing practices for acceptable compaction of highway base course materials.

3. As excessive moisture can become problematic, check moisture content of the Structural Soil Material in place before compaction proceeds. Have drainage systems functional to allow egress of additional water in the event of rain. Do not allow water to be introduced to the profile before compaction expecting to purposefully raise the moisture level of a dry mix. If moisture content is excessive, allow 24 hours to drain before compaction. Methods of quick field estimation for placement acceptance are under consideration.

4. After completion of the installation of the Structural Soil Material, protect the mix from contamination by toxic materials, trash and debris, and from water containing cement, clay, silt, or materials that will alter the particle size distribution of the mix.

5. Immediately after installation of the Structural Soil Material, install the base course material or paving material specified and shown on drawings. Do not schedule or phase the progress of the work to install the Structural Soil Material significantly prior to the installation of the next pavement layer.

3.06 CLEAN UP

A. Upon completion of the Structural Soil Material installation operations, clean areas within the contract limits.

1. Remove all excess fill soils and mix stock piles, and legally dispose of all waste materials, trash and debris.

2. Remove all tolls and equipment and provide a clean, clear site.

3. Sweep, do not wash, all paving and other exposed surfaces of dirt and mud until the paving has been installed over the mix. Avoid washing the area until all paving has been completed

END OF SECTION

SECTION 33

SYNTHETIC GRASS SAFETY SURFACING

1.0 GENERAL REQUIREMENTS

1.05 Related Documents

1.01 SCOPE OF WORK

A. Furnish all labor, materials, tools and equipment necessary to install, in place, all synthetic turf, drain core, pad, and infill material as indicated on the plans and as specified herein.

B. The installation of all new materials shall be performed in strict accordance with the manufacturers written installation instruction, and in accordance with all approved shop drawings.

C. All materials and work to be furnished by the ForeverLawn East Dealer, Designed for Fun, Inc. PO Box 883, Doylestown, PA 18901; Contact person: David Haddaway, Regional Sales Manager; Phone: (866) 464-7529, Fax: (215) 675-8702 or approved equal.

D. Prior to ordering materials, the Contractor shall submit any details that deviate from these plans and specifications

E. Prior to Final Acceptance, the Contractor shall submit to the Owner:

i. Three (3) copies of Maintenance Manuals, which will include all necessary instructions for the proper care and preventative maintenance of the synthetic turf system, including minor seam repair

ii. Product and Installation Warranty

iii. IPEMA certification letter

iv. Letter of certification that the resilient safety surfacing system installed is compliant with the currant ASTM and CPSC safety standards and guidelines as they pertain to playground equipment safety surfacing and certification that the system meets or exceeds the requirements of the manufacture and is in compliance with the requirements of the American with Disabilities

F. Prior to the beginning of the installation, the manufacturer/installer of the synthetic turf and pad shall inspect the sub-base and supply a letter of certifying the acceptance for the purpose of obtaining manufacturer's warranty for the finished synthetic playing surface.

1.02 DESCRIPTION OF WORK:

A. The contractor shall provide all labor, materials, equipment, and tools necessary for the complete installation of an in-filled synthetic grass playground surface with a stable draining base. The complete synthetic grass surfacing system shall consist of, but not necessarily be limited to, the following:

i. Synthetic grass surfacing system to the extents shown on the drawings.

ii. Subgrade, base, and drainage construction as specified in Section 2 and Section 3 of this document.

iii. Quality synthetic grass product manufactured in the USA according to specifications in Section 2 of this document. Product shall meet or exceed all guidelines as established herein, or for

characteristics not specifically stated, shall meet or exceed all guidelines published by the Synthetic Turf Council.

iv. The synthetic grass surface shall be specifically designed, manufactured and installed for the intended use as a playground safety surface.

v. Antistatic technology shall be inherent in turf design and manufacture. Post production application or topically applied antistatic agents shall not be permitted.

vi. Antimicrobial technology shall be inherent in turf design and manufacture. Post production application or topically applied antimicrobial agents shall not be permitted.

vii. Quality synthetic infill product manufactured in the USA according to the specifications in Section 2 of this document. Product shall meet or exceed the specifications as established herein, or for characteristics not specifically stated, shall meet or exceed all guidelines published by the Synthetic Turf Council.

viii. Antimicrobial technology shall be inherent in the synthetic infill design and manufacture. Post production application or topically applied antimicrobial agents shall not be permitted.

ix. A 1" layer of interlocking drain-core (which provides consistent 1292-04 HIC and GMAX ratings) for the indicated areas outside of the playground equipment use-zones for system stabilization and to provide an ASTM rated 5' fall height safety surface.

x. A 1" layer of perforated closed cell virgin material playground pad (which provides consistent 1292-04 Hic and GMAX ratings) for the indicated areas within playground equipment use-zones to provide an ASTM rated 8' fall height safety surface.

xi. A fully synthetic, or approved composite, perimeter anchoring board used to hold the staples used to secure the edge of the synthetic grass

1.03 SYSTEM PERFORMANCE:

A. Contractor shall ensure that products for playground system meet the following performance requirements:

B. All components and their installation method shall be designed and manufactured for use on playgrounds. The materials as hereinafter specified shall withstand full climatic exposure in the location of the playground, be resistant to insect infestation, rot, fungus, mold and mildew, shall also withstand ultra-violet rays and extreme heat, and allow the free flow of water vertically through the playing surface and into the drainage system below the surface.

C. The seams of all system components shall provide a permanent, tight, secure, and hazard free playing surface.

D. The installed synthetic playground grass and drainage system shall allow for drainage and water flow through the system at a rate of not less than 10 inches per hour.

E. At the time of substantial completion, the system's ASTM 1292 rated surface shall have a fall height rating based on playground design up to 5' in open areas and 8' in playground use-zones. Testing shall be based on ASTM 1292-04. At no time throughout the life of the warranty shall the fall height rating be less than the original design.

F. Based on independent laboratory tests, the synthetic grass product must be shown to meet or exceed ASTM testing standards as specified by architect or owner.

1.04 SUBMITTALS

A. Synthetic grass vendor must submit the following to owner or owner's representative with the official bid package:

i. One (1) copy of the most recent installation reference list for projects of similar scope to this project completed in last three years.
ii. One (1) 12"x12" loose sample of proposed synthetic grass product
iii. One (1) 12"x12" loose sample of proposed drain-core product
iv. One (1) 12"x12" loose sample of proposed playground pad product
v. One (1) 8" x 12" loose sample of proposed micromechanical seam tape
vi. One (1) loose sample of proposed synthetic infill
vii. One (1) loose sample of the proposed perimeter anchoring board
viii. One (1) boxed sample (if requested) including surfacing and resilient base course representative of finished synthetic grass playground system
ix. One (1) copy of independent test report from a certified independent laboratory certifying the proposed playground surface system over drain-core is fully compliant with ASTM 1292-04 up to 5' fall height.
x. One (1) copy of independent test report from a certified independent laboratory certifying the proposed playground surface system over playground pad is fully compliant with ASTM 1292-04 up to 8' fall height.
xi. One (1) copy of independent test report from a certified independent laboratory certifying the proposed playground surface system is fully compliant with ASTM 1951 Standardized test for ADA Compliance.
xii. One (1) sample product warranty for proposed synthetic grass product.
xiii. One (1) copy of their maintenance instructions, which include all necessary instructions for the proper care and maintenance of the newly installed synthetic turf system.
xiv. One (1) copy of edge details of proposed installation and terminations of synthetic grass playground system.
xv. One (1) copy of a signed letter from synthetic grass vendor certifying that the proposed synthetic grass product is manufactured in the USA.
xvi. One (1) copy of independent laboratory test results for proposed synthetic grass adhesive
xvii. One (1) copy (if requested) of independent laboratory test reports on system or components.

1.05 SHOP DRAWINGS

i. Shop drawings shall be prepared to scale and contain all pertinent information regarding installation and shall be submitted to the Owner for approval prior to the manufacturing and shipment of materials. Submit drawings for

i. Identifying the extent of coverage for both the grass and underlayments specified herein

ii. Identifying the grass roll-layout; seams of pad are not to coincide with seams of synthetic turf nor interfere with subsurface drain system.

iii. Installation details; edge detail, post detail, other inserts, ect.

iv. Striping plan; layouts for field lines, markings and boundaries

1.06 SERVICE AND QUALITY ASSURANCE:

A. Synthetic grass vendor shall provide ongoing service quality assurance and warranty consisting of, but not necessarily be limited to, the following:

i. The synthetic grass vendor must provide competent workmen skilled in this type of playground and fall safety surface installation.

ii. The synthetic grass vendor shall provide a qualified installation foreman to coordinate and review the component parts of the synthetic grass system. Foreman shall be introduced to owner or owner's representative prior to start of construction.

iii. The synthetic grass vendor and installer must be IPEMA Certified with no less than six completed playground grass installations with the last 5 years.

iv. Installer must be competent in the installation of this material, including attachment of seams and proper installation of infill material prior to the start of turf installation.

B. The synthetic grass vendor shall submit its manufacturer's warranty, which warrants the usability and playability of the synthetic grass playground system for its intended uses with the following minimum characteristics:

i. Provide full coverage of materials for a minimum of eight (8) years from the date of substantial completion.

ii. Warrant that the materials installed meet or exceed the product specifications.

iii. Be from a single source covering workmanship and all materials.

iv. Assure the availability of exact or substantially the same replacement materials for the synthetic grass system for the full warranty period.

v. Include general wear and damage caused by UV degradation. The warranty may specifically exclude vandalism and Acts of God beyond the control of the manufacturer or installer.

1.07 SCHEDULE

A. Contractor shall complete all work on the synthetic turf system no later than the contract time specified.

B. Delays, unforeseeable and beyond the control of the installer, must be met with speedy resolve

1.08 SURFACE AREA

A. See contract drawings and details for layout.

B. Contractor to verify all measurements.

1.09 UTILITIES

A. Owner shall identify and mark the locations of all utilities in the area prior to construction

2.0 PRODUCTS

2.01 GENERAL

A. The synthetic grass shall be delivered in 15' wide rolls. The rolls will be laid out and installed as specified in the roll-layout and equipment placement drawings.

B. 4" wide precut white lines to be supplied and installed as per the drawings

C. All seams shall be installed and secured with micromechanical bonding and reinforced with two beads of adhesive. Seams secured with adhesive or stitching alone shall not be acceptable.

D. Synthetic infill is required for best appearance, durability, and performance

2.02 MATERIALS

A. Synthetic grass – FLI (ForeverLawn, Inc.)
PlaygroundGrass ULTRA
Pile Weight: 48 oz/sy
Face Yarn Type: Primary: Polyethylene XP slit film; Secondary: Heat set textured nylon monofilament
Yarn Count: Primary: 5,040/1; Secondary: 4,200/8
Pile Height (tufted): 1-1/2 inch (finish height may be slightly lower)
Color: Primary: Olive green; Secondary: Turf green/tan blend
Construction: Dual yarn, same row
Tufting Gauge: 3/8 inch
Backing: 3-layer backing with geotex laminate
Seaming: Micromechanical bonding
Total Product Weight: 108 oz s/y (+/- 2 oz)
Antistatic technology: XStatic™ proprietary, patent-pending antistatic technology
Antimicrobial technology: AlphaSan™ antimicrobial technology
Finished Roll Width: 15 feet (4.6 m)
Finished Roll Length: Up to 240 feet (73 m)
Permeability: 46 gal/p/hr

B. Drain core – FLI
AirGrid
Construction: Injected molded copolymer
Composition: Polypropylene/polyethylene copolymer
Dimensions: 31.784" x 31.88" x 1.00" (7.03 SF)
Weight: 46.20 ozs. (2.90 lbs. per unit)
Density: 0.921 grams/cm^3 (ASTM D 1,505)

C. Playground pad – FLI
SafetyFOAM
Construction: Extruded polyethylene
Composition: Virgin material closed cell polyethylene foam
Dimensions: 1" x 48" x 54" sheets for 8' CFH
Permeability: 5/8" perforations on 4" grid pattern 138 gal/p/hr
Density: Medium 2.2 pcf (35.2 kg/m^3)

D. Seam tape – FLI

Ultra heavy-duty micromechanically bonding seam tape
Composition: Polyethylene
Dimensions: 8" wide rolls

E. Infill – FLI
Envirofill 12-20
Composition: 99.6% Silicon Dioxide, Pigment, and Acrylic
Density: 110 lbs/cf (ASTM F-1815-06)
Dust: Negligible
Roundness: 0.7+ (ISO13503-2/API RP19C) Krumbein Shape
Hardness: 6-8 Mohns Scale
Abrasiveness: 26 +/- 2 (ASTM F1015) Index
Coefficient of Friction: 0.80 dynamic direct (ASTM F1551)

F. Adhesive – FLI
TurfBond
Specific Gravity (ASTM D 1475): 1.11.
Weight per (ASTM D 792): 9.3 pounds per gallon (1.11 kg/l).
Solids (Percentage by Weight): 100 percent.
Breaking Strength (ASTM D 5034): 222 pounds/force (988 N) average at 70 °F (21 °C), 65 percent relative humidity; 103 pounds/force (458 N) average at 120 °F (49 °C).
Color: White.
Color Modifier: Translucent.
Tensile Strength: 3204 psi (225.32 Kg/cm), ±359 psi
Elongation: 916 percent, ±86 percent.

3.0 EXECUTON

3.01 GENERAL

A. The installation shall be performed in full compliance with approved shop drawings.

B. Only ForeverLawn and IPEMA certified technicians skilled in the installation of playground grass synthetic turf systems shall undertake the placement of the system.

C. The surface to receive the synthetic turf shall be inspected and certified by the manufacturer as ready for the installation of the synthetic turf system and must be perfectly clean as installation commences and shall be maintained in that condition throughout the process.

3.02 INSTALLATION

A. BASE CONSTRUCTION:

i. The synthetic grass base contractor shall strictly adhere to the installation procedures outlined under this section and by the Engineer's drawings. Any variance from these requirements must be accepted in writing, by the synthetic grass vendor, and submitted to the Owner or Owner's Representative, verifying that the changes do not adversely affect the performance or warranty.

ii. Excavation: Existing ground cover shall be excavated to the depth established on the excavation plan. The sub grade shall also be compacted to a minimum of a 90% compaction rate.

iii. Base Drainage Aggregate: Installation of the free draining base Aggregate of 5/8 minus (with fines) or smaller, shall follow procedures that protect the base grade soils. It must be installed to a minimum depth of 2 inches. The drainage network and its existing elevations shall not be disrupted through ground pressures from trucks, dozers or by any other means.

a) The stone shall be left firm, but not over-compacted as to protect the porosity and drainage capabilities of the aggregate profile.

b) The free draining base course should be designed to meet local soil and weather conditions. It must be installed to a minimum depth of 2 inches with an overall compaction rate of 90%.

B. PERIMETER ANCHORING BOARD

i. This shall be the responsibility of the synthetic turf base contractor.

a) See synthetic turf edge attachment detail.

ii. The synthetic turf perimeter fastening structure installation shall coincide with the installation of the drainage aggregate, drain core, and playground pad

iii. Furnish a full synthetic or composite (AZEK, TREX, or similar) 2"x3" nailer board perimeter

a) Top of board shall be 1" above gravel

b) Top of board shall be ½" below adjacent transfers for ADA

c) Board shall be anchored with Tap Cons anchors 12-18" on center into adjacent concrete paving, walls or curb typically, so that it does not move

1. Concrete anchoring screws and rebar are to be used

C. PLAYGROUND PAD INSTALLATION

i. After free draining aggregate base preparation and perimeter board is in place the playground pad shall be installed within the areas defined as the safety fall-zones and as indicated on the drawings

ii. 3/8" spacing between the sheets is required to allow for thermal expansion

iii. Sheet rows shall alternate so that joints are staggered

D. DRAINCORE INSTALLATION

i. After the playground pad placement, the drain core shall be installed in the areas defined outside of the identified safety fall zones

ii. Drain core shall be interlocked with hook and loop fasteners and shall must be secured to the perimeter board on its two perpendicular hook sides with wire during installation to ensure all possible stretch tolerance is removed and all hook connections are fully seated

iii. Drain core adjacent to the pad shall be secured with 10" landscape spikes at a rate of 1 spike per sheet, or as needed, to ensure securement where the consistency of the interlocking grid is interrupted by pad

E. SYNTHETIC GRASS INSTALLATION:

i. After a inspection of the underlayment by the IPEMA certified Forman the synthetic turf installation shall begin.

ii. Turf shall be of sufficient length to permit cross-playground installation. Head or cross grain seams should be limited and reserved for necessary relief cuts to go around obstacles

iii. Synthetic grass rolls shall be joined via heavy-duty micromechanical bond seaming and reinforced with specialty turf adhesive to reduce the probability of failure

a) 2, ¼" beads, ½" in from each grass edge

b) Seams shall be flat, tight, and permanent with no separation or fraying.

c) Seams shall be weighted or rolled with a weighted roller to ensure proper adhesion.

d) Synthetic turf yarn fabric that is trapped or glued between seams shall be freed from the seams by hand or other approved method to an upright position prior to the commencement of brushing and top dressing synthetic grass rolls by the manufacturer wherever possible.

iv. Synthetic turf perimeter shall at a minimum be secured to the top of a perimeter anchoring board by stainless steel staples every linear inch

v. Soil or surfacing material outside of the defined grass area shall be backfilled against turf edge leaving no grass edge exposed and to provide a smooth transition edge to synthetic turf, otherwise specified.

F. LINE APPLICATION:

i. After all grass is installed, the sports lines must be installed as per the seaming requirements specified herein.

ii. Refer to the site plan drawing for line locations

G. INFILL APPLICATION:

i. After all seaming is completed, the infill shall be applied evenly at 2.25 lbs. per square foot and groomed in-place by means of a power broom

ii. There shall no noticeable inconstancies in the thickness of the infill

3.03 CLOSE OUT

A. The synthetic grass vendor must verify that a qualified representative has inspected the installation and that the finished playground surface conforms to the manufacturer's requirements.

B. Extra materials: Owner shall be given the option to retain and store excess materials such as turf, tape, glue, and infill that were ordered for project, but not installed.

3.04 CLEAN UP

A. Contractor shall provide the labor, supplies and equipment as necessary for final cleaning of surfaces and installed items.

B. During the contract and at intervals as directed by the owner or owner's representative and as synthetic grass system installation is completed, clear the site of all extraneous materials, rubbish, or debris and leave the site in a clean, safe, well draining, neat condition.

C. Surfaces, recesses, enclosures, etc. shall be cleaned as necessary to leave the work area in a clean, immaculate condition ready for immediate occupancy and use by the owner.

END OF SECTION

SECTION 34

POLYVINYLCHLORIDE (PVC) DRAIN PIPE

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals necessary to for drains complete as shown on the Drawings and as specified herein.

1.02 RELATED WORK NOT INCLUDED

A. Excavation and backfilling are included in Section 11.

B. Precast concrete catch basins, manholes and inlets are included in Section 16.

C. Concrete is included in Section 29.

1.03 SUBMITTALS

A. Submit to the Engineer, as provided in Section 5, shop drawings, and a schedule of pipe lengths (including the length of individual pipes by size) for the entire job.

B. Prior to each shipment of pipe, submit certified test reports that the pipe for this Contract was manufactured and tested in accordance with ASTM, AASHO and ANSI/AWWA Standards specified herein.

1.04 QUALITY ASSURANCE

A. All polyvinylchloride pipe to be installed under this Contract may be inspected at the plant or on the site after delivery, or both places, for compliance with these Specifications by an independent testing laboratory provided by the Owner. The Contractor shall require the manufacturer's cooperation in these inspections. The cost of inspection of all pipe approved for this Contract, plus the cost of inspection of a reasonable amount of disapproved pipe will be borne by the Owner.

PART 2 PRODUCTS

2.01 POLYVINYLCHLORIDE (PVC) DRAIN PIPE

A. 6", 8"-12", 15-21", 24"-30", 36" and 42" inch polyvinylchoride drain pipe and fittings shall conform to ASTM D3034, latest revision, with a minimum SDR of 35, and with integral wall bell and spigot joints. Furnish in lengths of not more than 20'ft.

B. Pipe and fittings shall have bell and spigot push-on joints meeting the applicable requirements of ASTM D-3212.

PART 3 EXECUTION

3.01 LAYING POLYVINYLCHLORIDE PIPE

A. Each pipe shall be handled into its position in the trench and installed in such a manner as not to damage the pipe and so as to protect at all times the jointing surfaces of the pipe. Operations shall at times be conducted so as to prevent damage to existing structures, utilities and the work in place.

C. Furnish proper and adequate equipment such as slings, straps, hoists, and other equipment and devices necessary for the safe and suitable lifting, handling, laying and support of all pipe and appurtenances when it is lifted and placed into position.

D. All pipe, fittings, and appurtenances shall be carefully inspected by the Contractor for defects before installation and; all defective, unsound or damaged pipe, fittings, or other materials, shall be rejected. The Engineer will make such additional inspections as he/she deems necessary, and the Contractor shall furnish all necessary assistance for such inspection.

E. The interior of pipe shall be carefully and thoroughly cleaned of foreign matter before being lowered into the trench, and shall be kept clean during laying operations. Six inches of crushed stone or screened gravel bedding material, *as specified in Section 11 Earthwork*, shall be placed in the bottom of the trench and shaped and compacted to give substantial uniform support to the lower half of the full length of pipe. Pipe laying shall proceed upgrade with the spigot ends of the pipe pointing in the direction of flow so that bells are installed upstream or uphill of spigot ends. The pipe shall be laid true to line and grade and in such manner as to form a close concentric joint with the adjoining pipe and to prevent sudden offsets of the flow line.

F. Pipelines shall be constructed in dry trenches and shall not be laid when the condition of the trench or the weather is unsuitable for such work. At times when work in not in progress, open ends of pipe shall be securely sealed so that no trench water, earth, or other substance will enter the pipe. Pipes shall not be used as conductors for trench drainage during construction.

G. Diversion and control of sanitary and storm water flows and de-watering shall be the responsibility of the Contractor. The Contractor shall submit its planned methods for the diversion and control to the Engineer for advance review and approval.

H. The Contractor will also be responsible for road surface drainage/flow during construction. This includes taking preventative measures to keep water out of the trench and preventative measures to keep excavated materials out of nearby catch basins. *If during or after construction the City's catch basins within the work zone become partially or completely full of soil and/or debris, it will be the Contractor's responsibility to clean the catch basin and*

properly dispose of the material at no additional expense to the City.

I. Jointing of pipe shall be done by workmen/women thoroughly skilled in this type of work using the watertight gasket type joints and installed in strict accordance with the recommendations of the pipe manufacturer, and as approved. A gasket shall be placed in the groove of the spigot end of each pipe just prior to laying the pipe. After the pipe is aligned in the trench, ready to be joined, all joint surfaces shall be thoroughly cleaned. Immediately before jointing the pipe together the bell shall be completely covered with a lubricant, as recommended by the pipe manufacturer, then be carefully pushed home into the joint of the previously laid pipe. The position of the gasket and joint shall be carefully inspected to insure that the joint has been properly made, and that the gasket is properly positioned to insure a watertight joint. Joints that have been improperly made shall be made shall be taken apart and remade. It shall be the Contractor's responsibility to install the pipe in a manner that will maintain the gasket in adequate compression and proper position to insure watertight joints conforming to the latest testing requirements. The installation of pipe, the details of gasket, attachment, and joint formation shall be in accordance with the pipe manufacturer's printed recommendations, and as approved by the Engineer.

J. Connecting Pipe to Pipe:

Connecting pipe to pipe shall be performed in the following manner or as approved by the Engineer. Couplings which are factory manufactured shall be installed at all connections from existing pipe to proposed pipe, unless the existing pipe is the same material as the proposed pipe and the bell and spigot end of the pipe to be connected are compatible and free from defects. Couplings shall be pressure rated to at least equal that of the pipe. Coupling sleeves shall be ¼-inch minimum thickness elastomeric polyvinylchloride with a minimum tensile strength of 1500 psi. The length of the coupling shall be equal to the diameter of the pipe. The minimum length coupling allowed is 6 inches. Joining pipe surfaces shall be thoroughly cleaned before a connection is made. The maximum allowable gap between coupled pipe ends is ¼"inch. The sleeve shall fit snugly onto the pipe to be joined and be resistant to common chemicals present in sewerage and storm water. Adjustable pipe clamps to secure the coupling shall be stainless steel and consist of a slotted band that mates with a worm gear screw and a screw housing.

K. Connecting/Re-connecting Laterals:

Connecting/Re-connecting laterals shall be performed in the following manner or as approved by the Engineer. Lateral connections shall be made into the top one third of the City's main, between the 1:00 and 3:00 o'clock position or 9:00 and 11:00 o'clock position. The connection shall be made such that flow from the lateral is compatible with the direction of flow in the main. Chimneys shall only be installed when directed or approved by the City.

L. Dye testing lateral service connections, if needed, shall be the responsibility of the Contractor. Lateral connections that are improperly made shall be removed and remade at no additional expense to the City.

M. Sanitary service connection shall be installed at a minimum slope of 2 percent. Storm drain connections shall be installed at a minimum slope of 1 percent. It should be anticipated that

each building along the sewer or drain being installed would have one sewer connection and one drain connection. When these conditions are not present, the contractor shall notify a City Representative immediately for clarification. At these locations, wye connections for future construction may be required at no additional cost to the City. Each wye branch installed for future use shall be fitted with a watertight plug.

N. For main pipe sizes up to 24 inches in diameter, laterals shall be connected using either flexible saddles or wye fittings. Combination saddle-wye fittings are prohibited. Connections directly into existing pipe without a saddle or full wye fitting are not allowed unless approved by the Engineer.

O. For main pipe sizes greater than 24 inches in diameter, laterals shall be connected by saddles, resilient connectors with internal expansion rings, or methods approved by the Owner. Resilient connectors shall conform to ASTM C923-89.

P. Connecting Pipe to New or Existing Structures:

Connecting pipe to new or existing structures shall be performed in one of the two following manners or as approved by the Engineer.

1. Flexible Pipe to Manhole Connectors- Rubber flexible pipe to manhole connectors shall be manufactured in accordance with ASTM C923. Clamps and bands used to secure the Flexible Rubber Connectors Shall be stainless steel Type 304 including screws, wedges and other appurtenances required to provide secure tight connections between the manholes and the pipe. The connections shall be specifically designed for the pipe material and size to be connected to the structure.

2. Brick & Mortar- Mortar for patching holes in structure walls and at the connections of the pipe to the structure shall conform to Massachusetts Highway Department Standard Specifications for Highways and Bridges Material Specification M4.02.15. Brick shall conform to ASTM C32. Grade SS.

Q. Pipe joints and/or connections shall not be covered in any way until the Engineer has inspected them.

Once inspected, the pipe and/or connection shall be completely enveloped with 6 inches of ¾" crushed stone (i.e. both sides and above the crown of the pipe) prior to trench backfill.

Bricks required for the connection of sewers, combined sewers, storm drains, manholes, catch basins, bulkheads, risers (or other appurtenances as directed) shall be clay and shall conform to ASTM C32.

R. Payment for Polyvinylchloride (PVC) Pipe installation shall be made per linear foot and include the furnishing of all labor, equipment, materials, connections to proposed structures/pipes, dewatering, by-passing, ¾" crushed stone or screened gravel for pipe and/or connections bedding and enveloping; and any other incidentals necessary for the satisfactory completion of this work as specified.

K.

3.02 TESTING

A. If an inspection of the completed pipe line or any part thereof shows manholes, catch basins, pipes, or joints which allow an appreciable amount of infiltration, the defective work or material shall be replaced or repaired as directed.

3.02 CLEANING

A. At the conclusion of the work, the Contractor shall thoroughly clean all of the new pipe lines by flushing with water or other means to remove all dirt, stones, pieces of wood or other material which may have entered during the construction period. Debris cleaned from the Connecting pipe shall lines shall be removed from the lowest manhole. If, after this cleaning, obstructions remain, they shall be removed. After the pipelines are cleaned and if the groundwater level is above the pipe, or following a heavy rain, the Engineer will examine the pipe for leaks. If defective pipes or joints are discovered at this time, they shall be repaired by the Contractor.

* END OF SECTION *

SECTION 35
GRANITE/ MASONRY WORK

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required to install granite curbing for paved streets, parking lots, play areas, slope curb for landscaping planting beds, granite fence curb, stone/brick retaining walls, as shown on the drawings, as specified herein and as directed by the Project Engineer

1.02 RELATED WORK NOT INCLUDED

A. Site preparation is included in Section 10.

B. Earthwork is included in Section 11.

C. Dust control as required is included in Section 7.

D. Specialty pavers as required are included in Section 15.

1.03 SUBMITTALS

A. Submit to the Project Engineer in accordance with Section 5, shop drawings showing dimensions layouts and details of construction and accessories required.

B. Submit the Project Engineer samples of granite, brick, stone veneer, etc.

1.04 REFERENCE SPECIFICATIONS

A. Except as otherwise specified herein, the material and construction shall be in accordance with the Department of Public Works, Standard Specifications for Highways and Bridges (hereafter SSHB) of the Commonwealth of Massachusetts, latest edition, including all addenda.

PART 2: PRODUCTS

2.01 GRANITE CURB

A. Where shown on the Drawings and as required to complete the work of this Contract, furnish and install vertical granite curb for bituminous paved roads, walkways, parking areas, play areas and landscaping planting beds shall be type VA-4 6" x 18" conforming to Section M9.04.0 of SSHB or 4" x 18" dimension as required. Curb reveal will vary depending on the application. Refer to the drawings.

B. Any required vertical granite playground curbing, both straight and curved shall be type

VA-4 6"x18" (M9.04.0) with a 1-1/2" inch rounded exposed edge, or 4" x 18" with eased edges as required. Granite curb at ramps into play areas containing sand or other loose materials shall have exposed lengthwise edges and ends rounded or eased as shown on the drawings.

C. Crushed stone for granite curb work shall conform to Mass DPW SSHB, Section M2.01.1, and M2.01.4 in a fifty/fifty percent mix of each type of gravel placed and compacted as shown on Drawings and as specified in Section 11.

2.02 GRANITE FENCE CURB

A. Where shown on the Drawings and as required to complete the work of this Contract, furnish and install straight and curved granite fence curb at the dimensions as detailed. Holes for fence posts and supports shall be field or pre drilled as required and filled with "Por-Rok",or equal.

B. Curb shall have thermal finish top and face with eased exposed lengthwise edge (one side).

C. Submit shop drawings and granite samples prior to stone cutting to Engineer for approval.

2.03 POWER WASH GRANITE

A. Where shown on the Drawings and as required to complete the work of this Contract, power wash existing granite (curbing, granite fence posts, etc.) using acceptable chemical or other commercially available methods so as to lighten color of existing granite to match new granite as close as possible.

2.04 SLOPED GRANITE STONE CURB

A. Where shown on the Drawings and as required to complete the work of this Contract, furnish and install sloped natural field stone (Corintian Granite or equal) for raised planting beds shall be select stepping stones. Nominal thickness: Four (4") inches ± one (1") inch depth at face to be eighteen (18") inches with variations as follows.

B. Minimum and maximum depth at face to be eighteen to twenty-four (18" to 24") inches minimum and maximum length of individual stones to be twelve to twenty-four (12" to 24") inches.

C. Finish of granite to be all natural Corinian Granite.

C. Supplier shall be McVey Monument, Inc., 662 Arsenal Street, Watertown MA (or approved equal), Phone: (617) 923-8866.

2.05 RETAINING/ SITTING WALLS

A. Where shown on the drawings and as required to complete the work of this contract, furnish and install solid stone walls, and stone veneer walls, single sided

or double sided, to the dimensions, and to meet the proposed grades, as shown on the drawings.

B. Granite stones to be supplied by T.H. McVey Monuments Company, 662 Arsenal Street, Watertown, MA; Phone: (617) 923-8866, or approved equal. Random wall stones shall be Corintian granite wall stone minimum thickness of 4" inches, with random stones varying in size from 12" inch – 18" inch length and width. Wall cap shall be 3" inch thick blue stone with rock face edge and smooth top. Stone edges to be ninety degree corners. All materials to be selected and approved by Project Engineer prior to procurement and delivery to the site.

C. Cement mortar, concrete foundation, as specified herein Section 29.

D. Crushed stone and gravel backfill, as specified herein Section 11 Earthwork.

E. Stainless or galvanized steel fasteners and methods of attaching stone material to existing cement block or concrete walls, as required, shall be approved by the Project Engineer.

F. Walls to have either a concrete foundation or compacted gravel base, as shown on the drawings.

2.06 FIELD STONE SITTING BOULDERS

A. Where shown on the drawings or as required to complete the work of this Contract install natural field stone sitting boulders.

B. All boulders to be approximately one-half (1/2) cubic yard in size with actual dimensions varying. Approximate size shall be: 24"-36" length by 24"-36" width by 12"-24" height. Boulders to be smooth, weather-worn field stones without any protruding corners or sharp edges. No ledge. All boulders not selected for incorporation into the final work shall be legally disposed of by contractor at his/her expense.

C. All boulders shall be placed upon a bed of 12-18"inches of 1-1/2" crush stone, as specified under Section 11 Earthworks.

GRANITE STAIR TREADS:

A. Furnish and install 6" x 18" solid granite random length stair treads. Exposed tread surface shall be sawn and thermal, with eased edges. Lengths shall be as called for on the drawings.

B. Crushed stone for granite curb work shall conform to Mass DPW SSHB, Section M2.01.1, and M2.01.4 in a fifty/fifty percent mix of each type of gravel placed and compacted as shown on drawings and as specified in Section 11.

PART 3: EXECUTION

3.01 VERTICAL GRANITE CURB

A. The trench for the curb shall be excavated to a width of 18" inches. The bottom of the trench shall be a depth below the proposed finish grade of the curb equal to 6" inches plus the depth of the curbstone.

B. The foundation for vertical curb shall consist of a crushed stone base course spread upon the subgrade and after being thoroughly compacted by tamping shall be 6" inches in depth.

C. Vertical curbing shall be set on additional crushed stone spread upon the foundation. All spaces under the curb shall be filled with crushed stone thoroughly compacted so that the curb will be completely supported throughout its length. The curb shall be set at the line and grade required as shown on the Drawings unless otherwise directed.

Curb shall be fitted together as closely as possible. If curb of different quarries is used on the same project, curbing of each particular quarry shall be segregated and set to give uniform appearance.

D. The joints between curbstone (both front and back) shall be carefully filled with cement mortar and neatly pointed on the top and front exposed portions. After pointing, the curbstones shall be satisfactorily cleaned of all excess mortar that may have been forced out of the joints.

E. All granite curbing shall be laid out by the Contractor and staked for the approval of the Engineer prior to procuring or installing any curbing. The Contractor shall report immediately any discrepancies between actual field dimensions and the proposed layout of curbing as shown on the Contract Drawings to the Engineer.

F. The Contractor shall be responsible for submitting shop drawings showing the exact layout of all curbing in order to fit actual field dimensions, along with any adjustments in the quantity, the specific size for the various types of radius curbing required to achieve a complete installation of curbing, as shown on the Drawings, and to the complete satisfaction of the Engineer.

G. The Contractor shall be solely responsible for determining the quantity radius, and size for the various types of granite curbing required, and for resolving any further curbing layout problems encountered during construction to the complete satisfaction of the Engineer.

3.02 SLOPED GRANITE STONE CURB

A. The trench for the sloped curb stone shall be excavated to a width of eighteen (18") inches as shown.

B. The foundation for sloped curb stones shall consist of a crushed stone base course spread upon the subgrade, compacted to six (6") inches in depth.

C. Concrete base shall be as specified under Section 29, eighteen (18") inches wide by twelve (12") inches in depth.

D. All joints between individual stones to be fully mortared with an approved dark cement mortar.

3.03 FIELD STONE SITTING BOULDERS

A. Field stone sitting boulders shall be installed on a compacted base of 12" crushed stone. In general if stones are more square shaped, set tops level.

* END OF SECTION *