

CITY OF WORCESTER
Department of Public Works and Parks

Community Gardens
Worcester, MA

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SECTION 01014

SCOPE AND SEQUENCE OF WORK

PART 1 – GENERAL

1.01 WORK INCLUDED:

A. The City of Worcester-DPW proposes several amenities added to Green Hill Park. The main improvements to the park consist of the installation of community gardens, parking and access drives, walks, lighting, and the demolition of the existing concessions building along Green Hill Parkway. Elements include, but are not limited to:

1. Raised wooden community garden beds
2. Water yard hydrants
3. Unit-block retaining walls
4. Decorative and chain-link fencing
5. Storage sheds
6. Shade pergolas
7. Shade shelter
8. Concrete foundation and pad for future greenhouse
9. Parking
10. Accessible walkways
11. New maintenance paccess drive
12. Benches and other amenities
13. Information kiosks and wayfinding signage
14. Pipe gates

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION

3.01 GENERAL:

- A. The Contractor shall be responsible for scheduling its activities and the activities of any subcontractors involved, to meet the completion date, or milestones, established for the contract. Scheduling of the work shall be coordinated with the Owner and Engineer.
- B. The Construction Sequence Requirements shall be used by the Contractor to form a complete schedule for the project, which shall be coordinated with the Owner and Engineer. Prior to performing any work at the site, the Contractor shall submit a detailed plan to the Engineer for review. The plan shall describe the proposed sequence, methods, and timing of the work

END OF SECTION

SECTION 01110

CONTROL OF WORK AND MATERIALS

PART 1 – GENERAL

NOT APPLICABLE

PART 2 – PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.01 HAULING, HANDLING AND STORAGE OF MATERIALS:

- A. The Contractor shall, at its own expense, handle and haul all materials furnished by it and shall remove any of its surplus materials at the completion of the work.
- B. The Contractor shall provide suitable and adequate storage for equipment and materials furnished by it that are liable to injury and shall be responsible for any loss of or damage to any equipment or materials by theft, breakage, or otherwise.
- C. All excavated materials and equipment to be incorporated in the Work shall be placed so as not to injure any part of the Work or existing facilities and so that free access can be had at all times to all parts of the Work and to all public utility installations in the vicinity of the work. Materials and equipment shall be kept neatly piled and compactly stored in such location as will cause a minimum of inconvenience to public travel and adjoining owners, tenants, and occupants.
- D. The Contractor shall be responsible for all damages to the work under construction during its progress and until final completion and acceptance even though partial payments have been made under the Contract.

3.02 OPEN EXCAVATIONS:

- A. All open excavations 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 its own expense, provide suitable and safe means for completely covering all open excavations and for accommodating travel when work is not in progress.

3.03 MAINTENANCE OF TRAFFIC:

- A. Unless permission to close the street is received in writing from the proper authority, all excavated materials and equipment shall be placed so that vehicular and pedestrian traffic may always be safely maintained.
- B. Should the Chief of Police deem it necessary, uniformed officers will be assigned to direct traffic. The Contractor shall make all arrangements in obtaining uniformed officers required.
- C. The Contractor shall at its own expense, as directed by the Police Traffic Control/Safety Officer, provide and erect acceptable barricades, barrier fences, traffic signs, and all other traffic devices not specifically covered in a bid item, to protect the work from traffic, pedestrians, and animals. The Contractor shall provide sufficient temporary lighting such as lanterns/flashers (electric battery operated) or other approved illuminated traffic signs and devices to afford adequate protection to the traveling public, at no additional cost to the Owner. See Section 01552 CONSTRUCTION ZONE SAFETY PLAN.
- D. The Contractor shall furnish all construction signs that are deemed necessary by and in accordance with Part VI of the Manual on Uniform Traffic Control Devices as published by the U.S. Department of Transportation. In addition, the Contractor may be required to furnish up to 128 square feet of additional special construction warning signs. Size and exact wording of signs shall be determined by the Engineer during construction.
- E. The intent of policing is to ensure public safety by direction of traffic. Police officers are not to serve as watchmen to protect the Contractor's equipment and materials.
- F. Nothing contained herein shall be construed as relieving the Contractor of any of its responsibilities for protection of persons and property under the terms of the Contract.

3.04 CARE AND PROTECTION OF PROPERTY:

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 promptly restored by the Contractor, at its expense, to a condition similar or equal to that existing before the damage was done, to the satisfaction of the Engineer.

3.05 PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES:

- A. All existing buildings, utilities, pipes, poles, wires fences, curbing's property line markers and other structures which the Engineer decides must be preserved in place

without being temporarily or permanently relocated, shall be carefully supported and protected from damage by the contractor. Should such property be damaged, it shall be restored by the Contractor, at no additional cost to the Owner.

- B. The Contractor shall determine the location of all underground structures and utilities (including existing water services, drain lines, electrical lines, gas lines, and sewers). Services to buildings shall be maintained, and all costs or charges resulting from damage thereto shall be paid by Contractor.
- C. When fences interfere with the Contractor's operations, it shall remove and (unless otherwise specified) promptly restore them.
- D. On paved surfaces the Contractor shall not use or operate tractors, bulldozers, or other power-operated equipment with treads or wheels which are shaped so as to cut or otherwise damage such surfaces.
- E. All property damaged by the Contractor's operations shall be restored to a condition at least equal to that in which it was found immediately before work was begun. Suitable materials and methods shall be used for such restoration.
- F. Restoration of existing property and structures shall be carried out as promptly as practicable and shall not be left until the end of the construction period.

3.07 REJECTED MATERIALS AND DEFECTIVE WORK:

- A. Materials furnished by the Contractor and condemned by the Engineer as unsuitable or not in conformity with the specifications shall forthwith be removed from the work by the Contractor and shall not be made use of elsewhere in the work.
- B. Any errors, defects or omissions in the execution of the work or in the materials furnished by the Contractor, even though they may have been passed or overlooked or have appeared after the completion of the work, discovered at any time before the final payment is made hereunder, shall be forthwith rectified and made good by and at the expense of the Contractor and in a manner satisfactory to the Engineer.
- C. The Contractor shall reimburse the Owner for any expense, losses or damages incurred in consequence of any defect, error, omission or act of the Contractor or its employees, as determined by the Engineer, occurring previous to the final payment.

3.08 SANITARY REGULATIONS:

Sanitary conveniences for the use of all persons employed on the work, properly screened from public observation, shall be provided in sufficient numbers in such manner and at such locations as may be approved. The contents shall be removed and disposed of in a satisfactory manner as the occasion requires. The Contractor shall rigorously prohibit the committing of nuisances within, on or about the work. Any employees found

violating these provisions shall be discharged and not again employed on the work without the written consent of the Engineer. The sanitary conveniences specified above shall be the obligation and responsibility of the Contractor.

3.09 SAFETY AND HEALTH REGULATIONS:

This project is subject to the Safety and Health regulations of the U.S. Department of Labor set forth in 29 CFR, Part 1926, and to the Massachusetts Department of Labor and Industries, Division of Industrial Safety "Rules and Regulations for the Prevention of Accidents in Construction Operations (454 CMR 10.0 et. seq.)." The Contractor shall be familiar with the requirements of these regulations.

3.10 SITE INVESTIGATION:

The Contractor acknowledges that it has satisfied itself as to the conditions existing at the site of the work, the type of equipment required to perform this work, the quality and quantity of the materials furnished insofar as this information is reasonably ascertainable from an inspection of the site, as well as from information presented by the drawings and specifications made a part of this contract. Any failure of the Contractor to acquaint itself with available information will not relieve it from the responsibility for estimating properly the difficulty or cost of successfully performing the work. The Owner assumes no responsibility for any conclusion or interpretation made by the Contractor on the basis of the information made available by the Owner.

3.11 HANGERS, PADS, AND SUPPORTS:

- A. Unless otherwise indicated, hangers and supports shall be by the trade providing the supported item.
- B. Except where detailed or specified, design of hangers and supports shall be the responsibility of the Contractor. All parts of such hangers or supports shall be designed in accordance with accepted engineering practice, using a factor of safety of at least 2½.
- C. When proprietary hangers, etc., are supplied, satisfactory evidence of the strength of such items shall be furnished.
- D. Hangers for items hung from steel and concrete shall be centered on the vertical center of gravity of the beam.
- E. Locations and sizes of openings, sleeves, concrete pads, steel frames, and other equipment supports are indicated on the drawings for bidding purposes only. Final sizes and locations of such items shall be obtained from the shop drawings.

3.12 SLEEVES, HOLES, HANGERS, INSERTS, ETC.:

- A. Except where holes and openings are dimensioned, and hangers, inserts, and supports are fully called for on the architectural and structural drawings (or reference is made thereon to drawings containing such information) to accommodate mechanical or electrical items, they shall be by the mechanical or electrical trade concerned.
- B. Sleeves, inserts, anchors, etc., supplied under the mechanical and electrical contracts in sufficient time to so permit, shall be set in concrete, masonry, etc., or fastened to steel deck, etc., by the respective architectural or structural trade. Where not supplied in sufficient time, installation of such items shall be the responsibility of the mechanical or electrical trade involved.
- C. Nailers and other wood members attached to steel or masonry, for which fasteners are not indicated on the design drawings or in the specification, shall be fastened with the equivalent of ½-inch diameter bolts at 3 feet o.c.
- D. Openings for mechanical and electrical items in finished areas of the building shall be closed off with near escutcheon plates or similar closures. These closures shall be by the mechanical or electrical trade involved.

3.13 ELECTRIC SERVICE:

- A. The Contractor shall make all necessary applications and arrangements and pay for all fees and charges for electrical energy for power and light necessary for the proper completion of this contract during its entire progress. The Contractor shall provide and pay for all temporary wiring, switches, connections, and meters.
- B. There shall be sufficient electric lighting so that all work may be done in a workmanlike manner where there is not sufficient daylight.

3.14 HAZARDOUS WASTE:

Should the Contractor, while performing work under this contract, uncover hazardous materials, as defined in Massachusetts Hazardous Waste Regulations 310 CMR 30.00, he shall immediately notify the Engineer. The Contractor is not, and has no authority to act as, a handler, generator, operator or disposer of hazardous or toxic substances found or identified at the site, and the Owner shall undertake all such functions.

END OF SECTION

SECTION 01140

SPECIAL PROVISIONS

PART 1 - GENERAL

Not used

PART 2 - PRODUCTS

Not used

PART 3 - EXECUTION

3.01 WATER FOR CONSTRUCTION PURPOSES:

A.

If no water is available, the Contractor shall supply water at no additional cost to the Owner.

3.02 DIMENSIONS OF EXISTING STRUCTURES:

Where the dimensions and locations of existing structures are of critical importance in the installation or connections of new work, the Contractor shall verify such dimensions and locations in the field before the fabrication of any material or equipment that is dependent on the correctness of such information.

3.03 EXISTING UTILITY LOCATIONS – CONTRACTOR’S RESPONSIBILITY:

A.

The location of existing underground services and utilities shown on the drawings is based on available records. It is not warranted that all existing utilities and services are shown, or that shown locations are correct. The Contractor shall be responsible for having the utility companies locate their respective utilities on the ground prior to excavating.

B.

To satisfy the requirements of **Massachusetts law, Chapter 82, Section 40**, the Contractor shall, at least 72 hours, exclusive of Saturdays, Sundays and holidays, prior to excavation in the proximity of telephone, gas, cable television and electric utilities, notify the utilities concerned by calling “DIG SAFE” at telephone number: 1-888-344-7233.

C.

The Contractor shall coordinate all work involving utilities and shall satisfy itself as to the existing conditions of the areas in which it is to perform his work. It shall conduct

and arrange its work so as not to impede or interfere with the work of other contractors working in the same or adjacent areas.

3.04 COORDINATION OF WORK:

The General Contractor shall be responsible for coordinating its own work as well as that of any subcontractors. It shall be responsible for notification of the Engineer when each phase of work is expected to begin and the approximate completion date.

3.05 MAINTENANCE OF TRENCH SURFACE:

After backfilling and compacting the trench, the Contractor shall be responsible for keeping the ground surface dry and passable at all times until the surface has been restored to original conditions.

3.06 DESIGN OF EQUIPMENT:

Attention is directed to the fact that the layout of certain equipment is based on that of one manufacturer. If other equipment is submitted for approval, the Contractor shall prepare and submit for approval at its expense, detailed structural, mechanical and electrical drawings, equipment lists, maintenance requirements, and any other data required by the Engineer, showing all necessary changes and embodying all special features of the equipment he proposes to furnish. Such changes, if approved, shall be made at the expense of the Contractor.

3.07 SERVICES OF MANUFACTURER'S REPRESENTATIVE:

- A. The Contractor shall arrange for a qualified service representative, at a time suitable to the Engineer, from the company manufacturing or supplying certain equipment as indicated on the detailed specifications, to perform the duties described herein.
- B. After installation of the listed equipment has been completed and the equipment is presumably ready for operation, but before others operate it the representative shall inspect, operate, test, and adjust the equipment. The inspection shall include, but shall not be limited to, the following points as applicable:
 - 1. Soundness (without cracks or otherwise damaged parts); completeness in all details, as specified; correctness in setting, alignment, and relative arrangement of various parts; adequacy and correctness of packing, sealing and lubricants.
 - 2. The operation, testing, and adjustment shall be as required to prove that the equipment is left in proper condition for satisfactory operation under the

conditions specified. Where called for in the specifications, vibration readings shall be made and the equipment balanced accordingly.

3. On completion of its work, the Contractor shall submit in triplicate to the Engineer the manufacturer's or supplier representative's complete signed report of the results of its inspection, operation, adjustments, and test. The report shall include detailed descriptions of the points inspected, tests and adjustments made, quantitative results obtained if such are specified, and suggestions for precautions to be taken to ensure proper maintenance. The report shall also include a certificate that the equipment conforms to the requirements of the contract and is ready for permanent operation and that nothing in the installation will render the manufacturer's warranty null and void.
4. After the Engineer has reviewed the reports from the manufacturer's representative, the Contractor shall make arrangements to have the manufacturer's representative present when the field acceptance tests are made.

3.08 CUTTING, FITTING AND PATCHING:

- A. The Contractor shall do all cutting, fitting, or patching of its work that may be required to make its several parts come together properly and fit it to receive or be received by work of other Contractors, as shown upon or reasonably implied by the drawings and the specifications for the completed structure, including all existing work.
- B. The Contractor shall not endanger any work by cutting, digging, or otherwise and shall not cut or alter the work of any other Contractor, save with the consent of the Engineer.
- C. All holes or openings required to be made in new or existing work, particularly at pipe, conduit, or other penetrations not covered by escutcheons or plates shall be neatly patched. All such holes shall be made completely watertight as approved by the Engineer.
- D. Size and locations of holes required in steel, concrete, or other structural or finish materials for piping, wiring, ducts, etc., which have not been located and detailed on the drawings shall be approved by the Engineer prior to layout and cutting thereof. All holes shall be suitably reinforced as required by the Engineer.
- E. Workmanship and materials of patching and repair work shall match the adjacent similar work and shall conform to the applicable sections of the specification. Patches and joints with existing work shall provide, as applicable in each case, visual, structural, and waterproofing continuity.

3.09 CONTRACTOR'S REPRESENTATIVE:

The Contractor shall designate a representative who will be available to respond to emergency calls by the Owner at any time day and night and on weekends and holidays should such a situation arise.

3.10 OPERATOR TRAINING:

A trained representative of the manufacturer of all equipment shall instruct the plant operating personnel on the operation and maintenance of the equipment. The Owner reserves the right to videotape all training sessions.

3.11 HOURS OF CONSTRUCTION ACTIVITY:

- A. The Contractor shall conduct all construction activity between 7:00 a.m. and 5:00 p.m., Monday through Friday. No construction work shall be allowed on Saturdays, Sundays or Holidays without written authorization from the Owner.
- B. The Owner will provide personnel for assistance in locating and operating valves at no cost to the Contractor during the Owner's normal working hours (**Monday through Friday 7:00 a.m. to 3:00 p.m.**). When this assistance is required by the Contractor outside of the Owner's normal working hours the cost will be incurred by the Contractor at the prevailing overtime rate of pay for the personnel providing the assistance. The Owner will bill the Contractor directly.

3.12 HANDLING OF ASBESTOS CEMENT PIPE:

The Contractor will be required to connect to and/or remove asbestos-cement pipe on this project. There are special requirements for performing this work in accordance with OSHA and other federal and state standards. Please refer to specifications section number 02111 or 02112 for requirements for performing this work.

3.13 MASSACHUSETTS DATA SECURITY REGULATIONS:

The Contractor is required to comply with data security regulations contained in 201 CMR 17.00 that have been established to safeguard personal information of Massachusetts residents contained in paper or electronic records. The Contractor shall not submit to the Engineer or Owner documents in paper or electronic form that contain personal information (person's name combined with one or more of the following – Social Security Number, driver's license number or state-issued identification card number, financial institution account number, or credit or debit card number). Any document submitted to the Engineer that violates this provision shall be returned to the Contractor and the Contractor shall remove personal information from the document prior to resubmitting it to the Engineer. The Contractor shall require each Subcontractor to also comply with the MA data security regulations insofar as they involve submittal of personal information to the Engineer and Owner.

END OF SECTION

SECTION 01311

CONSTRUCTION MEETINGS

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. This Section specifies requirements for project meetings including but not limited to Pre-Construction Conference and Progress Meetings.
- B. It shall be the responsibility of the Contractor to coordinate work between all subcontractors, sections, and trades required for the proper completion of the Work.

1.02 PRE-CONSTRUCTION CONFERENCE:

- A. After the bids have been opened but prior to the start of the construction there will be a pre-construction conference to discuss the phasing and scheduling of the Project. The specific time and place of the conference shall be arranged by the Engineer after the Contract has been awarded.
- B. This pre-construction conference is intended to establish lines of communication between the parties involved, review responsibilities and personnel assignments, establish project schedules, discuss proposed performance methods, and coordinate Work to be performed by subcontractors.
- C. Authorized representatives of the Owner, Engineer and their consultants, the Contractor, its Superintendent and Site Foreman, and all others invited by the Contractor, shall attend the pre-construction conference. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.
- D. Discuss items of significance at the pre-construction conference that could affect progress including at least the following:
 - 1. Tentative construction schedule
 - 2. Critical Work sequencing
 - 3. Designation of responsible personnel
 - 4. Procedures for processing field decisions and Change Orders
 - 5. Procedures for processing Applications for Payment
 - 6. Review of Davis Bacon and other federal requirements

7. Distribution of Contract Documents
8. Submittal of Shop Drawings, Product Data and Samples
9. Preparation of record documents
10. Use of the premises
11. Office, work and storage, and laydown areas
12. Equipment deliveries
13. Construction safety procedures
14. Environmental health and safety procedures
15. First aid
16. Security
17. Housekeeping
18. Working hours
19. Traffic Control
20. Emergency Vehicle Access to and around work site
21. Environmental protection measures for construction site

1.03 PROGRESS MEETINGS:

- A. During the course of the Project, the Contractor shall attend weekly progress meetings as scheduled by the Owner. The Owner, based on work progress and activities, may adjust the progress meetings to biweekly or other. The attendance of subcontractors may be required during the progress of the Work. The Contractor's delegate to the meeting shall be prepared and authorized to discuss the following items:

1. Progress of Work/Critical Work Sequencing in relation to Contract Schedule.
2. Proposed Work activities for forthcoming period.
3. Resources committed to Contract.
4. Coordination of Work with others.
5. Status of procurement of equipment and materials.
6. Status of Submittals.
7. Outstanding actions, decisions, or approvals that affect Work activities.
8. Site access and/or security issues
9. Hazards and risks
10. Housekeeping
11. Quality issues
12. Potential Claims
13. Change Orders
14. Costs, budget, and payment requests

- B. The Contractor shall revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized and the revised schedule shall be submitted to the Engineer and Owner.

PART 2 - PRODUCTS

Not used.

PART 3 – EXECUTION

Not used.

END OF SECTION

SECTION 01330

SUBMITTALS

PART 1 - GENERAL

1.01 WORK INCLUDED:

The Contractor shall provide the Engineer with submittals as required by the contract documents.

1.02 RELATED WORK:

Divisions 1 – 16 of these specifications that require submittals.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 GENERAL:

- A. As required by the General Conditions, Contractor shall submit a schedule of shop and working drawing submittals.
- B. The Contractor shall submit the shop and working drawing submittals either electronically or hard copy.

3.02 ELECTRONIC SUBMITTALS:

- A. In accordance with the accepted schedule, the Contractor shall submit promptly to the Engineer by email (easlerm@wseinc.com) one electronic copy in Portable Document Format (PDF) of shop or working drawings required as noted in the specifications, of equipment, structural details and materials fabricated especially for this Contract.
- B. Each electronic copy of the shop or working drawing shall be accompanied by the Engineer's standard shop drawing transmittal form, included as Exhibit 1 of this section (use only for electronic submittals), on which is a list of the drawings, descriptions and numbers and the names of the Owner, Project, Contractor and building, equipment or structure.
- C. The Contractor shall receive a shop drawing memorandum with the Engineer's approval or comments via email.

3.03 HARD COPY SUBMITTALS:

- A. In accordance with the accepted schedule, the Contractor may submit promptly to the Engineer, by mail (to Weston & Sampson Engineers, Worcester Office, attention: Michael Easler), six (6) copies each of shop or working drawings required as noted in the specifications, of equipment, structural details and materials fabricated especially for this Contract.
- B. Each shipment of drawings shall be accompanied by the Engineer's (if applicable) standard shop drawing transmittal form on which is a list of the drawings, descriptions and numbers and the names of the Owner, Project, Contractor and building, equipment or structure.

3.04 SHOP AND WORKING DRAWINGS:

- A. Shop and working drawings shall show the principal dimensions, weight, structural and operating features, space required, clearances, type and/or brand of finish of shop coat, grease fittings, etc., depending on the subject of the drawings. When it is customary to do so, when the dimensions are of particular importance, or when so specified, the drawings shall be certified by the manufacturer or fabricator as correct for this Contract.
- B. All shop and working drawings shall be submitted to the Engineer by and/or through the Contractor, who shall be responsible for obtaining shop and working drawings from his subcontractors and returning reviewed drawings to them. All shop and working drawings shall be prepared on standard size, 24-inch by 36-inch sheets, except those, which are made by changing existing standard shop or working drawings. All drawings shall be clearly marked with the names of the Owner, Project, Contractor and building, equipment or structure to which the drawing applies, and shall be suitably numbered. Each shipment of drawings shall be accompanied by the Engineer's (if applicable) standard shop drawing transmittal form on which is a list of the drawings, descriptions and numbers and the names mentioned above.
- C. Only drawings that have been prepared, checked and corrected by the fabricator should be submitted to the Contractor by his subcontractors and vendors. Prior to submitting drawings to the Engineer, the Contractor shall check thoroughly all such drawings to satisfy himself that the subject matter thereof conforms to the Contract Documents in all respects. Shop drawings shall be reviewed and marked with the date, checker's name and indication of the Contractor's approval, and only then shall be submitted to the Engineer. Shop drawings unsatisfactory to the Contractor shall be returned directly to their source for correction, without submittal to the Engineer. Shop drawings submitted to the Engineer without the Contractor's approval stamp and signature will be rejected. Any deviation from the Contract Documents indicated on the shop drawings must be identified on the drawings and in a separate submittal to the Engineer, as required in this section of the specifications and General Conditions.

- D. The Contractor shall be responsible for the prompt submittal and resubmittal, as necessary, of all shop and working drawings so that there will be no delay in the work due to the absence of such drawings.
- E. The Engineer will review the shop and working drawings as to their general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Corrections of comments made on the drawings during the review do not relieve the Contractor from compliance with requirements of the Contract Documents. The Contractor is responsible for: confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; and performing his work in a safe and satisfactory manner. The review of the shop drawings is general and shall not relieve the Contractor of the responsibility for details of design, dimensions, code compliance, etc., necessary for interfacing with other components, proper fitting and construction of the work required by the Contract and for achieving the specified performance. The Engineer will review submittals two times: once upon original submission and a second time if the Engineer requires a revision or corrections. The Contractor shall reimburse the Owner amounts charged to the Owner by the Engineer for performing any review of a submittal for the third time or greater.
- F. With few exceptions, shop drawings will be reviewed and returned to the Contractor within 30 days of submittal.
- G. No material or equipment shall be purchased or fabricated especially for this Contract, nor shall the Contractor proceed with any portion of the work, the design and details of which are dependent upon the design and details of equipment or other features for which review is required, until the required shop and working drawings have been submitted and reviewed by the Engineer as to their general conformance and compliance with the project and its Contract Documents. All materials and work involved in the construction shall then be as represented by said drawings.
- H. Two copies of the shop and working drawings and/or catalog cuts will be returned to the Contractor. The Contractor shall furnish additional copies of such drawings or catalog cuts when he needs more than two copies or when so requested.

3.05 SAMPLES:

- A. 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.

- B. The number of samples submitted shall be as specified. Submittal and processing of samples shall follow the procedures outlined for shop and working drawings unless the specifications call for a field submittal or mock-up.
- C. Acceptance of samples will be acknowledged via a copy of the transmittal noting status. When samples are not acceptable, prompt resubmittal will be required.

3.06 OPERATING AND MAINTENANCE MANUALS AND SPARE PARTS LISTS:

- A. Where reference is made in technical specification sections to operating and maintenance manuals and/or spare parts lists, the Contractor shall submit four copies to the Engineer for review in accordance with the instructions furnished under "Shop and Working Drawings." If the submittal is complete and does not require any changes, an acknowledgement (copy of transmittal) will be returned noting status. If the submittal is incomplete or does require changes, corrections, additions, etc., two copies of the submittal will be returned with a copy of transmittal noting status. Four copies of the final operating and maintenance manuals and/or spare parts list shall be delivered to the Engineer prior to or with the equipment when it is delivered to the job site. For systems requiring field adjustment and balancing, such as heating and ventilating, the Contractor shall submit separate test results and adjustment data on completion of the work, to be incorporated into the system manual.
- B. The information included in the manual shall be as described in the specification sections, but as a minimum shall contain clear and concise instructions for operating, adjusting, lubricating and maintaining the equipment, an exploded assembly drawing identifying each part by number and a listing of all parts of the equipment, with part numbers and descriptions required for ordering spare parts. Spare parts lists shall include recommended quantity and price.
- C. Operating and maintenance manuals shall be in durable loose-leaf binders, on 8½-inch by 11-inch paper, with diagrams and illustrations either on 8½-inch by 11 inch or multiple foldouts. The instructions shall be annotated to indicate only the specific equipment furnished. Reference to other sizes or models of similar requirement shall be deleted or neatly lined out.

END OF SECTION

EXHIBIT 1 TO SECTION 01330 SUBMITTALS
SHOP DRAWING TRANSMITTAL FORM

7/8/2019

01330-6
SUBMITTALS

Shop Drawing Transmittal				Weston & SampsonSM			
Instruction for Preparing Transmittal No action will be taken on any item unless accompanied by this form. TRANSMITTAL NOS. to be consecutive (1, 2, 3, etc.). Each resubmittal of same item shall use same number with suffix letter (A, B, etc.). SPEC. SECT. NO: Only one spec. section no. to each transmittal. DESCRIPTION: Complete identification of document or group of documents. SOURCE: Originator of document(s) being submitted.				DRAWING NO: Identification of document(s). CONTRACT DRAWING REFERENCE: Contract drawing number(s) showing details of document(s). SPECIAL INSTRUCTIONS: Special cases and emergencies, changes in distribution and special handling requests, etc. should be entered here. SIGNATURE OF CONTRACTOR: Signature of individual who reviews and approves material prior to submittal to engineer.			
THIS SECTION TO BE COMPLETED BY CONTRACTOR							
TRANSM. NO.		SPEC. SECT. NO.		DATE		CONTRACTORS JOB NO. W&S JOB NO.	
PROJECT NAME & CONTRACT NO.				LOCATION			
Attention: CSD (David@wscinc.com) Weston & Sampson Engineers, Inc. 55 Walkers Brook Drive, Suite 100 Reading, MA 01867				BY W&S			
ITEM NO.	DESCRIPTION	SOURCE	DRAWING NO. CATALOG NO. BROCHURE, ETC	NO. OF COPIES	CONTRACT DRAWING REF.	ACTION CODE	REVIEWED BY
1							
2							
3							
4							
THIS CERTIFIES THAT ALL ITEMS SUBMITTED HEREWITH HAVE BEEN CHECKED BY THE CONTRACTOR, ARE IN CONFORMANCE WITH THE REQUIREMENTS OF THE CONTRACT DOCUMENTS, EXCEPT AS NOTED, AND ARE APPROVED BY THE CONTRACTOR FOR THIS PROJECT.							
THIS SECTION TO BE COMPLETED BY W&S							
ACTION CODE: 1. FURNISH AS SUBMITTED 2. FURNISH AS NOTED 3. REVISE AND RESUBMIT 4. REJECTED- SEE REMARKS 5. ACKNOWLEDGEMENT 6. SUBMITTAL NOT REQUIRED, RETURNED WITHOUT REVIEW				a. INSTALLATION SHALL PROCEED ONLY WHEN ACTION CODE IS 1 OR 2 b. ACTION CODED 3 SHALL BE RESUBMITTED WITHIN TIME LIMIT SET IN CONTRACT c. REVIEW DOES NOT RELIEVE CONTRACTOR FROM RESPONSIBILITY OF COMPLIANCE WITH ALL REQUIREMENTS OF THE CONTRACT DOCUMENTS			
				SIGNATURE & TITLE Weston & Sampson			

SECTION 01350

PERMITS

PART 1 - GENERAL

1.01 DESCRIPTION:

This Section provides specific information and defines specific requirements of the Contractor regarding the preparation and acquisition of permits required to perform the work of this project.

1.02 SCOPE OF WORK:

- A. The Contractor shall be responsible for obtaining all permits required to complete the work of this contract, to provide all coordination and furnish all bonds, assurances and required warranties. As applicable, the Contractor shall be responsible for any/all fees associated with the securing of permits necessary for the execution of the work of this contract. The City of Worcester will waive all City associated fees.

1.03 GENERAL REQUIREMENTS:

- A. The Contractor shall perform the work in accordance with the Contract Documents, including permits, and any applicable municipal requirements.

1.03 DIGSAFE:

- A. Contact Digsafe seventy-two (72) hours prior to initiating work at telephone # 1-888-344-7233.

PART 2 – PRODUCTS:

- A. All materials and equipment shall conform to permit requirements and the City's standards for utilities, excavation, backfill, patching, construction standards, and surveying or other work unless otherwise stated in these specifications. Coordinate as necessary with the appropriate Town official and/or private utility.

PART 3 – EXECUTION:

- A. Execute all work per permit requirements. The Contractor shall perform the work in accordance with the Contract Documents, and any applicable municipal requirements.
- B. Prior to commencing any construction activities, the Contractor shall demonstrate to the Owner and the Engineer, through on-site inspection and submitting copies of permits or approvals, that it is in full compliance with the terms and conditions of all permits specified herein. The Contractor shall maintain full compliance with all permits throughout the performance of the work, and upon request, grant access to permitting

authorities to inspect the site for the purpose of verifying such compliance.

END OF SECTION

SECTION 01380

HEALTH AND SAFETY PLAN

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. Prior to the start of work on the site, Contractor shall prepare and submit a site-specific health and safety plan that includes consideration of all known and potential hazards at the site. Work may not proceed at the project site until the Contractor's health and safety plan has been received and reviewed by the Engineer.

1.02 REFERENCES:

- A. OSHA 29 CFR 1910.120

1.03 RELATED WORK:

- A. Section 00890 – PERMITS
- B. Section 01380 – HEALTH AND SAFETY PLAN
- C. Section 01570 – ENVIRONMENTAL PROTECTION
- E. Section 02220 – BUILDING DEMOLITION
- F. Section 02051 – ASBESTOS ABATEMENT (BUILDINGS)
- G. Section 02300 – EARTHWORK

PART 2 – PRODUCTS

2.01 HEALTH AND SAFETY PLAN:

A. The health and safety plan shall include, but not necessarily be limited to the following:

1. Identification of Contractor's Site Safety Officer.
2. Identification of Hazards and Risks Associated with Project.
3. Contractor's Standard Operating Procedures, Including Personnel Training and Field Orientation.
4. Respiratory Protection Training Requirements.
5. Levels of Protection and Selection of Equipment Procedures.
6. Type of Medical Surveillance Program.
7. Personal Hygiene Requirements and Guidelines.
8. Zone Delineation of the Project Site.
9. Site Security and Entry Control Procedures.
10. Field Monitoring of Site Contaminants.
11. Contingency and Emergency Procedures.
12. Listing of Emergency Contacts.

PART 3 - EXECUTION

3.01 PERSONAL PROTECTIVE EQUIPMENT:

A. The personal protective equipment required to provide the appropriate level of dermal and respiratory protection shall be determined based on the results of continuous air monitoring performed by the Contractor and the standards set forth in the Contractor's health and safety plan. The Engineer may conduct duplicate air monitoring for quality control purposes. Modified Level D protection shall be the minimum requirement for all on-site personnel.

END OF SECTION

SECTION 01390

ENVIRONMENTAL HEALTH AND SAFETY PLAN FOR LEAD PAINT REMOVAL

PART 1 - GENERAL

1.01 WORK INCLUDED:

This specification covers the requirements for worker protection, environmental protection and the handling of debris generated from this lead paint removal project. Safety practices and regulations not specifically related to lead paint removal are not included in these specifications, but remain the Contractor's responsibility.

1.02 RELATED WORK:

- A. Section 02220, SELECTIVE STRUCTURE DEMOLITION

1.03 DESCRIPTION:

It has been determined that the existing paint to be removed from the exterior and interior surfaces of the former Little League concession snack structure contain hazardous concentrations of lead. Lead paint removal activities shall prevent fugitive emissions, passage of fine particles and provide containment of paint debris. In no event shall hazardous waste emissions exceed maximum levels allowed in Subsection 3.01. The Contractor shall provide workers, for use at this job site, respirators equipped with high efficiency particulate air (HEPA) filters, in accordance with 29 CFR 1926.62. The respirators shall be of the type approved by the Mine Safety and Health Administration (MSHA) and the National Institute of Occupational Safety and Health (NIOSH).

1.04 QUALITY ASSURANCE:

- A. No Contractor shall be considered qualified to do the work unless it has at least five years experience in the field of lead paint removal.
- B. Contractor shall be certified and licensed in accordance with 454 CMR 22.00 to perform as a Level I or Level II deleader contractor.

1.05 REFERENCES:

- A. The following standards form a part of this specification and indicate the minimum standards required unless indicated otherwise:

Code of Massachusetts Regulations (CMR)

454 CMR 22.00 Deleading Regulations

Code of Federal Regulations (CFR)

- | | | |
|----|----------|---|
| 29 | CFR 1910 | "Occupational Safety and Health Standards" (General Industry Standards). |
| 29 | CFR 1926 | "Safety and Health Regulations for Construction" (Construction Industry Standards). |
| 40 | CFR 50 | "National Primary and Secondary Ambient Air Quality Standards". |
| 40 | CFR 261 | "Identification and Listing of Hazardous Waste". |
| 40 | CFR 262 | "Standards Applicable to Generators of Hazardous Waste". |
| 40 | CFR 265 | "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities". |
| 40 | CFR 300 | "National Oil and Hazardous Substances Pollution Contingency Plan". |
| 40 | CFR 302 | "Designation, Reportable Quantities, and Notification". |

Occupational Safety and Health Administration (OSHA)

- | | | |
|------|--------------|---|
| OSHA | Booklet 3126 | "Working with Lead in the Construction Industry". |
|------|--------------|---|

National Institute of Occupational Safety and Health (NIOSH)

- | | | |
|-------|------------------------|---|
| NIOSH | Method 7082 | "Lead". |
| NIOSH | Publication No. 91-116 | "Preventing Lead Poisoning in Construction Workers" |

American Society for Testing and Materials (ASTM)

- | | | |
|------|-------|---|
| ASTM | D3335 | "Test Method for Low Concentration for Lead, Cadmium, and Cobalt in Paint by Atomic Absorption Spectroscopy". |
|------|-------|---|

Environmental Protection Agency (EPA)

- | | |
|--------------------|---|
| Publication SW-846 | "Test Method for Evaluating Solid Waste - Physical/Chemical Methods". |
|--------------------|---|

Steel Structures Painting Council (SSPC)

SSPC Guide for Containing Debris Generated During Paint Removal Operations (SSPC Guide 6I (CON) Section 5.2.1).

The Lead Paint Removal Guide/Supplement to Volume 2, (SSPC Guide 7I (DIS)).

1.06 DEFINITIONS:

- A. **Lead-Containing Paint:** A paint is classified by the Consumer Product Safety Commission (16 CFR 1303) as lead-containing if it contains 600 ppm lead, or greater. Paint on the exterior steel surfaces of this water tank is known to contain lead.
- B. **Hazardous Waste:** Paint and abrasive debris is classified as hazardous waste if any of the RCRA criteria (Resource Conservation & Recovery Act) are met, i.e.: Corrosivity, Ignitability, Reactivity or Toxicity. Waste from paint removal projects such as this one is usually found to be classified as hazardous by virtue of the toxicity characteristic. Toxicity is indicated, if after testing by the Toxicity Characteristic Leaching Procedure (TCLP), the leachate contains any of the following elements in the listed concentrations or greater:

Arsenic	5.0 PPM	Lead	5.0 PPM
Barium	1000.0 PPM	Mercury	0.2 PPM
Cadmium	1.0 PPM	Selenium	1.0 PPM
Chromium	5.0 PPM	Silver	5.0 PPM

- C. **Generator:** The Owner is the generator. For the purposes of this specification, the Owner is considered a Large Quantity Generator if it generates or causes to generate over 220 pounds of waste per month.
- D. **Containment System:** A containment system includes panels, tarps, scaffolds, supports, as well as shrouds used to enclose a paint removal tool. The purpose is to prevent the debris generated during the surface preparation from entering into the environment, and to facilitate the controlled collection of the debris for disposal. Containment systems may also employ the use of ground covers or water booms.
- E. **Debris:** Any materials or combination of materials that are removed from a surface or used to remove or contain paint. All dust, paint chips, spent abrasive, old containment materials, etc., are debris.
- F. **PM-10:** Particulate matter (dust) less than 10 micrometers (0.39 mils) in aerodynamic equivalent diameter. (Aerodynamic equivalent diameter is defined as the diameter of a unit density sphere having the same settling velocity as the particle in question, regardless of its shape and density.)
- G. **Permissible Exposure Limit (PEL):** Maximum allowable employee airborne exposure to a hazardous material, averaged over an eight hour workday. In the case of lead, the PEL is

50 micrograms of lead per cubic meter of air (50 ug/m³), as specified in the OSHA lead standard for the construction industry, 29 CFR 1926.62.

1.07 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

- A. Paint Removal Plan and Containment System: The Contractor shall provide a written plan for the method employed for surface preparation and containment. As specified in Section 2.01, the Contractor shall have the drawings approved by a Connecticut licensed Professional Engineer.
- B. Program for the Protection of Ambient Air, Soil and Water: The Contractor shall submit written testing and evaluation programs that will be used to confirm that the work does not violate Federal, State and Local regulations regarding air, soil and water pollution restrictions, including those discussed in Section 3.01 of this specification.
- C. Provide a detailed Lead Health and Safety Plan (LHASP) as described in subsection 2.01.
- D. Handling, Disposal, and Analysis of Debris: The Contractor shall provide the following:
 - 1. Handling and Site Storage. The Contractor shall submit a written plan that addresses the handling and site storage of lead-containing debris in accordance with 40 CFR 262 and 40 CFR 265. The Contractor shall describe the method of compliance with labeling, storage, transportation, disposal, and accumulation requirements.
 - a. The Contractor shall indicate the disposal facility, the method of disposal, and the method of testing for all hazardous wastes including, but not limited to paint debris, paint waste, and paint thinners. All disposal facilities shall be approved prior to award of contract.
 - (1) The Contractor shall submit a copy of its Preparedness, Prevention and Contingency Plan (PPCP).
 - (2) The Contractor shall submit a copy of a certificate for every employee on the project which indicates that he/she has been trained in compliance with 40 CFR 265.16.
 - 2. The Contractor shall submit written procedures which detail the sampling and testing of the debris to determine if it is a hazardous waste. The sampling procedures shall be in accordance with those outlined in SW-846 and with TCLP procedures and as defined in Appendix II of 40 CFR 261.
- E. CERCLA Release: The Contractor shall submit a plan for Reportable Quantities in accordance with 40 CFR 300 and 40 CFR 302.

PART 2 - PRODUCTS

2.01 LEAD HEALTH AND SAFETY PLAN (LHASP):

- A. This plan shall describe, in detail, the means by which the Contractor intends to implement and maintain the protocols necessary for protecting all personnel from hazards associated with the project operations and activities. The plan will establish and maintain policies, programs, and procedures that are necessary to be in compliance with OSHA and other regulatory agencies with jurisdiction, rules, regulations, standards or guidelines in effect at the time the work is in progress. It is the Contractor's ultimate responsibility to ensure the health and safety of all Contractors' employees and subcontracting personnel by implementing a health and safety plan.
 - B. The plan shall be kept on site and shall apply to all workers entering the work area. This plan shall be a dynamic document with provisions for change to reflect new information and practices or procedures, changing site environmental conditions or other situations that may affect site workers. All references to the "workers or employees" shall mean the Contractor's employees and subcontractor personnel.
 - C. A certified copy of the LHASP shall be submitted to the Engineer prior to the initiation of work.
 - D. The LHASP shall include, but not be limited to, the following elements:
 - General Introduction/Lead Health and Safety Organization and Responsibility
 - Hazard Communication
 - Exposure Monitoring
 - Engineering, Administrative Control and Housekeeping
 - Respiratory Protection
 - Medical Surveillance Program, including Removal and Protection Procedures
 - Hygiene Facilities and Practices
 - Employee Information, Access to Records and Training Procedures
1. General Introduction/Lead Health and Safety Organization and Responsibility:
 - a. This general introduction shall include structure location; names, addresses and telephone numbers for the Contractor's project manager, field superintendent, qualified person responsible for the LHASP, and available emergency assistance; and an approval sheet with the signatures of the project manager, field superintendent and qualified person responsible for the LHASP.
 - b. Procedures to be followed to protect personnel and the general public in case of emergencies will be defined in the general introduction of the LHASP. Potential emergencies to be addressed include, but are not limited to, overt personnel exposure, personnel injury, fire or explosion, and environmental incident (i.e., spread of hazardous substances). For each emergency scenario, a chain of command and responsibilities must be clearly defined. In addition, a contingency plan for large scale emergencies such as site evacuation or other situations where significant outside emergency services and interactions are

required shall be developed. The emergency plan shall include designation of responsible on-site and off-site personnel, chain of command, facility services and interface with government agencies.

- c. The Contractor shall engage "qualified person(s)" to develop and to implement the LHASP. The qualifications of person(s) assigned and responsible for all aspects of the plan shall be included under the lead health and safety organization and responsibilities section of the LHASP. These person(s) are defined as follows:

- (1) Health and Safety Officer (HSO): The Health and Safety Officer shall be an individual capable of identifying hazardous or dangerous conditions in the workplace, shall have had previous experience dealing with lead paint removal from steel structures, and shall have authorization to take prompt corrective measures to eliminate any hazardous conditions identified. The HSO shall have field experience, completed study courses in the field, and had other formal learning experience necessary to prepare him/her to perform the technical monitoring, consulting, testing and inspecting.
- (2) Monthly Certification: The HSO shall certify weekly in writing to the Engineer on the Contractor's compliance to the LHASP and on the requirements of other agencies or organizations. The HSO shall approve all changes to the LHASP. The Engineer shall be immediately informed of all major changes to the LHASP and all changes must meet the approval of the Engineer.

2. Hazard Communication:

Submit a copy of the Contractor's Hazards Communication Program as required by 29 CFR 1910.1200. This may be included as a section of the LHASP.

3. Worker Exposure Monitoring:

A written program for determining the level of airborne lead exposure within the workers breathing zone, and around the lead paint removal areas, in accordance with 29 CFR 1926.62 (d). Monitoring shall be performed in accordance with NIOSH Method 7082 using personal pumps on representative workers. Contractor is hereby notified that on most projects, all workers, including those outside containments are usually exposed to levels of lead above the Permissible Exposure Limit (PEL).

4. Engineering, Administrative Control and Housekeeping:

A written compliance program to describe the engineering, administrative, housekeeping, and protective equipment that will be used to reduce the exposure of the employees to a level less than the PEL (50 ug/m³). The program shall be in compliance with 29 CFR 1926.62 (e).

5. Respiratory Protection:

A copy of the respiratory protection program as required by 29 CFR 1926.62 (f), and 29 CFR 1910.134. Copies of pulmonary function test results, or a physician approval to wear negative pressure respirators, as well as face fit-testing results, shall also be submitted.

6. Medical Surveillance Program:

- a. A written medical surveillance program shall be submitted, including mechanism for submitting Blood Lead Level testing results. The program shall include the frequency of testing, the company policy at various action levels, the company policy regarding employee removal, protection of wages and positions, and medical exams. The program shall be in accordance with 29 CFR 1926.62 (j) and (k).
- b. The medical surveillance, removal and protection program shall be provided by a physician, certified or eligible for certification in occupational medicine by the American Board of Preventive Medicine.

7. Hygiene Facilities and Practices:

A written description of the hygiene facilities and housekeeping practices to be used, and protective clothing controls shall be submitted. These shall be in compliance with CFR 1926.62 (g), (h) and (I).

8. Employee Information, Access to Records, Training:

- a. For each worker, submit a statement that the employee has been informed of the hazards on the project, and of his or her right of access to exposure and medical records as required by 29 CFR.
- b. Submit a copy of the employee training program in accordance with 29 CFR 1926.62, as well as copies of employee Certificates of Completion of the course.

9. Hearing Conservation:

It is anticipated that paint removal operations will generate noise levels above the OSHA noise limits of 90 dBA over an eight-hour period. The Contractor shall conduct sound level meter surveys to document such noise levels, and provide a written Hearing Conservation Program as required by 29 CFR 1910.95 and 29 CFR 1926.101. The following items shall be included:

- (1) Noise Dosimetry for potentially exposed workers.
- (2) Audiometric testing.

- (3) Hearing Protection.
- (4) Training.

10. Fall Protection:

Maximum safety against falls shall be provided to workers working on elevated work platforms, scaffolding or other elevated surfaces. The Contractor shall prepare a written Fall Protection Program which complies with all OSHA requirements of 29 CFR 1926.104, 105, 451, 452, 500 and 502, including the following elements:

- (1) Safety Equipment, ie: belts, lanyards and lifelines.
- (2) Safety Nets, as needed.
- (3) Training.
- (4) Inspection and Supervision.

11. Eye and Face Protection:

The Contractor shall ensure that all workers wear eye and face protection at all times when operating power tools, hand tools and other equipment likely to generate flying objects which may cause injury to the eyes or face. The Contractor shall comply with 29 CFR 1926.102.

2.02 FULL CONTAINMENT SYSTEM:

- A. If full removal of the exterior paint system is required, the Contractor shall utilize as a minimum, an SSPC Class II Containment system. To achieve a Class II Containment, the Contractor shall provide impermeable walls, fully sealed joints, sealed entry ways and negative air pressure. It is the intent of this specification that all blast abrasive, paint, dust, rust, and other contaminant material shall be fully contained.
- B. The Contractor shall design or use a pre-designed containment system for the work area. The containment shall control the environmental emissions according to the criteria listed in Section 3.01 and, control the working environment according to the criteria listed in Section 3.02
- C. The Contractor shall thoroughly examine the structure and be prepared to verify its ability to support the containment and debris collection system. The scaffolding and loads shall be approved by a Connecticut licensed professional civil engineer. The Contractor shall submit the containment drawings to the Engineer for information prior to start of the work.

2.03 SPOT REMOVAL SYSTEM:

If spot removal of the exterior paint system is required, the Contractor shall utilize, as a minimum, vacuum assisted power tools or close abrasive blast cleaning equipment with vacuum. It is the intent of this specification that all blast abrasive, paint, dust, rust, and other contaminant material shall be fully contained.

PART 3 - EXECUTION

3.01 CONTROL OVER ENVIRONMENTAL EMISSION:

AMBIENT AIR QUALITY FOR PARTICULATE MATTER: (40 CFR 50)

1. To establish the background level of respirable dust, prior to beginning the work, the Contractor shall conduct Ambient Air Quality Monitoring using high volume air samplers equipped for the collection of respirable dust (PM-10). Test results shall be communicated to the Engineer.
2. Additional PM-10 air quality monitoring shall be conducted by the Contractor during paint removal operations. To determine the level of dust originating from the paint removal operations, a minimum of two PM-10 monitors shall be placed at the perimeter of the tank, and/or at points of maximum environmental impact, i.e., homes, playgrounds, etc., as directed by the Engineer. Monitors may be moved to maintain this condition due to shifting wind patterns. Placement shall be at the discretion of the Engineer. The PM-10 filters shall be analyzed by gravimetric analysis, pursuant to the EPA method G in 40 CFR Part 50. The National Ambient Air Quality Standard for respirable dust is 150 micrograms dust per cubic meter of air, as a 24 hour average, averaged over a 90 day period. Emissions in excess of 400 micrograms per cubic meter of PM-10 respirable dust over an 8-hour workday shall be cause for shut-down of the project until corrections to the containment, ventilation or paint removal equipment are made to comply with this level.

B. AMBIENT AIR QUALITY FOR LEAD EMISSIONS:

1. To establish the background level of lead dust, prior to beginning the work, the Contractor shall conduct Ambient Air Quality Monitoring using high volume air samplers equipped for the collection of total suspended particulate (TSP). Test results shall be communicated to the Engineer prior to the start of the work.
2. Additional TSP air quality monitoring shall be conducted by the Contractor during paint removal operations. To determine the level of lead emissions originating from the paint removal operations, a minimum of two TSP monitors shall be placed at the perimeter of the tank, and/or at points of maximum environmental impact, i.e., homes, playgrounds, etc., as directed by the Engineer. Monitors may be moved to maintain this condition due to shifting wind patterns. Placement shall be at the discretion of the Engineer.
3. The TSP filters shall be analyzed for lead in accordance with the EPA 40 CFR Part 50, Appendix G. The National Ambient Air Quality Standard for lead according to 40 CFR Part 50, is 1.5 micrograms per cubic meter as a 90-day average. Emission in excess of the value attained by the following formula shall be cause to shut-down the project until improvements are made to the containment, ventilation or paint removal equipment to comply with the allowable value.

4. Allowable 8-hour Emission in microgram per cubic meter (mcg/m^3) = AE

$$\text{AE} = 90/\text{PD} \times 1.5 \text{ mcg}/\text{m}^3 \times 3$$

where PD is the Project Duration in Days. The maximum value for PD is 90 and the minimum is 30.

C. SOIL QUALITY:

The Contractor shall not contaminate the soil with lead or paint chips. The Engineer will visually monitor the presence of paint chips from the tank in the soil surrounding the tank. If any paint chips from the Contractor's operations are found on or in the soil, the Contractor shall remove the paint chips or the soil containing the paint chips and dispose of in accordance with state regulations. Any required cleanup and the associated cost due to paint chip contamination shall be the responsibility of the Contractor.

D. WATER QUALITY:

The Contractor shall take all precaution necessary to prevent debris (spent abrasive, paints, and other debris) from entering water supplies or drainage systems. The Contractor shall protect all drains. Debris shall not be allowed to enter the storm sewer system. The cost of any clean-up required as a result of Contractor activities shall be the Contractors responsibility.

E. SAMPLING PROCEDURES:

The Contractor shall take required air samples daily (at approximately midday) during the paint removal operations in the presence of the Engineer. The Contractor shall arrange for the samples to be delivered overnight to a State Certified Laboratory. Samples shall be placed in properly sealed packages to avoid contamination. Results of the tests shall be faxed to the Engineer within three days from taking the sample to determine compliance with specified air quality standards for particulate matter and lead emissions. A summary report including the results of the soil and air testing shall be submitted to the Engineer by the laboratory at the completion of the project. All fees associated with the sampling and testing including the shipping costs shall be the responsibility of the Contractor.

3.02 CONTROL OVER WORKER PROTECTION:

- A. OSHA requirements, as outlined in 29 CFR 1926.62, shall be considered the minimum level of protection, unless greater control measures are required by this specification. Section 2.01, provides some of the requirements.
- B. Worker blood lead results shall be supplied to the Engineer on a monthly basis. All workers shall be tested prior to working on the project. The frequency of testing shall be at least every four (4) weeks or less depending on worker blood levels. At the completion of the project, all workers shall be re-tested, regardless of their last test date or test result.

3.03 HANDLING OF HAZARDOUS WASTE AND REPORTING RELEASE:

- A. All waste shall be presumed to be hazardous until it is clearly demonstrated to be non-hazardous. The results shall be confirmed by tests on the actual production debris, as detailed in Section 1.06, Part B of this specification. The tests shall be performed by the Contractor at no cost to the Owner.
- B. Testing shall be mandatory to determine the hazardous potential of waste materials generated from the removal of the existing paint on the exterior of the tank.
- C. HAZARDOUS WASTE:
 - 1. If the test results indicate that the debris is a RCRA-defined Hazardous Waste (per 1.06, Part B), the following requirements shall apply:
 - a. Site Storage and Handling: The Contractor shall comply with all the requirements of 40 CFR 262 and 40 CFR 265 for on-site handling of debris. The Contractor shall pay particular attention to the following:
 - 1. 90-day maximum accumulation.
 - 2. Label with date of first accumulation, and hazard warning.
 - 3. DOT approved containers.
 - 4. Proper storage facility; covered, protected, level and off the ground.
 - 5. Training of personnel.
 - b. Paint debris shall not be allowed to be placed or accumulate on unprotected ground and shall be shielded to prevent dispersion of the debris by rain or water run-off. Any evidence of improper storage shall be cause for immediate shut-down of the project until corrective action is taken.
 - 2. If the test results indicate that the debris is not a RCRA - defined hazardous waste, the contractor shall dispose of the debris in accordance with all applicable federal, state and local requirements. The Contractor is responsible for the cost of disposal of all materials.
- D. CERCLA Release: Discharge of one (1) or more pounds of lead with a particle size of 4 mils or less into the atmosphere, water or soil within a 24-hour period is classified as a reportable release in accordance with 40 CFR 300 and 40 CFR 302. CERCLA releases shall be reported to the Engineer immediately. If a non-hazardous waste contains lead meeting the above requirement, it is also a CERCLA violation.

3.04 PROJECT CLEAN-UP AND CLOSE OUT:

- A. DESCRIPTION:
 - 1. The cleaning requirements specified in this section provide for ongoing as well as for final clean-up and disposal to insure that the work-site is maintained in an orderly

and professional manner. Refer to Section 01740, CLEANING UP, for additional requirements.

2. In addition to clean-up requirements for the work and the work-site, the Contractor shall be responsible for maintaining adjacent properties free from waste, debris or rubbish resulting from the work.
3. If the Contractor fails to maintain the work-site as herein specified, the Owner may do so and the cost thereof shall be charged to the Contractor.
4. All work performed shall comply with health, safety, and fire protection codes and all other applicable codes and regulations established by the agencies having jurisdiction.

B. CLEAN-UP DURING CONSTRUCTION:

1. Clean and clear the work-site daily, or as otherwise ordered by the Engineer, to ensure that the site and adjacent private and public properties are maintained free from accumulations of waste materials and rubbish resulting from the work.
2. Provide on-site dump containers for collection of waste materials, debris and rubbish. Secure all waste materials and rubbish from being blown by the wind. Keep trash separate from hazardous waste.
3. Remove waste materials, debris and rubbish at least weekly and legally dispose of away from the site.
4. Provide odor, insect, and rodent control during periods between disposal of debris and rubbish.

C. FINAL CLEAN-UP:

1. Immediately prior to the Contractor's request for final inspection of the project or any portion thereof, perform final clean-up in all areas to be inspected.
2. Contracts shall be considered complete and final payments made, only when:
 - a. All provisions of the Contract Documents have been strictly adhered to.
 - b. All damage to the Owner's property and adjoining premises caused by the work has been repaired.
 - c. The project and premises have been left in good order, including removal of all temporary installations, Contractor-owned material and extraneous materials as specified.

- d. All guarantees, maintenance instructions, releases, and permits called for in the contract have been furnished to the Owner.

END OF SECTION

SECTION 01400

QUALITY CONTROL

PART 1 - GENERAL

1.01 GENERAL PROVISIONS:

Attention is directed to the General Conditions of the Contract, all Divisions of the Specifications and the Drawings, all of which apply to this section.

1.02. SCOPE OF WORK:

- A. The scope of the work under this Specification section, without limiting the generality thereof, includes the furnishing of all labor, materials, equipment, services, and incidentals necessary to complete all of the work in accordance with the Contract Documents, which are intended to describe and provide for a finished piece of work.
- B. The work includes the following, without limiting the generality thereof;
 - 1. The making available to the Owner's testing laboratory any samples or specimens which the laboratory may require to perform quality control testing on concrete, fill materials, or other material as the Owner may elect.
 - 2. The coordinating and scheduling of work and the giving of timely notice so as to afford the Owner's testing laboratory the opportunity to take samples and make observations or tests.
 - 3. Provide safe access to the site or area for the Owner's agent to collect data, samples, and the like.

1.03. TESTING LABORATORY:

- A. The Contractor will select, engage, and pay for the services of an independent testing laboratory to perform structural tests on concrete, soil testing, compaction testing and such other materials as the Owner may deem appropriate.
- B. Retesting of materials which fail the original test shall be paid for by the Contractor.

END OF SECTION

SECTION 01450

SAMPLING & TESTING

PART 1 - GENERAL

1.01 SCOPE OF WORK:

- A. In the event that Owner testing discovers unsatisfactory work, the Contractor shall conduct any additional testing in accordance with this specification. The work under this Section shall consist of performing or ordering the work of collecting samples for testing, having tests performed by a Certified Testing Laboratory satisfactory to the Engineer, having all test results forwarded to the Engineer for approval, and paying all costs associated with the collection and sampling, transportation, shipping, postage, and testing, and the coordination of test results and approvals.

1.02 SUBMITTALS:

- A. In accordance with Section 01330 of these Specifications, submit the names, addresses and certification of laboratories to be utilized for approval by the Engineer.

PART 2 - PRODUCTS

2.01 CONTAINERS AND TOOLS:

- A. Utilize tools recommended by the laboratory to obtain samples, packaging or containers suitable to, or furnished by, the laboratory, and collect all samples in the proper number and quantity to permit tests to be conducted.

2.02 TESTS:

- A. Refer to Section specifications for test requirements and criteria for results; coordinate with the Owner's Representative.
- B. All building utilities, park elements, gates, lighting systems, and any other components from the scope of work as requested by the Owner's Representative shall be tested to ensure complete compliance with manufacturer's installation instructions and warrantee requirements.

PART 3 - EXECUTION

3.01 METHODOLOGY

- A. Unless otherwise directed by the Section specifications, perform sampling and testing will be ordered by the Contractor and approved by the Owner's Representative. Locations, number and quantity of samples shall be submitted for

approval as directed in accordance with the Specifications.

- B. Sampling and Testing results must be provided to the Owner's Representative and Approved prior to the installation of any work potentially impacted by unacceptable test results.

3.02 PAYMENT

- A. Payment for additional sampling and testing efforts shall be included in the lump sum contract price bid.

END OF SECTION

SECTION 01452

STRUCTURAL TESTS AND INSPECTIONS

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. Provide labor, materials, and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Obtaining, coordinating, and providing notifications to the Owner and Engineer.
 - 2. Provide safe access to the work of this Contract to accommodate the indicated tests and inspections.
 - 3. Implementing corrective action and providing additional tests and/or inspections for work identified as non-conforming by the Independent Testing Agency.

1.02 GENERAL REQUIREMENTS:

- A. The Massachusetts State Building Code, Latest Edition, 780 CMR, requires the Structural Engineer of Record (SER) to provide a program of structural tests and inspections for this project.
- B. The Contractor or its subcontractors shall be required to meet the responsibilities and obligations for quality control of the Work; their other obligations for supervising the Work; for any design work which is included in their scope of services; for full compliance with the requirements of the Contract Documents; the detection of, or failure to detect, deficiencies or defects, whether detected or undetected, in all parts of the Work, and to otherwise comply with all requirements of the Contract Documents.
- C. The Program of Structural Tests and Inspection does not apply to the Contractor's equipment, temporary structures used by the Contractor to construct the project, the Contractor's means, methods, procedures, and job site safety.

1.03 CONTRACTOR RESPONSIBILITIES:

- A. The Contractor shall provide free and safe access to the Work for the SER and all other individuals who are observing the Work or performing structural tests or inspections. The Contractor shall provide all ladders, scaffolding, staging, and up-

to-date safety equipment, all in good and safe working order, and qualified personnel to handle and erect them, as may be required for safe access.

- B. The Contractor shall give reasonable notice to the Owner and the Engineer of when the various parts of the Work will be ready for testing and/or inspection. The Contractor shall notify the Owner and the Engineer a minimum of 48 hours before such tests and/or inspections are to take place.

PART 2 - PRODUCTS

NOT USED.

PART 3 - EXECUTION

NOT USED.

ATTACHMENT A

PROGRAM OF STRUCTURAL TESTS AND INSPECTIONS

The following is a summary of Work subject to Tests and Inspections under the Program.

1. In-situ Bearing Strata for Footings
2. Controlled Structural Fill
3. Cast-In-Place Concrete

Abbreviation Agent

SER Structural Engineer of Record
ITA Owner – Independent Testing Agency

In-Situ Bearing Strata for Footings

Item	Agent	Scope
1. Bearing Strata QC Review	ITA	Review Contractor's field quality control procedures.
2. General Excavation	ITA	Inspect strata for conformance to the structural drawings, specifications, and/or geotechnical report.
3. General Excavation	ITA	Ensure that excavation is to proper depth or material.
4. General Excavation	ITA	Ensure that excavation is controlled and contains no unsuitable materials.
5. Bearing surfaces for footings	ITA	Inspect bearing surfaces for conformance to the requirements of the structural drawings, specifications, and/or geotechnical report.

Controlled Structural Fill

Item	Agent	Scope
1. Controlled Structural Fill QC Review	SER	Review Contractor's field quality control procedures
2. Fill Material	ITA	Test material for conformance to specifications or geotechnical report. Perform laboratory compaction tests in accordance with the specifications to determine optimum water content and maximum dry density.
3. Installation of controlled structural fill	ITA	Provide full-time inspection of the installation, in accordance with the specifications.
4. Density of Fill	ITA	Perform field density tests of the in-place fill in accordance with the specifications.

Cast-In-Place Concrete Construction

Item	Agent	Scope
1. Cast-In-Place Concrete Construction QC Review	SER	Review Contractor's field quality control procedures. Review frequency and scope of field testing and inspections.
2. Mix Design	SER	Review Mix Designs
3. Materials	SER	Review material certifications for conformance to Specifications
4. Batching Plant	ITA	Review Plant quality control procedures and batching and mixing methods
5. Reinforcement Installation	ITA	Inspect reinforcing for size, quantity, condition and placement
6. Anchor Rods	ITA	Inspect anchor rods prior to and during placement of concrete.
6. Formwork	ITA	Inspect form sizes for proper sizes of concrete members.
7. Concrete Placement and Sampling fresh Concrete	ITA	Observe concrete placement operations. Verify conformance to specifications including cold-weather and hot-weather placement procedures. Perform slump, density and air content tests at point of discharge.
8. Evaluation of Concrete	ITA	Test and evaluate in accordance with the specifications.
9. Curing and Protection	ITA	Observe procedures for conformance to the specifications.

END OF SECTION

SECTION 01500

TEMPORARY FACILITIES

PART 1 - GENERAL

1.01 GENERAL PROVISIONS:

Attention is directed to the General Conditions of the Contract, all Divisions of the Specifications and the Contract Drawings, all of which apply to this section.

1.02 SCOPE OF WORK:

- A. The scope of the work under this Specification section, without limiting the generality thereof, includes the furnishing of all labor, materials, equipment, services, and incidentals necessary to complete all of the work in accordance with the Contract Documents, which are intended to describe and provide for a finished piece of work.
- B. The work includes the following, without limiting the generality thereof;
 - 1. Temporary utilities.
 - 2. Field office (not required).
 - 3. Barriers and enclosures.
 - 4. Safety and security.
 - 5. Material and contractor Equipment Storage.
 - 6. Construction Entrance.
 - 7. Temporary Curb.

1.03. TEMPORARY UTILITIES:

- A. The Contractor is responsible for all temporary electrical distribution, lighting, and water distribution from existing sources.
- B. The provision for temporary toilets is included under Section 01010 - Summary of Work.

1.04 FIELD OFFICE:

- A. The contractor is responsible for his/her own office space, if deemed necessary.
- B. The Contractor shall provide appropriate survey equipment on site for use by the Engineer, field checking layouts and installations.

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1.05 BARRIERS AND ENCLOSURES:

- A. The Contractor shall maintain the construction fence if required by the Owner and furnish warning signs around the work area to limit unauthorized entry within the Contract Limit Line.
- B. At the earliest practical time provide temporary enclosure of materials, equipment, work in progress and completed portions of the work to provide protection to the work and employees.

1.06 SAFETY AND SECURITY:

- A. The Contractor shall be responsible for the safety and security of the buildings and the site within the Contract Limit Line, and for the safety of all persons who enter within the Contract Limit Line.
- B. The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the work.
- C. The Contractor shall erect and maintain, as required by existing conditions and progress of the work, all reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations, and notifying the Owner of particular hazards.
- D. The Contractor shall cooperate with and maintain a close liaison with the Police Department and Fire Department, and he shall abide by safety-related requests from any of these agencies.

END OF SECTION

SECTION 01562

DUST CONTROL

PART 1 - GENERAL

1.01 DESCRIPTION:

This section of the specification covers the control of dust via water, complete.

PART 2 - PRODUCTS

2.01 WATER:

- A. Water shall not be brackish and shall be free from oil, acid, and injurious alkali or vegetable matter.

PART 3 - EXECUTION

3.01 APPLICATION:

- A. Water may be sprinkler applied with equipment including a tank with gauge-equipped pressure pump and a nozzle-equipped spray bar.
- B. Water shall be dispersed through the nozzle under a minimum pressure of 20 pounds per square inch, gauge pressure.

END OF SECTION

SECTION 01570

ENVIRONMENTAL PROTECTION

PART 1 – GENERAL

1.01 DESCRIPTION:

- A. The work covered by this section of the specifications consists of furnishing all labor, materials, tools, and equipment and performing all work required for the prevention of environmental pollution during and as a result of construction operations under this contract.
- B. The requirements set forth in this section of the specifications apply to cross-country areas, river and stream crossings, and construction in and adjacent to wetlands, unless otherwise specifically stated.
- C. All work under this Contract shall be in accordance with the Conservation Commissions' Orders of Conditions as well as any conditional requirements applied, all of which are attached to Section 00890, PERMITS.
- D. Prior to commencement of work, the Contractor shall meet with representatives of the Engineer to develop mutual understandings relative to compliance of the environmental protection program.

1.02 RELATED WORK:

- A. Section 01350, PERMITS
- B. Section 01330, SUBMITTALS
- C. Section 01562, DUST CONTROL
- D. Section 02240, DEWATERING
- E. Section 02252, SUPPORT OF EXCAVATION
- F. Section 02300, EARTHWORK

1.03 SUBMITTALS:

The Contractor shall submit details and literature fully describing environmental protection methods to be employed in carrying out construction activities within 100 feet of wetlands or across areas designated as wetlands.

PART 2 - PRODUCTS

2.01 SILT FENCE:

- A. The silt fence shall consist of a 3-foot wide continuous length sediment control fabric, stitched to a mesh backing, and stapled to preweathered oak posts installed as shown on the drawings. The oak posts shall be 1-1/4-inches by 1-1/4-inches (Minimum Dimension) by 48-inches and shall be tapered. The bottom edge of the silt fence shall be buried as shown on the drawings.
- B. The silt fence shall be DOT Silt Fence PPDM3611, as manufactured by U.S. Silt & Site Supply/Getsco, Concord, NH, or approved equal.
- C. Silt fence properties:

<u>Physical Properties</u>	<u>Test Method</u>	<u>Minimum Value</u>
Grab Strength, lbs.	ASTM-D-4632	124
Grab Elongation, %	ASTM-D-4632	15
Mullen burst, psi	ASTM-D-3786	300
Puncture, lbs.	ASTM-D-4833	65
Trapezoidal Tear, lbs.	ASTM-D-4833	65
UV Resistance ² , % ³	ASTM-D-4355	80@500 hrs.
AOS, US Sieve No.	ASTM-D-4751	30
Flow Rate, gal/min/sq. ft.	ASTM-D-4491	10
Permittivity, (1/sec) gal/min/sq. ft.	ASTM-D-4491	0.05 sec ⁻¹

2.02 STRAW BALES:

Straw bales shall consist of certified seed free stems of agricultural grain and cereal crops and shall be free of grasses and legumes. Standard bales shall be 14-inches high, 18- inches wide and 36- to 40-inches long tied with polypropylene twine and weigh within 5 percent of 7 lbs. per cubic ft.

2.03 STRAW WATTLES:

Straw Wattles shall consist of a 100% biodegradable exterior jute or coir netting with 100% wheat straw interior filling as manufactured by GEI Works, Sebastian, Florida (Phone: 772-646-0597; website: www.erosionpollution.com), or approved equal.

2.04 CATCH BASIN PROTECTION:

To trap sediment and to prevent sediment from clogging drainage systems, catch basin protection in the form of a siltation sack (Siltsack as manufactured by ACF Environmental, Inc. or approved equal) shall be provided as approved by the Engineer.

PART 3- EXECUTION

3.01 NOTIFICATION AND STOPPAGE OF WORK:

The Engineer will notify the Contractor in writing of any non-compliance with the provisions of the Order of Conditions. The Contractor shall, after receipt of such notice, immediately take corrective action. Such notice, when delivered to the Contractor or his authorized representative at the site of the work, shall be deemed sufficient for the purpose. If the Contractor fails to act promptly, the Owner may order stoppage of all or part of the work through the Engineer until satisfactory corrective action has been taken. No claim for an extension of time or for excess costs or damage incurred by the Contractor as a result of time lost due to any stop work orders shall be made unless it was later determined that the Contractor was in compliance.

3.02 AREA OF CONSTRUCTION ACTIVITY:

Insofar as possible, the Contractor shall confine his construction activities to those areas defined by the plans and specifications. All land resources within the project boundaries and outside the limits of permanent work performed under this contract shall be preserved in their present condition or be restored to a condition after completion of construction at least equal to that which existed prior to work under this contract.

3.03 PROTECTION OF WATER RESOURCES:

- A. The Contractor shall not pollute streams, lakes or reservoirs with fuels, oils, bitumens, calcium chloride, acids or other harmful materials. It is the Contractor's responsibility to comply with all applicable Federal, State, County and Municipal laws regarding pollution of rivers and streams.
- B. Special measures should be taken to insure against spillage of any pollutants into public waters.

3.04 LOCATION OF STORAGE AREAS:

- A. The location of the Contractor's storage areas for equipment and/or materials shall be upon cleared portions of the job site or areas to be cleared as a part of this project and

shall require written approval of the Engineer. Plans showing storage facilities for equipment and materials shall be submitted for approval of the Engineer.

- B. No excavated materials or materials used in backfill operations shall be deposited within a minimum distance of one hundred (100) feet of any watercourse or any drainage facility. Adequate measures for erosion and sediment control such as the placement of baled straw around the downstream perimeter of stockpiles shall be employed to protect any downstream areas from siltation.
- C. There shall be no storage of equipment or materials in areas designated as wetlands.
- D. The Engineer may designate a particular area or areas where the Contractor may store materials used in his operations.

3.05 PROTECTION OF LANDSCAPE:

- A. The Contractor shall not deface, injure, or destroy trees or shrubs nor remove or cut them without written authority from the Owner. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorages unless specifically authorized by the Engineer. Excavating machinery and cranes shall be of suitable type and be operated with care to prevent injury to trees which are not to be removed, particularly overhanging branches and limbs. The Contractor shall, in any event, be responsible for any damage resulting from such use.
- B. Branches, limbs, and roots shall not be cut except by permission of the Engineer. All cutting shall be smoothly and neatly done without splitting or crushing. When there is unavoidable injury to branches, limbs and trunks of trees, the injured portions shall be neatly trimmed and covered with an application of grafting wax or tree healing paint as directed.
- C. Where, in the opinion of the Engineer, trees may possibly be defaced, bruised, injured, or otherwise damaged by the Contractor's equipment or by his blasting or other operations, the Engineer may require the Contractor to adequately protect such trees by placing boards, planks, poles or fencing around them. Any trees or landscape feature scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the expense of the Contractor. The Engineer will decide what method of restoration shall be used, and whether damaged trees shall be treated and healed or removed and disposed of.
- D. Cultivated hedges, shrubs, and plants which could be injured by the Contractor's operations shall be protected by suitable means or shall be dug up, balled and temporarily replanted and maintained. After construction operations have been substantially completed, they shall be replanted in their original positions and cared for until growth is re-established. If cultivated hedges, shrubs, and plants are injured to such a degree as to affect their growth or diminish their beauty or usefulness, they shall

be replaced by items of a kind and quality at least equal to that existing at the start of the work.

3.06 CLEARING AND GRUBBING:

- A. The Contractor shall clear and grub only on the Owner's land or the Owner's easements, and only the area required for construction operations, as approved by the Engineer. Removal of mature trees (4 inches or greater DBH) will not be allowed on temporary easements.
- B. The Contractor shall not remove trees in the Owner's temporary easements without permission of the Engineer.

3.07 DISCHARGE OF DEWATERING OPERATIONS:

- A. Any water that is pumped and discharged from the trench and/or excavation as part of the Contractor's water handling shall be filtered by an approved method prior to its discharge into a receiving water or drainage system.
- B. Under no circumstances shall the Contractor discharge water to the areas designated as wetlands. When constructing in a wetlands area, the Contractor shall discharge water from dewatering operations directly to the nearest drainage system, stream, or waterway after filtering by an approved method.
- C. The pumped water shall be filtered through filter fabric and baled straw, a vegetative filter strip or a vegetated channel to trap sediment occurring as a result of the construction operations. The vegetated channel shall be constructed such that the discharge flow rate shall not exceed a velocity of more than 1 foot per second. Accumulated sediment shall be cleared from the channel periodically.

3.08 DUST CONTROL:

- A. During the progress of the work, the Contractor shall conduct his operations and maintain the area of his activities, including sweeping and sprinkling of streets as necessary, to minimize creation and dispersion of dust. If the Engineer decides it is necessary to use calcium chloride for more effective dust control, the Contractor shall furnish and spread the material, as directed. Calcium chloride shall be as specified under Section 01562, DUST CONTROL.
- B. Calcium Chloride shall not be used for dust control within a drainage basin or in the vicinity of any source of potable water.

3.09 BALED HAY OR STRAW:

To trap sediment and to prevent sediment from clogging drainage systems, baled straw shall be used where shown on the drawings. Care shall be taken to keep the bales from breaking apart. The bales should be securely staked to prevent overturning, flotation, or displacement. All deposited sediment shall be removed periodically. Hay bales shall not be placed within a waterway during construction of the pipeline crossing.

3.10 ERECTION AND MAINTENANCE OF SILT FENCE:

Where indicated on the drawings or where required by the Engineer, the Contractor shall erect and maintain a temporary silt fence. In areas designated as wetlands, the Contractor shall line the limits of the construction easement with a silt fence. The silt fence shall be used specifically to contain sediment from runoff water and to minimize environmental damage caused by construction.

3.11 SURFACE RESTORATION OF CROSS-COUNTRY AREAS:

Plantings detailed in Section 02921 shall be conducted when construction of the pipeline has been completed within the areas designated. A one-year guarantee of maintenance will be required on these plantings to ensure that they establish in the area.

3.12 CATCH BASIN PROTECTION:

- A. Catch basin protection shall be used for every catch basin, shown on the plans or as required by the Engineer, to trap sediment and prevent it from clogging drainage systems and entering wetlands. Siltation sacks shall be securely installed under the catch basin grate. Care shall be taken to keep the siltation sacks from breaking apart or clogging. All deposited sediment shall be removed periodically and at times prior to predicted precipitation to allow free drainage flow. Prior to working in areas where catch basins are to be protected, each catch basin sump shall be cleaned of all debris and protected. The Contractor shall properly dispose of all debris at no additional cost to the Owner.

- B. All catch basin protection shall be removed by the Contractor after construction is complete.

3.13 STRAW WATTLES:

- A. The wattles will be placed in a shallow trench (2-3 inches deep) and staked in the ground using wooden stakes driven at 4-foot intervals. The wooden stakes will be placed at a minimum depth of 24-inches into the ground.
- B. The wattles shall be regularly inspected and before and after every forecasted major weather event. All deposited sediment shall be removed and not allowed to accumulate to the top of the wattles. Wattles damaged during construction shall be repaired or replaced as required by the Engineer at no additional cost to the Owner.
- C. The Contractor shall remove all wattles after construction is completed.

END OF SECTION

SECTION 01580

PROJECT SIGN

PART 1 – GENERAL

1.01 SCOPE OF WORK:

- A. Provide all materials, labor, mountings, and incidentals for one (1) temporary construction sign, four feet by eight feet (4' x 8'), installed in a location directed by the Owners Representative at each site. one (1) temporary construction sign will be provided in total.

PART 2 – MATERIALS

2.01 SIGN:

- A. Sign shall be made of durable, exterior plywood or metal, securely mounted to wood posts or attached to existing fencing, as directed by the Owner's Representative. Sign shall be professionally lettered. Wording and layout to be supplied by the Owner. Submit samples of color and a Shop Drawing indicating lettering layouts to Engineer for approval. Electronic file with sign layout to be provided to Contractor and Owner's representative by the Landscape Architect.
- 1. Sign shall be a project sign (or banner) and will include color renderings of the final park layout as well as the Town Seal and other pertinent information to be provided by the Owner's Representative.
- B. Sign shall be securely mounted with galvanized metal attachments and shall be framed to be durable. All attachments and mountings shall be child safe and vandal resistant. Should a project banner be provided, it may be securely attached to construction fencing.

PART 3 – EXECUTION

3.01 PLACEMENT:

- A. Sign shall be installed facing the street or access point to the construction area to be visible and inform the general public. Where possible, the sign should be located so as not to conflict with the construction activity nor to require moving during the construction process.
- B. The construction sign shall be maintained in satisfactory condition during construction and then removed and disposed of legally by the Contractor just prior to the final acceptance of the work.

END OF SECTION

SECTION 01600

CONSTRUCTION LAYOUT

PART 1 - GENERAL

1.01 SCOPE OF WORK:

- A. The work under this section shall consist of field staking the horizontal and vertical alignment of all essential features and proposed work including walkways, pavement areas, retaining walls, fencing, plantings, utilities and other related features as shown on the plans by a registered Engineer or Land Surveyor Registered in the Commonwealth of Massachusetts. The Contractor shall familiarize himself with the existing conditions and shall be responsible for locating or re-establishing survey field ties, property lines, and benchmarks indicated on the plans.
- B. Existing survey tie information, if available, shall be provided by the Town upon request.
- C. The individual retained to perform the work of this Section shall be as approved by the Town Representative.

1.02 QUALIFICATIONS & SUBMITTALS:

- A. The Contractor shall engage the services of a Professional Engineer or Land Surveyor Registered in the Commonwealth of Massachusetts and shall submit the name, address, and registration number of such person or persons to the Engineer in writing.
- B. Whenever reference is made on the plans or in these specifications to a Land Surveyor registered in the Commonwealth of Massachusetts, the Contractor may substitute a Registered Professional Engineer, qualified in the laying out of similar facilities.

PART 2 - MATERIALS

2.01 LAYOUT AND STAKING:

- A. The Contractor shall be responsible for furnishing all stakes, pins, and grade markings as required to implement the work of layout and staking and shall make all field adjustments ordered by the Project Representative at no extra cost to the Owner.
- B. Upon request by the Project Representative, the Contractor shall make available to the Owner survey instruments necessary to check the proposed vertical and horizontal alignments at no extra cost.

PART 3 - EXECUTION

3.01 SURVEY LAYOUT:

- A. The Contractor shall use the alignments shown on the plans to establish the layout of all proposed features and shall perform field adjustments as ordered by the Project Representative.
- B. The Surveyor shall lay out the essential or necessary grades and locations of footings, pavements, utilities, structures and all other proposed site features and elements. The surveyor shall verify the location of any existing spikes, stakes, pipes, drill holes, etc. and shall be responsible for their accuracy. Proposed features shall be located in relation to dimensions shown on the drawings and as adjusted by the Project Representative.
- C. The Contractor shall inform the Project Representative when the general layout is completed and shall not begin excavation until the Project Representative approves the various alignments. Any discrepancies encountered in field conditions shall be reported to the Project Representative immediately and shall be adjusted as directed.
- C. The Contractor shall be responsible for maintaining the correct vertical and horizontal alignment of all elements, which responsibility shall not be waived by the Project Representative's approval of basic layout and stakeout.

END OF SECTION

SECTION 01700

PROJECT CLOSE-OUT

PART 1 - GENERAL

1.01 GENERAL PROVISIONS:

Attention is directed to the General Conditions of the Contract, all Divisions of the Specifications, the Drawings, all of which apply to this section.

1.02 SCOPE OF WORK:

- A. The scope of work under this specification section, without limiting the generality thereof, includes the furnishing of all labor, materials, equipment, services, and incidentals necessary to complete all the work in accordance with the Contract Documents, which are intended to describe and provide for a finished piece of work.
- B. The type of work includes the following, without limiting the generality thereof:
 - 1. Substantial completion
 - 2. Final cleaning.
 - 3. Record drawings.
 - 4. Operating and maintenance data.
 - 5. Warranties.
 - 6. Maintenance materials.
 - 7. Final completion.

1.03 SUBSTANTIAL COMPLETION:

- A. Prior to requesting Substantial Completion as provided in the General Conditions the Contractor shall make a thorough inspection of the Work. During this inspection the Contractor shall prepare a comprehensive list of all items remaining to be completed or corrected. This list shall include all remaining Contractor and Subcontractor items to be provided under the Contract Documents.
- B. Upon completion of the list, the Contractor shall notify, the Engineer in writing, that the Work is Substantially Complete. The Engineer shall then conduct a thorough inspection. If the Engineer agrees that the Work is Substantially Complete, the Engineer will promptly prepare a punch list, setting forth in accurate detail any items on the Contractor's list and additional items that are not acceptable or incomplete. The Contractor shall coordinate all Subcontractors to achieve prompt completion of the punch list.

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- C. The Contractor shall not be relieved of the responsibility to provide Contract items left off the Engineer's punch list.
- D. If the Engineer determines that the Work is not Substantially Complete, the Engineer shall inform the Contractor of those items that must be completed before the Engineer will prepare a monetized punch list. Upon completion of those items, the Contractor shall again request the Engineer to prepare a punch list.
- E. When the punch list has been prepared, the Engineer will arrange a meeting with the Contractor and Subcontractors to identify and explain all punch list items and answer questions on work which must be done before final acceptance.
- F. The Engineer may revise the punch list, from time to time, to ensure that all items of Work are properly completed.

1.04 FINAL CLEANING:

- A. Immediately prior to Substantial Completion of the work, the Contractor shall perform all cleanup work as follows:
 - 1. Remove all waste materials and rubbish from the site and legally dispose of it.
 - 2. Remove all tools, equipment, machinery, surplus material, temporary enclosures, and any other material belonging to the Contractor or his Subcontractors.
 - 3. Clean all surfaces, fixtures, and equipment within the work areas, and any surfaces outside the work area which have been made dirty by the work of the contract. Leave the entire site clean and ready for use.
 - 4. Ensure all storm pipes and structures within the Limit of Construction have been cleaned of silt and debris. If the Owner's representative determines that the Contractor's operations have caused silt or debris accumulation in the storm system outside of the Limit of Construction, the Contractor shall be responsible for its cleaning to the satisfaction of the Owner's representative, and at no additional cost to the Owner.

1.05 RECORD DRAWINGS/AS-BUILT DRAWINGS:

- A. During the course of the work the Contractor shall maintain, at the site, a clean set of black line prints of the contract drawings. This set of prints will be marked "Record Drawings" and shall be kept in a clean condition and separate from the drawings in general reference use. On these record drawings, the Contractor shall record all deviations from the work as described in the contract drawings, especially those deviations in utilities work.

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- B. At the completion of the work, neat, clean and complete record drawings in AutoCAD format files (.dwg) shall be prepared and submitted to the Owner as a condition precedent to final payment. At his own expense the Contractor shall obtain reproducible of working drawing sheets from the Owner from which as-built drawings will be prepared.

1.06 OPERATING AND MAINTENANCE DATA:

At substantial completion of the project, the Contractor shall deliver to the Owner two sets of all operating and maintenance instructions for the various pieces of equipment or parts included in the project. This information shall be neatly bound in loose leaf notebooks for the Owner's permanent record.

1.07 WARRANTIES:

At substantial completion of the project, the Contractor shall deliver to the Engineer copies of all warranties for the various materials and pieces of equipment included in the project. These warranties shall be submitted in duplicate and shall be bound together with the operating and maintenance data called for above.

1.08 FINAL COMPLETION:

- A. Related Requirements: The Contractor's attention is directed to the General Conditions of the Contract.
- B. Final Completion:
 - 1. Within 10 days after Substantial Completion, if any of the items on the Landscape Architect/Engineer's punch list are not complete or if the Contractor has not provided the appropriate Record Drawings, Operating Manuals, Warranties, Guarantees, or Spare Parts, the Engineer shall assign a monetary value for each incomplete item as well as any other items as provided by M.G.L. c.30 sec.39K.
 - 2. The Contractor shall provide the Engineer with a Notarized Contractor's Certificate and Release and an appropriate Application for Payment. This Application shall be for an amount equal to the remaining balance of the Contract less the amount of the Landscape Architect/Engineer's monetized punch list and any other items as provided under M.G.L. c.30 sec.39K.
 - 3. The Contractor shall complete all remaining Work in accordance with the provisions of the General Conditions.
 - 4. Upon completion of all remaining items, and after receipt of all appropriate Record Drawings, Operating Manuals, Warranties, Guarantees and Spare Parts required by the Contract Documents, The Contractor shall provide a notarized Contractor's Certificate and Release and a final Application for Payment to complement this close-out process.

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5. The Contractor shall provide copies of Lien Waivers for all subcontractors and suppliers to obtain final payment. No final payment or release of retainage shall be made without notarized copies of all Lien Waivers for the completed project.

END OF SECTION

SECTION 01740

CLEANING UP

PART 1 - GENERAL

1.01 DESCRIPTION:

The Contractor must employ at all times during the progress of its work adequate cleanup measures and safety precautions to prevent injuries to persons or damage to property. The Contractor shall immediately, upon request by the Engineer provide adequate material, equipment and labor to cleanup and make safe any and all areas deemed necessary by the Engineer.

PART 2 - PRODUCTS

- A. Section 01110 CONTROL OF WORK AND MATERIALS
- B. Section 01140 SPECIAL PROVISIONS
- C. Section 01570 ENVIRONMENTAL PROTECTION

PART 3 - EXECUTION

3.01 DAILY CLEANUP:

- A. The Contractor shall clean up, at least daily, all refuse, rubbish, scrap and surplus material, debris and unneeded construction equipment resulting from the construction operations and sweep the area. The site of the work and the adjacent areas affected thereby shall at all times present a neat, orderly and workmanlike appearance.
- B. Upon written notification by the Engineer, the Contractor shall within 24 hours clean up those areas, which in the Engineer's opinion are in violation of this section and the above referenced sections of the specifications.
- C. If in the opinion of the Engineer, the referenced areas are not satisfactorily cleaned up, all other work on the project shall stop until the cleanup is satisfactory.

3.02 MATERIAL OR DEBRIS IN DRAINAGE FACILITIES:

- A. Where material or debris has washed or flowed into or has been placed in existing watercourses, ditches, gutters, drains, pipes, structures, such material, or debris shall be entirely removed and satisfactorily disposed of during progress of the work, and the

ditches, channels, drains, pipes, structures, and work shall, upon completion of the work, be left in a clean and neat condition.

3.03 REMOVAL OF TEMPORARY BUILDINGS, STRUCTURES AND EQUIPMENT:

- A. On or before completion of the work, the Contractor shall, unless otherwise specifically required or permitted in writing, tear down and remove all temporary buildings and structures it built; shall remove all temporary works, tools and machinery or other construction equipment it furnished; shall remove all rubbish from any grounds which it has occupied; shall remove silt fences and hay bales used for trapping sediment; and shall leave the roads and all parts of the property and adjacent property affected by its operations in a neat and satisfactory condition.

3.04 RESTORATION OF DAMAGED PROPERTY:

- A. The Contractor shall restore or replace, when and as required, any property damaged by its work, equipment or employees, to a condition at least equal to that existing immediately prior to the beginning of operations. To this end the Contractor shall do as required all necessary highway or driveway, walk and landscaping work. Materials, equipment, and methods for such restoration shall be as approved by the Engineer.

3.05 FINAL CLEANUP:

- A. Before acceptance by the Owner, the Contractor shall perform a final cleanup to bring the construction site to its original or specified condition. This cleanup shall include removing all trash and debris off of the premises. Before acceptance, the Engineer shall approve the condition of the site.

END OF SECTION

SECTION 01765

PROJECT AS-BUILT RECORD DRAWINGS

PART 1 - GENERAL

1.01 WORK INCLUDED:

This Section covers the Contractors As-Built Record drawings for the project. The As-Built Record drawings for the project shall include, but are not limited to:

- A. The Contractors construction coordination drawings for all the project disciplines. The Contractors construction coordination drawings for the project disciplines shall be submitted to the Engineer prior to Construction of the said discipline. The Contractors construction coordination drawings for the project disciplines shall include but are not limited to the following:

- 1. Civil
- 2. Structural
- 3. Electrical

- B. Draft Record Documents Review

Upon completion of the project construction the Contractor shall submit a complete copy of 24- by 36-inch Record Drawings to the Owner and the Engineer for review. The Owner and the Engineer shall jointly review the Record Drawings and provide comments to the Contractor. The Contractor shall modify the Record Drawings as necessary based on the comments provided by the Owner and the Engineer.

- C. Final Record Documents

Upon incorporation and acceptance of the Draft Record Drawings comments from the Owner and the Engineer, the Contractor shall submit the Final Record Drawings and documentation. The Contractor shall submit two sets of 24- by 36-inch Record Drawings to the Owner and an additional two sets of 24- by 36-inch Record Drawings to the Engineer for their records. The Contractor shall also submit to the Engineer a minimum 20 gigabyte flash drive with the electronic Record Drawing files. The electronic Record Drawing files shall be obtained from the Owner (the Engineer shall provide on behalf of the Owner if the Engineer was the project designer) and developed in AutoCAD 2010/Revit 2017 (or later) and the submittal shall include the Final AutoCAD DWG/Revit RVT file documents, drawing line types, blocks, etc. The actual version of AutoCAD/Revit shall be coordinated with the Engineer.

D. Pre- and Post-Construction Survey

The Contractor shall perform a pre- and post-construction survey of the entire project area. The topographic survey shall be performed by or under the supervision of and certified by a Registered Land Surveyor in the State of **Massachusetts**. The Contractor shall also submit to the Engineer a minimum 20 gigabyte flash drive with the electronic pre- and post-construction survey files. The Contractor shall send the electronic pre- and post-construction survey files to the Engineer which shall be developed in AutoCAD 2010/ Revit 2017 (or later) and the submittal shall include the Final AutoCAD DWG / Revit RVT file documents, drawing line types, blocks, etc. The actual version of AutoCAD / Revit shall be coordinated with the Engineer. The Contractor shall notify the Owner and Engineer at least 48-hours in advance of each survey.

1.02 RELATED WORK:

- A. General Requirements in their entirety.
- B. Division 2 through Division 16.

1.03 AS-BUILT DOCUMENTS:

- A. Contractor shall maintain on site, separate from the documents used for construction, one complete set of the documents listed below, and as construction progresses, shall legibly record on these documents all changes made during construction.
 - 1. Contract Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other Modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.
 - 6. Written interpretations and clarifications.
 - 7. Field Orders.
 - 8. Field test reports properly verified.
- B. The completed set of documents shall include but are not limited to:
 - 1. Significant deviations of any nature made during construction.
- C. The completed set of as-built documents shall be submitted to the Engineer with the final Application for Payment.

PART 2 - MATERIALS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 02051

ASBESTOS ABATEMENT FOR BUILDINGS

PART 1 GENERAL

1.01 GENERAL PROVISIONS:

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all sections within DIVISION 1-GENERAL REQUIREMENTS, which are hereby made part of this Section of the Specifications.
- B. Equality of material, article, assembly or system other than those named or described in this Section shall be determined in accordance with the provisions of Article 6 of the GENERAL CONDITIONS.
- C. Examine all conditions as they exist at the project before submitting a bid for the work of this Section.
- D. All provisions of this Section relating to the health and safety of workers and the public, as well as protection of the environment are minimum standards. The Contractor and the asbestos abatement contractor are responsible for determining whether any additional and/or more stringent protective measures are required by any legal requirements or prudent conservative work practices and implementing such measures if deemed necessary. Nothing in this Section shall be deemed to relieve the Contractor and the asbestos abatement contractor from any liability with respect to any such legal requirements or requirement of prudent conservative practice.
- E. Should renovation/demolition activities, as performed by the Contractor, uncover materials not readily identified as non-asbestos-containing, the material should be assumed to be asbestos-containing until classified otherwise. Removal should be performed in compliance with all requirements outlined in **the Department of Labor and Work Force Development (DLWD) 453 CMR 6.00**; NESHAP 40 CFR 61; and OSHA 29 CFR 1926.1101, including all applicable local ordinances.
- F. All work under this Section shall be performed by a contractor holding a current **Massachusetts Department of Labor and Work Force Development (DLWD) asbestos abatement contractor's license**. The asbestos abatement contractor shall furnish all labor, worker training, materials, equipment, and services for the complete and proper removal and disposal of asbestos-containing materials, as Specified in Section 1.02 of this Specification.
- G. Weston & Sampson performed a comprehensive site survey for asbestos-containing materials (ACM) in support of up-coming renovation/demolition activities at the former Little League concession shack structure. Laboratory bulk sample results identified no ACM in the building materials sampled, however, based on visual evidence and the age

of the structure, it is assumed the chimney/vent flashing (5 linear feet) and subgrade water service transite piping (20 linear feet) are asbestos containing.

H. For the purpose of this Section, the following definitions apply:

"Site" shall refer to the the former Little League concession shack structure.

"Contractor" shall refer to the asbestos abatement contractor.

"Engineer" shall refer to the Weston and Sampson Engineers, Inc.

"Owner" shall refer to the City of Worcester.

1.02 DESCRIPTION OF WORK - GENERAL:

A. Provide labor, materials, and equipment to complete the work of this Section, including but not limited to:

1. Removal and disposal of all specified asbestos-containing materials (ACM) and specified non-ACM materials, as indicated in Section 1.03, in accordance with the provisions set forth in this Section. This shall include the removal and disposal of asbestos-containing asphalt-based tar pitch material, exterior window caulking, and specified non-ACM material either contaminated with asbestos, or deemed necessary to access asbestos-containing materials. All quantities of ACM will be verified by the Engineer, and agreed upon by the Owner, before any work area preparations.

2. Work area preparations, including pre-cleaning, installation of critical barriers and polyethylene sheeting, construction of decontamination facilities, work area enclosures, sealing, isolation, and other activities.

3. Protection of non-ACM materials and equipment inside the limits of the work areas.

4.

Removal and disposal of all non-asbestos-containing materials (i.e., roof tar paper), contaminated with asbestos-containing asphalt-based tar pitch material, as identified in Section 1.03, in accordance with Section 3.03. The Contractor, in accordance with the provisions as set forth herein, will perform the removal of asbestos-containing asphalt-based tar pitch material. The asbestos-contaminated roof tarpaper consists of multiple layers. The Contractor shall remove and dispose of all disturbed layers of the roof tarpaper as one material, with no additional costs to the Owner.

5. The Contractor shall remove and dispose of all disturbed asbestos-containing exterior window sealant as identified in Section 1.03, in accordance with Section 3.04.

6. In the event that the Contractor (or roofing contractor) performs removal in a manner that results in rendering the non-friable asphalt-based tar pitch material, exterior window caulking, or asbestos-contaminated materials friable, the Contractor will be required to immediately cease all asbestos work activities, implement corrective measures (i.e., decontaminate affected areas, etc.), and continue the asbestos removal

activities in accordance with all applicable provisions set forth in this specification. Under no circumstances is the Contractor allowed to utilize mechanical methods of cutting or removing non-friable asbestos-containing roofing or window materials.

7. Removal and disposal of all asbestos-containing materials, and specified non-ACM materials, uncovered during renovation activities.
8. Decontamination and clean up following removal activities in each designated work area.
9. Performance of any other work or activities required by this Specification, applicable regulations, or as necessary to perform a complete job.
10. Compliance with all applicable federal, state, and local regulations, as well as all requirements set forth in these Specifications and facility requirements.

1.03 DESCRIPTION OF WORK - DETAILED:

- A. The following is the approximate location of asbestos-containing materials that may be removed, in accordance with this Section, and the unit price schedule:

LOCATION	ASBESTOS-CONTAINING MATERIAL
Roof	Chimney/vent flashing
Subgrade	Water service transite piping

- B. If the above asbestos-containing materials are to be impacted by planned renovations, the quantities will be verified by the Engineer and agreed upon by the Owner, before project initiation.

1.04 RELATED WORK:

- A. Related work specified elsewhere: Examine all Drawings and all other Sections of the Specifications for requirements of related sections affecting the work of this Section, including, but not limited to:

1. 02112 Removal of Underground Non-Friable AC Pipe

- B. The work of this Section shall be performed as stated herein. In performing the work of this Section, the Contractor shall refer to Division 1 for additional procedures. The Contractor is responsible for the coordination of the work of this section with other related work.

1.05 SEQUENCE OF WORK:

- A. The following is a typical sequence of work that the Contractor shall adhere to during the asbestos abatement project. Engineer may authorize deviations from this typical sequence based upon the specific conditions encountered during the project.

1. Post all required signage.
2. Isolate work area from unauthorized access.
3. Prepare the specified Work Area as described in Part 3 of this Section.
4. Construct decontamination unit, and any other construction needed to complete the work area, as described in this Section.
5. Request Engineer to inspect work area preparation and obtain Engineer approval before beginning removal work.
6. Remove and dispose all asbestos-containing materials as required by these Specifications.
7. Decontaminate the work area upon completion of removal.
8. Request Engineer to perform a final visual inspection to assure that no visible debris exists in the work area. Contractor shall re-clean the work areas as needed until they pass a visual inspection by Engineer.
9. Remove all work area barriers, equipment, polyethylene sheeting, etc. and clean any areas as described in this Section.
10. Submit all materials as required at the post abatement removal meeting not more than thirty days after completion of asbestos removal work.

1.06 ESTIMATES:

- A. Section 1.03 represents a brief description of the location of asbestos-containing materials. This data is provided for informational purposes only and is based on the best information available at the time of specification preparation. Nothing in this section may be interpreted as limiting the scope of work otherwise required by this contract and related documents.
- B. The quantities and location of ACM and the extent of work included in this section are only best estimates that are limited by the physical constraints imposed by occupancy of the buildings.

1.07 COORDINATION AND PHASING OF WORK:

- A. Contractor shall coordinate all work in this Section with all other work of this Project. Where additional regulatory requirements apply to the work in this Section, the Contractor shall ensure compliance with all requirements.

- B. Contractors work schedule must be coordinated with, and acceptable to the Owner. Contractor shall work continuously and diligently in each work area on the days and during the hours indicated on their work schedule
- C. Contractor shall cooperate fully with other Contractors at the facility.
- D. Contractor shall subdivide work areas and/or otherwise provide additional containments and mobilization where and when necessary to accomplish asbestos abatement in accordance with the project phasing, as determined and specified by the Owner.

1.08 SUBMITTALS:

A. PRE-ABATEMENT MEETING:

The Contractor shall meet with the Owner and the Engineer for a Pre-Abatement meeting before commencing work on the project. At the meeting, the Contractor shall be represented by authorized representatives and the field supervisor who shall run the project on a daily basis, and who shall present evidence that all requirements for initiation of the work have been met. The minimum agenda for the meeting shall be:

1. Review of "Pre-Job Submittals".
2. Channels of communication.
3. Abatement schedule, including sequence of critical work.
4. Designation of responsible personnel.
5. Procedures for safety, security, quality controls, housekeeping, and related matters.
6. Use of premises, facilities, and utilities.

B. PRE-JOB SUBMITTALS:

The Contractor shall provide two copies of the following Pre-Job Submittals at the Pre-abatement Conference, or submit electronically per Section 01330 SUBMITTALS no later than the day of the Pre-abatement Conference:

1. Copies of all notifications, permits, applications, personal licenses and like documents required by Federal, State, or local regulations obtained or submitted in proper fashion,
2. List of employees to be used on this project.
3. Copies of applicable OSHA Training certificates for proposed asbestos abatement staff pursuant to Title II of the Toxic Substances Control Act (TSCA).
4. Copies of OSHA 10-hour construction safety and health training documentation for all proposed asbestos abatement staff that will work on the site.

5. Copies of medical records as required by OSHA or a notarized statement by examining medical doctor that such examinations took place and when for each employee to be used on project,
6. Record of successful respiratory fit test performed by a Competent person (as defined by OSHA) within the previous 6 months, as required elsewhere in the documents for each employee to be used on this project,
7. Certificate of Insurance,
8. Proposed respiratory program for employees throughout all phases of the job, including make, model and NIOSH approval numbers of respirators to be used,
9. Written description of all procedures, methods, or equipment to be utilized by the Contractor that differs from the Contract Specifications, including manufacturers specifications on any equipment not specified for use by the Contract Specifications,
10. Proposed electrical safeguards to be implemented, including but not limited to location of transformers, GFCI outlets, lighting, etc., necessary to safely perform the job, including a description of an electrical hazard safety plan for common practices in the work area,
11. A list of all equipment to be used on site, by make and model, including negative pressure equipment, HEPA vacuums, Water Atomizing Devices, etc.,
12. Chain of Command of responsibility at work site including supervisors, foreman, and competent person, their names, resumes and certificates of training,
13. Contractor's testing lab, AIHA PAT proficiency, and Certification in the State where work site is located,
14. Abatement schedule detailing phasing, including approximate days per phase, for asbestos abatement of all materials included under the base bid.

C. POST-CONSTRUCTION SUBMITTALS:

1. Submittals shall be prepared in accordance with Section 01330 SUBMITTALS.
2. The Contractor shall submit the following to the Engineer within thirty (30) days after completion of the project:
 - a. Manifests and waste receipts acknowledging disposal of all waste material from the project showing delivery date, quantity, and appropriate signature of landfill's authorized representative,
 - b. A copy of the entry-exit logbook required elsewhere in these specifications,

- c. All personnel monitoring results as required by OSHA and elsewhere in these specifications,
- d. Copy of licenses, medical, and fit tests of all workers and supervisors who performed work on the project,
- e. All notifications as required elsewhere in these specifications.

1.09 REFERENCE STANDARDS, REGULATIONS AND CODES:

- A. All work shall be performed strictly according to the Specifications contained herein and with the regulations cited in this Article. The Contractor and all sub-contractors undertaking asbestos abatement work and persons in their employ shall comply with and be bound to requirements of the following Federal, State, and Local standards, regulations and codes. These standards and codes shall be by reference made part of this Section and shall be complied with. Whenever regulations are conflicting, the more stringent regulation will prevail.
 - 1. US Department of Labor; Occupational Safety and Health Act of 1970. (Particular attention is drawn to the Asbestos Regulations: CFR Title 29, Part 1910, Sec. 1910.1001 and Part 1926, Sec. 1926.1101, and the Respirator Regulations; CFR Title 29, Part 1910, Sec. 1910.134 and the Hazard Communication Program, CFR Title 29, Part 1910.1200).
 - 2. US Environmental Protection Agency, CFR, Title 40, Part 61, Subparts A and M, National Emission Standards for Hazardous Air Pollutants; Asbestos NESHAP Revision; Final Rule, Dated Tuesday, November 20, 1990.
 - 3. US Environmental Protection Agency; TSCA Title II, Asbestos Hazard and Emergency Response Act (AHERA), 40 CFR Part 763 Subpart E - "Asbestos-Containing Materials in Schools" and also 40 CFR, Part 763, Subpart G - "Worker Protection Rule".
 - 4. US Department of Transportation regulations, 49 CFR Parts 172 and 173.
 - 5. **All Commonwealth of Massachusetts laws, regulations and standards, including the regulations 453 CMR 6.00 "The Removal, Containment or Encapsulation of Asbestos" and 310 CMR 7.15 "Asbestos", 18.00 and 19.00 and MGL Chapter 21E.**
 - 6. Other Federal, State and local statutes, ordinances, regulations, or rules pertaining to this Section and the work described herein, including the storage, transportation and disposal of asbestos.
- B. All regulations by these and other governing agencies in their most recent version are applicable. These specifications refer to many requirements found in these references, but in no way intend to cite or reiterate all provisions therein or elsewhere. It is the

contractor's responsibility to know, understand, and abide by all such regulations and common practices. The Owner at his own discretion may from time to time during the execution of this contract enforce other provisions contained in these references.

1.10 REGULATORY SUBMITTALS:

- A. The Contractor shall be responsible for securing all necessary permits for asbestos related work, including hauling, removal, and disposal, fire, and materials usage, or any other permits required to perform the specified work.
- B. The Contractor shall notify the following agencies in appropriate manner and place of impending work, and shall provide evidence of notifications at the pre-construction conference:
 - 1. U.S. Environmental Protection Agency,
J. F. Kennedy Federal Building
Boston, Massachusetts 02203
(10 working days in advance)
 - 2. Massachusetts Department of Environmental Protection
Division of Air and Hazardous Materials
(10 working days in advance)
Send Notification to:
Commonwealth of Massachusetts
Asbestos Program
P.O. Box 120087
Boston, Massachusetts 02112-0087
 - 3. Massachusetts Department of Labor and Work Force Development
Asbestos Control Unit
(10 working days in advance)
 - 4. **Worcester** Fire Department, Inspectional Services Department, Office of Health and Hospitals, and other state or city agencies as required by law or ordinance.

1.11 PROJECT CONDITIONS:

- A. Working space and space available for storing materials is restricted within the confines of the project and as shown in the Drawings.
- B. Provide access and personal protective equipment, to the Engineer and his Sub-Consultant.
- C. Schedule the use of existing utilities with the Owner. No utility service, fire protection system, or communication system may be interrupted without prior approval of the Owner and Engineer.

- D. Water, electric power, lighting and other utilities, toilets, and other facilities shall be provided by the Contractor from existing sources where Contractor's use is not excessive and does not interfere with buildings normal use. Where existing utilities of the development are not adequate or cannot be used, the Contractor is responsible for providing alternative sources. The use of the building's utilities shall be coordinated through the Owner.
- E. Post and affix caution signs and labels as required by OSHA regulation, 29.CFR.1926.1101 (k) (1). Post safety signs outside the work project as may be required by the Owner. Obtain two copies of 29.CFR.1910.1001, 29.CFR.1926.1101, 40.CFR.61, Subpart M, and Commonwealth of Massachusetts Regulations 453 CMR 6.00 and 310 CMR 7.00, and post one copy at the job site and retain one copy on file.
- F. Post at the job site, or at the entrance to each independent Work Area, one copy of all Material Safety Data Sheets (MSDS's) of all chemicals and other substances to be used on this contract. These sheets shall be made available to the Engineer for review.

1.12 GENERAL REQUIREMENTS:

- A. All work-site preparations and practices will be conducted in accordance with all Federal, **Massachusetts** and appropriate City/town and other local regulations, standards and codes pertaining to worker health protection, protection of the public health and the environment, including current US Environmental Protection Agency (EPA), Department of Labor Occupational Safety and Health Administration (OSHA), US Department of Transportation (DOT), **Massachusetts Department of Labor and Work Force Development (DLWD)**, **Massachusetts Department of Environmental Protection (DEP)**, local and all other Federal, **Commonwealth of Massachusetts** and local regulations pertaining to asbestos removal, its transportation and disposal.
- B. All operations involving exposure to airborne asbestos fiber shall be carried out according to the requirements of Part 3.
- C. The Sub-Consultant will render certain technical services to the Engineer during the Work, including without limitation, the services described at 453 CMR. 6.07 (5) and described within this Section. All services performed by such Representative shall be considered advisory to, and for the sole and exclusive benefit of the Owner. The Contractor acknowledges that the Sub-Consultant is an independent contractor of the Engineer and agrees that no act or omission by such Engineer, and no communication by said " Engineer", shall be deemed in any manner to alter or modify the terms of this Contract, or to waive any provision hereof, or to bind Owner, unless specifically agreed upon by Owner in a signed written instrument.
- D. Prior to use of any design, device, material, method of operation, or process covered by letters patent or copyright, the right for such use shall be secured by suitable legal agreement with the patentee or Owner of the letters patent or copyright. No arrangement involving letters patent or copyright is acceptable, if subsequent payment for permanent use following completion of the work is required or implied.

1.13 QUALITY CONTROL:

- A. The Owner may retain the services of the Engineer and the Sub-Consultant to provide project administration, monitoring of Contractor work practices and performance, inspection of the worksites, bulk fiber identification, and air sampling and analysis throughout the asbestos removal project.

B. AIR MONITORING:

1. Background (pre-testing) air and appropriate dust samples may be taken to represent conditions before the Contractor starts masking and sealing operations.
2. During removal, area samples may be collected by the Owner or his agent in the building proximate to those areas where removal of asbestos-containing materials is ongoing. Contractor shall be responsible for all OSHA personal sampling.
3. A Final Visual Inspection of the work area may be conducted by the Owner or his agent to insure no visible asbestos debris exists in the work area, prior to demobilizing from the work area.

C. WORK REVIEW:

1. Outside work area, airborne fiber concentrations must not exceed **0.010 fibers/cc** or pre-abatement levels, whichever is greater. If concentrations exceed this level, the work must be stopped, conditions reviewed as to the probable cause, and then corrected. A description of procedures regarding fiber concentrations greater than **0.010 fibers/cc** outside the containment can be found above.

D. INSPECTIONS:

1. The Engineer will conduct a pre-abatement inspection. The Engineer will also conduct periodic inspections during abatement. The Engineer will conduct a final visual inspection.

1.14 PERSONAL PROTECTION:

A. RESPIRATORS AND PROTECTIVE CLOTHING:

1. Personal protection, in the form of disposable Tyvek suits, and NIOSH approved respirators, are required for mechanics, contractor supervision, Engineer and visitors at the work site during the set-up, removal, and cleaning operations. Contractor shall provide all this protective equipment for workers, Engineer, Sub-Consultant, and authorized personnel to access this work site.
2. Each worker shall be supplied with a minimum of two complete disposable uniforms everyday. Removal workers shall not be limited to two uniforms. Supply additional uniforms as is necessary. Under no circumstances will anyone entering the work area be allowed to reuse a contaminated uniform.

3. Work clothes shall consist of disposable full body suits, head covers, gloves, footwear, and eye protection.
4. Supply workers and supervisory personnel with NIOSH approved protective respirators and HEPA/filters. Appropriate respirator selection shall be determined by the daily personnel samples being taken and strictly follow the guidelines set forth in the OSHA respiratory program 29 CFR 1910.134 and the Massachusetts DLWD Regulations 453 CMR 6.00. The respirators shall be sanitized and maintained according to the manufacturer's specifications. Appropriate respirators shall be selected using the information provided in OSHA Title 29 CFR Part 1910.1926 Final Rules. Disposable respirators shall not be considered acceptable in any circumstance. The Contractor will maintain on site a sufficient supply of disposable HEPA/filters to allow workers and supervisory personnel to change contaminated filters at least three (3) times daily. The Contractor is solely responsible for means and methods used and for compliance with applicable regulations.
5. Respirators shall be individually assigned to removal workers for their exclusive use. All respiratory protection shall be provided to workers in accordance with the written submitted respiratory protection program, which includes all items in OSHA 29 CFR 1910.134 (b) (1-11) A copy of this program shall be kept at the worksite and shall be posted in the Clean Room of the Decontamination Unit.
6. Workers must perform negative and positive pressure fit tests each time a respirator is put on, whenever the respirator design so permits.
7. Workers shall be given a qualitative fit test in accordance with procedures detailed in the OSHA 29 CFR 1910.134, Qualitative Fit Test Protocols for all respirators to be used on this abatement project. An appropriately administered quantitative fit test may be substituted for the qualitative fit test.
8. Upon leaving the active work area, pre-filters shall be discarded, cartridges removed, and respirators cleaned in disinfectant solution and clean water rinse. Clean respirators shall be stored in plastic bags when not in use. The contractor shall inspect respirators daily for broken, missing, or damaged parts.
9. Provide daily personal sampling to check personal exposure levels for the purpose of establishing respiratory protection needs. Samples shall be taken for the duration of the work shift or for eight hours, whichever is less. Personal samples need not be taken every day after the first day if working conditions remain invariant but must be taken every time there is a change in the removal operation, either in terms of the location or the type of work. Sampling will be to determine eight-hour Time-Weighted-Averages (TWA). The contractor is responsible for personal sampling as outlined in OSHA Standard 1926.1001.

10. Sampling personnel shall be proficient in the taking of air samples under NIOSH 7400 and must be supervised by an individual who has completed the training course NIOSH 572 or equivalent.
11. Air sampling results shall be available at the job site in written form no more than twenty-four (24) hours after the completion of a sampling cycle. The document shall list each sample's result, sampling time and date, person monitored, flow rate, sample duration, microscope field area, number of fibers per fields counted, cassette size and analysts name and company. Air sample analysis results will be reported in fibers per cubic centimeter.

B. WORK PROCEDURES:

In order to avoid possible exposure to dangerous levels of asbestos, and to prevent possible contamination of areas outside the demarcated work zone, work shall follow the guidelines listed below.

1. Before leaving the work area, the worker shall remove all gross contamination and debris from the coveralls. In practice, this is carried out by one worker assisting another.
2. All equipment used by the workers inside the demarcated work zone shall be either left in the Dirty Room of the Decontamination Unit or thoroughly decontaminated before being removed from the area. Extra work clothing (that in addition to the disposable garment) shall be left in the Dirty Room of the Decontamination Unit until the completion of work in that area.
3. As stated in Section 3.01(D) (Decontamination Unit and Procedures), all persons leaving the removal area must decontaminate before leaving the demarcated work area.
4. Under no circumstance shall workers or supervisory personnel be allowed to eat, drink, smoke, chew gum, or chew tobacco in the work area. Only in the case of life-threatening emergency shall workers or supervisory personnel be allowed to remove their protective respirators while in the work area. In this situation, respirators are to be removed for as short a duration as possible.

1.15 SPECIAL CONSIDERATIONS:

- A. Storage - Limited storage space may be provided by the Owner for this project and inside the building. Contractor will supply any additional temporary storage as needed. All materials and equipment are to be kept in orderly fashion in designated areas, free and clear of high traffic areas and doorways, and in conformance with all regulations, codes, and in consideration of building usage. Contractor will be allowed to store waste in a waste dumpster on-site, to be coordinated with the Owner.
- B. Working Hours - Working hours are specified in Division 1 - GENERAL REQUIREMENTS.

- C. Security - The Owner will provide specific access as required during the project to the Contractor and personnel assigned to the project. The Contractor will be responsible for the security of the section of the building involved in the abatement project. It will also be the Contractor's responsibility to allow only authorized personnel into the work area, and to secure all assigned entrances and exits at the end of the workday. Any person entering or leaving the contained areas must sign the Contractor's bound logbook and enter the date and time. The logbook must be located immediately outside the entrance to the Decontamination Unit at all times and be open for inspection by the Owner.

PART 2 PRODUCTS

2.01 MATERIALS:

- A. Wetting Agents: The wetting agent shall be approved by the Engineer.
- B. Sealants: Sealing material shall be both penetrating and bridging and may be applied by a one or two coat system and shall meet the following criteria:
 - 1. ASTM Standard E-84.
 - 2. Underwriter's Laboratory approval for Class 1A
 - 3. Fire Rating: Class A
 - a. Flame Spread: 0-25
 - b. Fuel contribution: 10
 - c. Smoke Density: 5
- C. Containment Bags: Upon approval of the Engineer, containment bags may be utilized for the removal of pipe insulation. Removal shall be as manufacturers instructions and as described in these specifications.
- D. Framing Materials and Doors: As required to construct temporary decontamination facilities and critical barriers.
- E. Fire Retardant Clear Polyethylene Sheeting, minimum thickness 8 mil.
- F. Fire Retardant Black Plastic Sheeting, minimum thickness 6 mil.
- G. Drums: Asbestos-transporting drums, sealable and clearly marked with warning labels as required by OSHA and EPA.
- H. Plastic Bags: Sealable, asbestos disposal bags, mm. 6 mil. thick and labeled
- I. Signs: Asbestos warning signs for posting at perimeter of work area, as specified in 29 CFR 1926.1101(k)(1)CIIi).

- J. Tape: Tape shall be high quality polyethylene film as approved by the Engineer.
- K. Contamination Control Flooring: As approved.
- L. Spray Adhesive: As approved.
- M. Respirators: NIOSH approved with HEPA cartridges.
- N. Disposable Coveralls: As approved.

2.02 TOOLS AND EQUIPMENT:

- A. Air Filtration Device (AFD): Air Filtration Devices shall be equipped with High Efficiency Particulate Absolute (HEPA) filtration systems.
- B. Scaffolding: Scaffolding, as required to accomplish the specified work, shall meet all applicable safety regulations.
- C. Transportation Equipment: Transportation Equipment, as required, shall be suitable for loading, temporary storage, transit and unloading of contaminated waste without exposure to persons or property. Waste material shall be stored in 30 cubic yard closed dumpsters.
- D. Vacuum Equipment: All vacuum equipment utilized in the work area shall utilize HEPA filtration systems. Vacuum equipment shall be as manufactured by Nilfisk of America of Malvern, Pennsylvania, Norclean Vacuum Systems distributed by Power Products and Services Co., Inc., Forest, Virginia or approved equal.
- E. Vacuum attachments: Soft brush attachment, Asbestos Scraper Tool, Drill Dust Control Kit.
- F. Electric Sprayer: An electric airless sprayer suitable for application of encapsulating material.
- G. Water Sprayer: The water sprayer shall be an airless or other low-pressure sprayer for amended water application.
- H. Portable Shower: For personnel decontamination.
- I. Water Atomizer: Powered air misting device equipped to operate continuously.
- J. Other Tools and Equipment: Provide other suitable tools for the stripping, removal, encapsulation, and disposal activities including but not limited to hand-held scrapers, wire brushes, sponge, rounded-edge shovels, brooms, and carts.

PART 3 EXECUTION

3.01 GENERAL CONSIDERATIONS:

A. APPROVALS AND INSPECTION:

All temporary facilities, work procedures, equipment, materials, services, and agreements must strictly adhere to and meet these contract specifications along with EPA, OSHA, NIOSH, regulations and recommendations as well as any other federal, state, and local regulations. Where there exists overlap of these regulations, the most stringent one applies.

Modifications to these isolation and sealing methods, procedures, and design may be considered if all elements of proper and safe procedures to prevent contamination and exposure can be demonstrated. Written modifications to these specifications must be made to the Engineer for review before they can be used for work on this project.

B. DAMAGE AND REPAIRS TO THE WORK SITE:

Asbestos removal and disposal shall be performed without damage to the building, including, but not limited to, structural members, ceilings, walls, etc. Contractor shall provide protection of these items and materials as part of the work area preparation. Where asbestos abatement activity causes damage, the Contractor shall patch, repair, replace or otherwise restore the area to its original condition at no additional cost to the Owner.

C. BARRIERS AND ISOLATION AREAS:

Construct and maintain suitable critical barriers within the building to separate work areas from spaces occupied by the Owner. Critical barriers shall be of sufficient size and strength to prevent staff, residents, the public and others from entering the work areas.

Warning signs shall be posted on all critical barriers at the commencement of the work area preparation, as required in 1926.1101 of the Occupational Safety and Health Standards Federal Register, Volume 51, Number 119, June 20, 1986. The signs shall display the proper legend in the lower panel, with letter sizes and styles of a visibility at least equal to that specified in OSHA Standard 1926.1101.(k)(1)(ii). The signs will read as follows:

**DANGER
ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATOR AND PROTECTIVE CLOTHING
REQUIRED IN THIS AREA**

The signs shall be posted at the perimeters of asbestos removal, demolition or construction areas where the asbestos-containing material to be removed exists.

The Contractor shall maintain all temporary and critical barriers, facilities and controls as long as needed for the safe and proper completion of the work. Work will not be allowed to commence until all control systems are in place and operable.

No barriers shall be removed until the work areas are thoroughly cleaned, and all debris has been properly bagged and removed from work areas, and the area has passed final visual inspection, in accordance with provisions detailed herein.

D. DECONTAMINATION UNIT AND PROCEDURES:

A remote two-stage decontamination unit shall be constructed in conformance with requirements set forth in OSHA 29 CFR 1926.1101, and may be used at the approval of the Engineer for the removal of asbestos-containing exterior roofing and/or window materials to be removed in accordance with all applicable Sections of this specification. A "two stage" unit resembles the "three-stage" unit in construction detail, but it is built without a shower section.

3.02 REMOVAL AND DISPOSAL OF ASBESTOS-CONTAINING WINDOW SEALANT MATERIAL:

- A. Removal of asbestos-containing category II non-friable window sealant from around the perimeter of the window units and the surrounding masonry wall surface shall be in accordance with all applicable regulations including Part II, OSHA, 29 CFR Parts 1910, et al., dated August 10, 1994. At a minimum, the following work practices shall apply:
1. Post all OSHA required signage.
 2. Persons not involved in the removal shall be excluded from the work areas.
 3. Licensed workers are required to wear protective clothing and respirators, and to have participated in the training required within the provisions of this Section.
 4. All openings into building near the work area shall be sealed with polyethylene sheeting or other appropriate covering. The interior side of the window work area from which asbestos-containing sealant is being removed shall be sealed using at least two layers of 6 mil fire retardant polyethylene sheeting.
 5. Place polyethylene sheeting on the ground area directly below where window sealant material is being removed.
 6. A minimum of a two-chambered worker decontamination enclosure system shall be provided on site in accordance with OSHA 29 CFR 1926.1101, Appendix G. Procedures for the utilization of this system shall be established which prevent contamination of areas outside the demarcated work area.
 7. Using wet methods, remove sealant material and the actual window as whole units in a manner that precludes the sealant from being sanded, ground, abraded or otherwise rendered friable.

8. The Contractor is responsible to remove any residual sealant material on masonry wall surfaces that are to remain.
9. The Contractor is advised that the limited work area preparation is based on the consideration that the asbestos-containing sealant material is non-friable and can be removed without rendering the material friable. In the event that the Contractor performs removal in a manner that results in rendering the non-friable exterior window sealant material friable, the Contractor will be required, at no additional cost, to immediately cease all asbestos work activities, implement corrective measures (i.e., decontaminate affected areas, etc.), and continue the asbestos removal activities at the direction of the Engineer, and as well as other provisions set forth in this Section. Under no circumstances is the Contractor allowed to utilize mechanical methods of cutting non-friable asbestos-containing exterior window sealant material.
10. Properly wet and double bag or appropriately wrap all window units with sealant material, and all non-ACM materials contaminated with asbestos for disposal as asbestos waste. The Contractor is responsible for the proper handling, transportation, and disposal of window units, and associated components as asbestos waste.
11. Properly decontaminate all non-ACM materials in contact with the asbestos-containing sealant and dispose of as construction debris. All non-ACM materials in contact with the asbestos-containing sealant, not properly decontaminated, shall be wrapped in two layers of six-mil polyethylene sheeting and disposed of as asbestos contaminated waste. All exterior masonry that is to remain shall be decontaminated and cleaned of any residual asbestos sealant material.
12. Clean-up procedures using HEPA vacuuming and wet cleaning techniques shall be performed following abatement.

3.03 REMOVAL AND DISPOSAL OF CATEGORY I NON-FRIABLE ASBESTOS-CONTAINING ROOFING MATERIALS:

- A. Because roofing material is classified as non-friable material; regulations for the removal of roofing material are less stringent if certain procedures are followed. Disturbed Category I non-friable asbestos-containing roofing materials shall be removed from the roof and disposed in accordance with all regulations of applicable federal, state and local authorities concerning roofing materials, including the Interpretive Rule for Roof Removal Operations under the Asbestos NESHAP (40 CFR 61, Appendix A to Subpart M). The Department of Environmental Protection (DEP) has a policy statement that addresses the requirements for handling Category I non-friable asbestos-containing roofing materials. In addition, the following minimum work practices shall be adhered to:
 1. Contractor shall post all OSHA required signage.

2. Persons not involved in the removal shall be excluded from the roof areas.
3. Workers are recommended to wear protective clothing and respirators.
4. All openings into building near the work area shall be sealed with polyethylene sheeting or other appropriate covering.
5. A minimum of a two-chambered worker decontamination enclosure system shall be provided on site in accordance with OSHA 29 CFR 1926.1101, Appendix G. Procedures for the utilization of this system shall be established which prevent contamination of areas outside the roof area.
6. Category I Non-friable ACM shall be removed in small sections and containerized when wet. At no time shall material be allowed to accumulate or become dry.
7. The roofing materials shall be wetted down with amended water and shall be maintained in damp condition throughout the demolition and disposal process. Mechanical methods of cutting are prohibited.
8. Category I Non-friable ACM shall not be dropped or thrown to the floor/ground level. For roofs of heights greater than fifty (50) feet above the floor/ground, a dust-tight enclosed chute shall be constructed to transport removed Category I Non-friable ACM to containers on the floor/ground. Category I Non-friable ACM may be dropped to a raised scaffold or containerized at elevated levels for disposal.
9. All Category I Non-friable ACM shall be adequately wetted before being placed into containers for disposal. Dispose of all non-friable, Category I asbestos-containing roof material and associated demolition debris in a landfill that legally accepts the material.
10. A coating of encapsulating agent shall be applied to any porous surfaces that have been stripped of Category I Non-friable ACM to securely seal any residual fibers that may be present. The encapsulating agent should be chosen to be compatible with subsequent coverings.
11. Clean-up procedures using HEPA vacuuming and wet cleaning techniques shall be performed following abatement.
12. Personnel air monitoring of Asbestos abatement workers, which demonstrates compliance with the provisions of OSHA 29 CFR 1926.1101 (f), may be used in lieu of clearance air sampling requirements.

3.04 DISPOSAL OF ASBESTOS WASTE:

- A. Waste removal procedure shall be done in accordance with all regulations as set forth by the agencies having authority to regulate.

- B. Provide proof that disposal sites for the waste materials have current and valid permits to dump asbestos waste at the time of the pre-construction meeting.
- C. Obtain receipts from the dumping site(s) and submitted to the Engineer upon request for final payment.
- D. Warning labels having permanent, waterproof print and adhesive shall be affixed to all bags, trucks, drums (lids and sides), and other containers used to store and/or transport asbestos-containing material. Labels must be conspicuous and legible and contain the following warning:

**CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD**

- E. Be responsible for all necessary precautions to prevent pollution by spilling during the performance of services and shall assume full responsibility for all Contractor caused spills, which shall be cleaned up at the Contractor's expense.

3.05 HOUSEKEEPING:

- A. Throughout the work period, maintain the work areas in a standard of cleanliness as specified throughout these specifications.
 - 1. Contaminated disposable clothing, respirator filters, and other debris shall be bagged and sealed at the end of each workday.
 - 2. All asbestos generated by either removal or repair shall be bagged immediately and not allowed to be left exposed at the end of each workday.
 - 3. Respirators shall be thoroughly cleaned at the end of each workday and stored for the next day's use.
 - 4. Retain all stored items in an orderly arrangement allowing maximum access, not impeding traffic, and providing the required protection materials.
 - 5. Do not allow the accumulation of scrap, debris, waste material, and other items not required for completion of the work.
 - 6. Provide adequate storage for all items awaiting removal from the job site, observing all requirements for fire protection and protection of the ecology.
 - 7. Daily and more often if necessary, inspect the work areas and adjoining spaces, and pick up all scrap, debris, and waste material. Remove all such items to the place designated for their storage.
 - 8. Maintain the site in a neat and orderly condition at all times.

3.06 TEMPORARY UTILITIES:

Provide temporary connections to existing building utilities and provide temporary facilities as required and necessary to carry out the work.

A. WATER SERVICE:

The Contractor shall provide temporary connections to building water service and provide all lines necessary for distribution of water.

B. ELECTRICAL SERVICE:

1. General: Comply with applicable NEMA, NECA and UL standards and governing regulations for materials and layout of temporary electrical service. All power connections and panel work are to be performed by a licensed electrician.
2. Temporary Power: Provide temporary service connections from power sources as required. Sub-panel and disconnect shall be sized and equipped to accommodate all electrical equipment required for completion.
3. Voltage Differences: Provide I.D. warning signs at power outlets that are other than 110-120 volt power. Provide polarized outlets for plug-in type outlets, to prevent insertion of 110-120 volt plugs into higher voltage outlets.
4. Ground Fault Protection: Provide all receptacle outlets equipped with ground fault circuit interrupters (GFCI) and reset button for plug-in connection of equipment.
5. Electrical Power Cords: Use only graded extension cords.

C. LIGHTING:

1. The Contractor must supply temporary lighting for all lighting requirements within contained areas. All existing lighting within the containment area shall be isolated and shut down.

END OF SECTION

SECTION 02071

GEOTEXTILE FABRIC

PART 1 - GENERAL

1.01 WORK INCLUDED:

This Section covers furnishing of all labor, materials, and equipment necessary to install specified geotextile fabrics in locations shown on the drawings and as required by the Engineer.

1.02 SUBMITTALS:

In accordance with requirements of general specifications, submit the following:

Six (6) sets of shop drawings or working drawings and material specifications shall be submitted to the Engineer for review for each type of geotextile fabric furnished. General installation practices and installation schedule shall be included.

PART 2 - PRODUCTS

2.01 EROSION CONTROL FABRIC:

- A. Erosion Control Fabric shall be of the best quality proven design and construction and shall be entirely suitable in every respect for the intended service.
- B. Erosion Control fabric shall be Tencate Miramesh as manufactured by Tencate Geosynthetics, Pendergrass, GA; Enkamat Soil Erosion Matting as manufactured by Bonar, Asheville, N.C.; Tenax Radix Erosion Control Netting as manufactured by Tenax Corp., Baltimore, MD or approved equal.

2.02 FILTER/DRAINAGE FABRIC:

- A. The filter/drainage fabric shall be composed of continuous-filament fibers bonded together to form a sheet. The fabric shall be an average of 20 mils thick and possess the characteristics of Mirafi 140N.
- B. The filter/drainage fabric shall be Mirafi 140N as manufactured by TenCate Geosynthetics; Foss-65 by Foss Manufacturing Co., Hampton, NH; US 120NW, as manufactured by US Fabrics, Cincinnati, OH.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. GENERAL:

Installation of geotextile fabrics shall be strictly in accordance with manufacturer's instructions and specific layout plans and details reviewed by the Engineer.

B. EROSION CONTROL FABRIC:

Erosion control fabric shall be placed over the prepared surface in drainage swales and other locations as required by the Engineer. The fabric shall be unrolled, placed in the direction of water flow, overlapped, pinned down with wood stakes, and seeded. All installation work shall be in accordance with manufacturer's recommendations or as required by the Engineer.

C. FILTER/DRAINAGE FABRIC:

The filter/drainage fabric shall be installed in the final graded trench bottom prior to placement of the crushed stone bedding and at other locations shown on the drawings or designated by the Engineer. The drainage fabric in place shall cover the entire trench bottom and trench sides as shown on the drawings. Each width of drainage fabric shall be overlapped in accordance with manufacturer's recommendations, but not less than 2 feet, to prevent intrusion of soil fines into the bedding.

3.02 FINAL INSPECTION AND ACCEPTANCE:

- A. The Contractor shall, at his expense, have a manufacturer's representative inspect the work at completion of the installation. Any work found to be unsatisfactory shall be corrected at the Contractor's expense.
- B. The Engineer, at the Contractor's expense, reserves the right to have a manufacturer's representative inspect the installation process at any time during construction.

END OF SECTION

SECTION 02112

REMOVAL OF UNDERGROUND NONFRIABLE ASBESTOS CEMENT PIPE (For MA Projects)

PART 1 - GENERAL

1.01 GENERAL:

A. Definitions –

“Friable” – material can be crushed, pulverized, or reduced to powder, when dry, by hand pressure.

“Non-friable” – material that cannot be crushed or pulverized under hand pressure.

B. This section specifies requirements for the removal of nonfriable (pipe that has been below the groundwater level or is in otherwise saturated soils will generally be nonfriable because it has been saturated/wet) asbestos-cement pipe during trenching and excavation operations associated with the installation of new water or sewer pipes, where existing AC pipes may be encountered.

C. All asbestos cement pipe that is shown on the drawings and which is removed during construction is the responsibility of the Contractor, for removal, transportation and proper disposal.

1.02 RELATED WORK:

A. Section 01110, CONTROL OF WORK AND MATERIALS

B. Section 01350, PERMITS

C. Section 01380, HEALTH AND SAFETY PLAN

D. Section 01570, ENVIRONMENTAL PROTECTION

E. Section 01740, CLEANING UP

F. Section 02300, EARTHWORK

1.03 SUBMITTALS:

A. The Contractor shall submit to the Engineer the following listed items at least 14 days before work is to proceed. No asbestos pipe removal work activities shall commence until the Engineer reviews these items, unless otherwise waived.

Submittal No. 1

Plan of Action and Standard Operating Procedure: Submit a detailed plan of the procedures proposed for use in complying with all applicable regulations and the requirements of this specification.

Submittal No. 2

Name, location, and copies of applicable licenses for primary and secondary landfill for disposal of asbestos-containing or asbestos-contaminated waste.

Submittal No. 3

Within 30 days of receipt of asbestos waste at the approved landfill, the Contractor shall submit to the Engineer the original copy of the "Waste Shipment Record" acknowledging disposal of all associated waste material from the Contract showing delivery date, quantity, and appropriate signature of Contractor, transporter, and landfill's authorized representative.

1.04 GENERAL APPLICABILITY OF CODES, REGULATIONS AND STANDARDS:

- A. All applicable federal, state and municipal codes, regulations, and standards have the same force and effect (and are made a part of the contract documents by reference) as if copied directly into the contract documents, or as if published copies are bound herewith. All regulations by governing agencies in their most recent version are applicable. Provisions contained in this specification that are more stringent than applicable codes, regulations and standards shall govern for this project.

1.05 LICENSING AND TRAINING OF WORKERS:

- A. Contractor and Contractor's workers performing asbestos pipe removal must meet the licensing and training requirements of the Commonwealth of Massachusetts (453 CMR 6.00).

PART 2 - PRODUCTS

2.01 MATERIALS, TOOLS, AND EQUIPMENT:

- A. Wetting Materials: For wetting before disturbance of asbestos-containing materials use either amended water or a removal encapsulant. The material must be odorless, non-flammable, non-toxic, non-irritating, and non-carcinogenic. It shall be applied as a mist using a low-pressure sprayer recommended by the manufacturer.
 - 1. Amended Water: Provide water to which a surfactant has been added. Use a mixture of surfactant and water which results in wetting of the asbestos containing material and retardation of fiber release during disturbance of the material equal to

or greater than that provided by the use of one ounce of a surfactant consisting of 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with five gallons of water.

2. Removal Encapsulant: Provide a penetrating type encapsulant designed specifically for removal of asbestos containing material. Use a material which results in wetting of the asbestos-containing material and retardation of fiber release during disturbance of the material equal to or greater than that provided by water amended with one ounce of a surfactant consisting of 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with five gallons of water.
- B. Encapsulant: A material that surrounds or embeds asbestos fibers in an adhesive matrix, to prevent release of fibers.
1. Bridging Encapsulant: An encapsulant that forms a discrete layer on the surface of an in situ asbestos matrix.
 2. Penetrating Encapsulant: An encapsulant that is absorbed by the in situ asbestos matrix without leaving a discrete surface layer.
 3. Removal Encapsulant: A penetrating encapsulant specifically designed for removal of asbestos-containing materials rather than for in situ encapsulation.
- C. Polyethylene Sheet: Provide flame resistant polyethylene film that conforms to requirements set forth by the National Fire Protection Association Standard 701, Small Scale Fire Test for Flame-resistant Textiles and Films. Provide largest size possible to minimize seams, 6.0 mils thick as required, frosted or black as indicated.
- D. Duct Tape: Provide duct tape in 2-inch or 3-inch widths as indicated, with an adhesive, which is formulated to aggressively stick to sheet polyethylene, is waterproof, and will adhere to other materials.
- E. Spray Cement: Provide spray adhesive in aerosol cans that is specifically formulated to stick tenaciously to sheet polyethylene.
- F. Waste Containers: Provide 6 mil thick leak-tight polyethylene bags labeled as follows:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD

If the waste material contains sharp edges or may otherwise puncture polyethylene bags, provide properly labeled drums or other closed containers for storage, transportation, and disposal.

- G. Warning Signs and Labels: Shall comply with 29 CFR 1926.59(k), and all other federal, state, or local codes and regulations.
- H. Brushes: All brushes shall have nylon bristles. Wire brushes are excluded from use due to their potential to shred asbestos fibers into small fibers. Wire brushes may be used on pipe joint applications upon prior written notice to the Engineer.

PART 3 – EXECUTION

3.01 GENERAL:

- A. Nonfriable asbestos cement pipe shall be handled, transported, and disposed of in a way that prevents it from becoming friable and releasing asbestos fibers. AC pipe cannot be shattered, crumbled, pulverized, sanded, chipped, or ground.
- B. Nonfriable AC pipe may not be used as fill; it shall be disposed of at a landfill that is state-approved to accept asbestos waste. Landfills may require special packaging and labeling in order to accept the AC pipe.
- C. AC pipe shall not be removed from the excavation if it is not necessary to disturb it during the installation of the new pipeline.
- D. AC pipe shall never be handled unless it is wet. Dry pipe shall be wet down with a suitable wetting material prior to handling it.

3.02 NOTIFICATION OF MASSDEP:

- A. At least ten (10) working days in advance of asbestos pipe removal, submit Asbestos Notification Form ANF-001 to MassDEP. This may be done online using the MassDEP website.

3.03 PRE-DEMOLITION SURVEY:

- A. Contractor shall conduct a thorough inspection to determine the location of any asbestos-containing pipe, insulation or other materials. Contractor may satisfy this requirement with:
 - 1. As-built plans or other documents identifying the content of particular cement pipes or pipe segments and any other material in the conduit that may be affected by a removal or repair project, provided that the documentation has been updated to reflect any repairs or alterations; or

2. Other measures that demonstrate that a “thorough inspection” has been completed to identify asbestos cement pipe that will be affected by a removal or repair project. These measures can include visual identification through field observations of the pipe to be worked on (e.g., the manufacturer’s brand-label markings indicating transite material or the source of the pipe); or sampling and analysis of cement pipe material at a laboratory certified by DLS.
- B. A qualified person must be present to observe the pipe when it is exposed and document in writing what features were used to identify the type of pipe to be removed/repaired/replaced. Contractor shall provide this documentation to the owner using the form included at the end of this section as “Template A”. A DLS-certified asbestos inspector is qualified to perform this work. If relying on someone other than a DLS-certified asbestos inspector, a person is deemed qualified by having completed a DLS-approved training course specific to asbestos cement pipe worker safety (e.g., the “8 hour OSHA Class II Asbestos Training: Asbestos Cement Pipe (ACP) Worker Safety” course developed jointly by the Massachusetts Water Works Association (MWWA) and the Utility Contractors of New England (UCANE), or another course similar in length and content that has been reviewed and approved in writing by DLS).

3.04 POST-DEMOLITION VISUAL INSPECTION:

- A. Contractor shall, upon the conclusion of each asbestos abatement activity, provide a visual inspection that is performed by a qualified person, as defined in 3.03(B) above. The person doing the inspection must inspect all surfaces within the work area for visible debris and if any is found, the contractor must re-clean the work areas until there is no visible debris.
- B. The following conditions must be met to complete to satisfy the requirement for a visual inspection by a qualified person:
1. The qualified person is physically present to conduct the final visual inspection of the work area prior to backfilling the trench.
 2. The qualified person documents in writing that there was no visible debris remaining in the excavation trench, in soil excavated from the trench, in the surrounding area adjacent to the trench after the removal of the asbestos cement pipe, and on any tools used during the removal/repair/replacement activities.
 3. All ACWM has been removed for proper storage/disposal.
 4. The qualified person signs and dates the documentation of the final inspection as evidence that the inspection was performed and that the condition of no remaining visible debris was met. Contractor shall provide this documentation to the owner using the form included at the end of this section as “Template B”.

3.05 PERSONAL PROTECTION:

03/31/2020

- A. Contractor shall comply with applicable provisions of OSHA Construction Standard for Asbestos, 29 CFR Part 1926.1101, for personal protection.

3.06 AC PIPE REMOVAL DURING EXCAVATION:

- A. This section is provided for removal of AC pipe in excavation areas.

- B. Removal of Non-Friable Asbestos Materials:

1. Carefully excavate, by hand but no closer than 6-inches from the pipe, a sufficient area around the pipe to perform the work. Assess if the pipe is damaged, cracked or broken. Any asbestos debris that is present or generated by these activities will be promptly wetted and placed into 6-mil asbestos waste bags before continuing with the work.
2. Once excavation is complete and the pipe is found to be intact, place one layer of 6-mil polyethylene sheeting on sidewalls and bottom of trench under the AC pipe to be removed.
3. Thoroughly encapsulate AC pipe with an acceptable penetrating encapsulant per manufacturer guidelines.
4. Remove AC pipe as follows:

Whenever possible, the Contractor will limit cutting of asbestos cement materials and dismantle materials in intact sections

Remove pipe to the nearest coupling by sliding it apart at the joints. Sections of pipe will be removed from the trench and immediately wrapped and sealed in two layers of 6-mil asbestos waste bags, sealed with duct tape, and labeled. Removal shall be up to Contractor's means and methods in accordance with applicable laws and regulations, including 310 CMR 7.15 and 310 CMR 19.061.

Pipe that must be cut shall be done so within a "mini-containment" in accordance with 310 CMR 7.15 and DOS regulations at 453 CMR 6.00 unless such activity is conducted using HEPA exhausted, shrouded cutting equipment. Wrap, seal and label as stated above.

Packaged waste will then be placed into acceptable waste transportation vehicle.

3.07 AC PIPE LEFT IN PLACE:

- A. Ends of AC pipe to be left in the excavation shall be encapsulated. AC pipe is not to be crushed and left in place. Any crushed pieces must be removed and properly disposed of.

3.08 AC PIPE DISPOSAL PROCEDURES:

- A. The Contractor shall package, label, and remove all AC pipe as specified below. Packaging shall be accomplished in a manner that minimizes waste volume, but insures waste containers shall not tear or break. Transportation and disposal of the containerized waste at an approved landfill shall be the responsibility of the Contractor.
- B. Waste Labeling:
 - 1. Warning labels, having waterproof print and permanent adhesive in compliance with OSHA, EPA and Department of Transportation requirements shall be affixed to or printed on the sides of all waste bags or transfer containers. Warning labels shall be conspicuous and legible.
 - 2. In compliance with NESHAPS, 40 CFR, Part 61.150, all waste containers or bags shall be labeled with the following generator information:
 - a. Name of waste generator.
 - b. Location where waste was generated.
- C. Dispose of ACWM in accordance with 310 CMR 7.15 and 310 CMR 19.061.
- D. Contractor to provide Engineer and Owner one copy of each waste shipment record.

END OF SECTION

SECTION 02220

DEMOLITION

PART 1- GENERAL

1.01 SCOPE OF WORK:

- A. Work under this Section shall consist of the careful removal, storage on site, storage for reuse, legal transportation off-site, or demolition, of all structures and site features encountered or noted to be removed or abandoned to four feet below finished grade, and the removal and legal disposal of all materials not called for to be reused or salvaged, in accordance with the contract drawings, these specifications, and the directions of the Engineer. Provide all labor, equipment, materials, transportation and permits necessary to complete the work.
- B. Items plan-referenced to be removed and stored shall be carefully removed and stored on site in a manner and location designated by the Engineer for reinstallation later or pick up by DPW representatives as shown on the plans or as required by the Engineer.
- C. Items plan referenced, or as required by the Engineer to be removed and disposed of shall be removed from the site and properly and legally disposed of by the Contractor.
- D. Items indicated on the contract drawings or in the specifications to be removed and salvaged, or other items required to be removed by the Engineer, shall be transported to a municipal storage facility, located within the Town's confines, and unloaded and stacked as required by the Engineer or Project Manager.
- E. The scope for the general work/demolition requirements of this section include:
 - 1. Removing and disposal of concrete pad, cement and bituminous concrete pavements.
 - 2. Removal and disposal of existing fences, tree grind stump, and curbs.
 - 3. Protection of existing catch basin.
 - 4. Stripping and stockpiling of existing topsoil.
 - 5. Clearing and grubbing of existing vegetation.
 - 6. Removal and disposal of miscellaneous site features within the project areas, as indicated on the drawings.
 - 7. Installation and maintenance of erosion controls.

8. Installation of Construction tracking pad, and temporary curb mounting.
9. Protection of existing electrical utilities, light fixtures, furniture and vegetation to remain as indicated on the drawings.

1.02 PROTECTION:

- A. The Contractor shall assume complete responsibility and liability for the safety and structural integrity of all work and utilities to remain during demolition.
- B. Provide safeguards including, but not limited to, warning signs, barricades, temporary fences, warning lights and other items required for protection of personnel and the general public during performance of all work.
- C. All features related to protection shall be maintained until that work has been completed to the point when such safeguards are no longer required.

1.03 SPECIAL REQUIREMENTS:

- A. The Contractor shall salvage all, frames, grates, and covers from any demolition work and transport these to the Municipal Storage Yard unless these are called for to be reused, stored on site, or ordered by the Engineer to be disposed of.
- B. Install erosion controls to protect adjacent areas from eroded materials likely to enter wetlands, resource areas, or drainage ways/systems, downstream of areas disturbed by work activities. Refer to Section 01570 ENVIRONMENTAL PROTECTION.
- C. Where items to be demolished are located within or adjacent to pavements to remain, the Contractor shall make provisions to protect that pavement to remain. Cut concrete pavement back to nearest score line and cut bituminous concrete pavement back far enough so as not to allow disturbance to base course materials. Pavements damaged as a result of Contractor activities shall be replaced to the extent determined by the Engineer at no additional cost to the Owner.

PART 2 - MATERIALS

2.01 BACKFILL:

- A. The Contractor shall provide suitable backfill as specified under Section 02300 EARTHWORK of these Specifications, to fill voids left by removal or abandonment of site features, and shall provide all pipe cap ends, mortar, brick and other material needed to cap off or plug pipes of various sizes and kinds.
 1. Suitable materials shall be used as base course fill and topsoil to the depth as specified herein. Restore disturbed areas with similar materials blended to match the line and grades of adjacent surfaces.

2.02 TEMPORARY FENCE:

- A. Refer to Section 02821- TEMPORARY CHAIN LINK FENCE

PART 3 – EXECUTION

3.01 SALVAGEABLE MATERIAL:

- A. Frames, grates, and other salvageable material shall be carefully removed to minimize damage and stored for later reuse, transport, or removal from site.

3.02 ABANDONED STRUCTURES:

- A. All inlets and outlets shall be plugged with at least eight (8) inches of brick and mortar masonry. Upper portions of masonry structures shall be removed to a depth of three feet. The bottoms of all structures shall be broken to allow drainage, and the structure shall be filled with suitable backfill material placed in six (6) inch layers and thoroughly compacted at each level.
- B. The Engineer shall review work related to abandoned structures before backfilling. Those items not reviewed before backfilling shall be uncovered and backfill procedures observed, at no expense to the Owner.

3.04 ABANDONED PIPES OR CONDUITS:

- A. Plug previously abandoned drainpipes encountered with masonry brick at least eight (8) inches in thickness.
- B. Abandon discontinued water supplies that are encountered during the execution of this contract in accordance with Town requirements.
- C. Electrical conduits encountered and previously abandoned shall be capped or plugged.

END OF SECTION

SECTION 02220

SELECTIVE STRUCTURE DEMOLITION

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. Demolish designated interior structures, remove slabs-on-grade; disconnect utilities; remove building wall panels and girts where noted.
- B. Remove designated building equipment and fixtures; remove designated partitions and components.
- C. Remove foundations and substructures.

1.02 REGULATORY REQUIREMENTS:

- A. Conform to applicable codes and requirements for demolition of structure, safety of adjacent structure, dust control, service utilities, and discovered hazards.
- B. Dispose or recycle all demolition debris in accordance with all applicable regulations.
- *C. Contractor shall be aware that existing structure is painted with lead paint. Hence, demolition of the structure shall comply with all applicable lead paint regulations. Contractor performing this work shall be thoroughly knowledgeable of all federal, state and local laws, rules, and regulations regarding hazardous waste containing lead. By bidding this contract, the Contractor is stating his expertise in this work and the Owner shall not be responsible for any additional costs incurred by the Contractor as a result of any misunderstanding or disagreement with the applicable federal, state, and local laws, rules and codes.**
- *D. Collection, treatment, and disposal of all lead-containing wastes shall be in strict accordance with current applicable federal, state, and local laws, rules, and codes, including, but not limited to, Resource Conservation and Recovery Act (RCRA), Toxic Substance Control Act (TSCA), Occupational Safety Health Act (OSHA), and USEPA.**

1.03 RELATED WORK:

- A. Section 01014, SCOPE AND SEQUENCING OF WORK
- B. Section 01390, ENVIRONMENTAL HEALTH AND SAFETY PLAN FOR LEAD PAINT REMOVAL**

- C. Section 01562, DUST CONTROL
 - D. Section 02300, EARTHWORK
 - E. Section 02115, REMOVAL AND DISPOSAL OF UNDERGROUND FUEL OIL TANKS
- 1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:
- A. In accordance with Section 01330, SUBMITTALS, submit a demolition plan to the Engineer for review at least two weeks prior to the start of work, describing the proposed sequence, methods, and equipment required for the demolition and disposal. Also, indicate measures to be taken to protect new work, and structures and facilities to remain.
 - B. Do not proceed with the demolition until the Engineer has given written acceptance of the demolition plan. Also, no demolition work shall proceed until the new facility is complete, fully operational, and beneficial occupancy has been obtained by the Owner.
 - *C. The Contractor shall submit a complete Health and Safety Plan to the Engineer prior to initiating work at the site. The Health and Safety plan shall be prepared by a Certified Industrial Hygienist and shall contain at a minimum but not be limited to, a description of an on-site contamination reduction zone and decontamination procedures and a description of the on-site exclusion zone where the minimum level of personnel protection shall be level 'C'.**
 - *D. The Contractor shall be licensed to remove lead paint and shall submit a copy of the license to the Engineer at least two weeks prior to initiating work at the site.**
 - *E. A paint debris collection plan must be submitted for approval before any work may commence.**
 - *F. The Contractor shall certify in writing that the debris has been disposed of in accordance with all applicable regulations.**

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 PREPARATION:

- A. Provide, erect, and maintain temporary barriers and security devices.
- B. Notify Owner of procedures which may affect property, of potential noise, utility outage, or disruption. Coordinate with Owner.

- C. Erect and maintain weatherproof airtight closures for exterior openings.
- D. Erect and maintain temporary partitions to prevent spread of dust, odors and noise to permit continued Owner occupancy.
- E. Protect existing items which are not indicated to be removed.
- F. Arrange with, pay for all required fees, and perform work required by utility companies and municipal departments for discontinuance or interruptions of utility services due to demolition work.

3.02 DEMOLITION REQUIREMENTS:

- A. Conduct demolition in accordance with approved plan, so as to minimize interference with adjacent building areas.
- B. Under no circumstances shall explosives be used.
- C. Conduct operations with minimum interference to public or private accesses.
- D. Maintain protected access and egress at all times. Do not close or obstruct roadways without permits.
- E. Cease operations immediately if adjacent structure appears to be in danger. Notify Engineer.

3.03 BUILDING DEMOLITION:

- A. Disconnect, cap, identify and remove designated utilities.
- B. Demolish components indicated, in an orderly and careful manner.
- C. Remove concrete slabs-on-grade in areas noted.
- D. Remove foundations and substructure to a minimum of 4 feet below finished grade.
- E. Backfill foundations and substructure excavations with Class B or Select Backfill. Compact backfill in accordance with Section 02300, EARTHWORK.
- F. Rough grade and compact areas affected by demolition to maintain grades and contours per Drawings.

3.04 SELECTIVE DEMOLITION:

- A. Demolish and remove components in an orderly and careful manner, in sequence as indicated on Drawings.

- B. Protect existing supporting structural members and equipment.

3.05 CLEAN UP:

- A. Remove demolished materials from site as work progresses.

- B. Leave areas of work in clean condition.

- *C. Upon completion of demolition, the Contractor is required to implement his approved sampling plan on all collected paint debris.**

END OF SECTION

SECTION 02223

SELECTIVE SITE DEMOLITION

PART 1 - GENERAL

1.01 SCOPE OF WORK:

- A. Work under this Section shall consist of the careful removal, storage for reuse, transportation off-site, or demolition, of all structures and site features encountered or noted to be removed or abandoned to a minimum of three feet below finished grade, and the removal and disposal of all materials not called for to be reused or salvaged, in accordance with the contract drawings, these specifications, and Engineer's requirements. Provide all labor, equipment, materials and transportation necessary to complete the work.
- B. Items plan referenced to be removed and stored shall be carefully removed and stored on site in a manner and location designated by the Engineer for reinstallation later as shown on the plans or as indicated by the Engineer.
- C. Items plan referenced, or as indicated by the Engineer to be removed and disposed of shall be removed from the site and properly and legally disposed of by the Contractor.
- D. Items indicated on the contract drawings or in the specifications to be removed and salvaged, or other items required to be removed by the Engineer, shall be transported to a municipal storage facility, located within the City confines, and unloaded and stacked as required by the Engineer.
- E. Items indicated on the contract drawings or in the specification to be removed and reset shall be carefully removed and reset in the same location as existing according to the specification and details.
- F. The following scope describes the general work/demolition requirements of this Section but not limited to the following:
 - 1. Cement concrete and bituminous concrete pavements.
 - 2. Salvaged Curbing
 - 3. Light fixtures and footings
 - 4. Chain link fencing and footings complete.
 - 5. Wood guard rail

6. Site furniture
5. Other features as indicated on the drawings.

1.02 PROTECTION:

- A. The Contractor shall assume complete responsibility and liability for the safety and structural integrity of all work and utilities to remain during demolition.
- B. Provide safeguards including, but not limited to, warning signs, barricades, temporary fences, warning lights and other items required for protection of personnel and the general public during performance of all work.
- C. All features related to protection shall be maintained until that work has been completed to the point when such safeguards are no longer required.

1.03 SPECIAL REQUIREMENTS:

- A. The Contractor shall salvage items labeled as such and transport these to the **Owner's City Yard** unless these are called for to be reused or required by the Engineer to be disposed of.
- B. Install erosion controls to protect adjacent areas from eroded materials likely to enter resource areas or drainage ways/systems, downstream of areas disturbed by work activities.
- C. Where items to be demolished are located within or adjacent to pavements to remain, the Contractor shall make provisions to protect that pavement to remain. Cut concrete pavement back to score line and cut bituminous concrete pavement back far enough so as not to allow disturbance to base course materials. Pavements damaged as a result of Contractor activities shall be replaced to the extent determined by the Engineer at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 BACKFILL:

- A. The Contractor shall provide suitable backfill as specified under Section 02300, EARTHWORK of these specifications, to fill voids left by removal or abandonment of site features, and shall provide all pipe cap ends, mortar, brick and other material needed to cap off or plug pipes of various sizes and kinds.
- B. Suitable materials shall be used as base course fill and topsoil to the depth as specified herein. Restore disturbed areas with similar materials blended to match the line and grades of adjacent surfaces.

2.02 TEMPORARY FENCE:

- A. The work under these Items shall conform to the relevant provisions of section 644 of the MassDOT standard specifications.
- B. The work shall include temporary installation of chain link fence around the perimeter of the work limits where shown on the plans, and as required by the Engineer, and as Contractor sees fit to protect work.
- C. Temporary fence shall consist of 6 foot high chain link fence anchored into a base that is both stable and movable to allow access and adjustment as needed. Reclaimed existing fence fabric and materials may be used with the approval of the Engineer. The Contractor shall submit a shop drawing to the Engineer for approval prior to installation.

PART 3 - EXECUTION

3.01 SALVAGEABLE MATERIAL:

- A. Frames, grates and other salvageable material shall be carefully removed to minimize damage and stored for later reuse, transport, or removal from site.

3.02 ABANDONED STRUCTURES:

- A. All inlets and outlets shall be plugged with at least eight (8) inches of brick and mortar masonry. Upper portions of masonry structures shall be removed to a depth of three feet. The bottoms of all structures shall be broken to allow drainage, and the structure shall be filled with suitable backfill material placed in six (6) inch layers and thoroughly compacted at each level.
- B. The Engineer shall review work related to abandoned structures before backfilling. Those items not reviewed before backfilling shall be uncovered and backfill procedures observed, at no expense to the Owner.

3.03 ABANDONED PIPES OR CONDUITS:

- A. Plug previously abandoned drainpipes encountered with masonry brick at least eight (8) inches in thickness.
- B. Abandon discontinued water supplies that are encountered during the execution of this contract in accordance with Owner requirements.
- C. Electrical conduits encountered and previously abandoned shall be capped or plugged.

END OF SECTION

SECTION 02230

CLEARING AND GRUBBING

PART 1 - GENERAL

1.01 SCOPE OF WORK:

- A. The work under this Section shall consist of clearing, grubbing, cutting, removal and disposal of all vegetation and debris from areas within the Limit of Work where noted on the plans or as designated by the Engineer. The work shall also include the preservation from injury or defacement of all vegetation and objects designated or directed to remain.

1.02 SPECIAL INSTRUCTIONS:

- A. The burning of trees, brush, stumps, etc., shall not be permitted. The Contractor shall provide other satisfactory methods of disposal without additional compensation.
- B. When fencing is installed outside normal clearing areas, every reasonable effort shall be made to preserve trees or shrubs whose removal is not essential to the installation of the fencing.
- C. Trees and shrubs that are not to be cut, removed, destroyed, or trimmed shall be saved from harm and injury. All damage done to trees by the Contractor's operation shall be appropriately pruned in accordance with accepted horticultural practice unless damage is so extensive that the damage claim process shall be adopted.
- D. Equipment and supply storage areas shall be kept well away from the root zones of existing trees. This zone is determined to be equal to the outreach of the above ground branch structure of the trees. All effort shall be made to minimize any activity in these areas to help insure the continued good health of the existing trees.

1.03 PERMITS:

- A. Per Permit Section of these Specifications, the Engineer shall be furnished notarized copies of agreements between the Contractor and owners of legal landfills and disposal or storage areas upon request. The Contractor shall make arrangements and negotiations necessary for the satisfactory legal disposal of trees, shrubs, stumps, roots, dead-wood and other litter off site.

PART 2 - MATERIALS

2.01 SUITABLE BACKFILL:

- A. Refer to Specification Section 02300, EARTHWORK for suitable backfill requirements.

PART 3- EXECUTION

3.01 CLEARING AND GRUBBING:

- A. Clear and grub all areas as designated on the plans or as required to provide for proposed improvements. At the discretion of the Owner, individual plant materials, not plan referenced, may be denoted in the field to remain as determined by the Project Representative.
- B. The stumps of all trees, brush and major roots shall be grubbed and removed per Section 02232, TREE PRUNING AND TREE AND STUMP REMOVALS of these Specifications.

3.02 DISPOSAL OF TREES, BRUSH, AND STUMPS:

- A. Trees and stumps shall be properly disposed of off-site at a legal dump site as specified.

3.03 DISPOSAL OF DUTCH ELM DISEASED WOOD SHALL BE DONE IN THE MANNER HEREIN SPECIFIED:

- A. Dutch Elm diseased wood shall be disposed of in accordance with the provisions of General Law, Chapter 87, Section 5 and Chapter 132, Sections 8 and 11, as amended, and in accordance with any additional local regulations.
- B. Where the work includes the removal of elm trees or the limbs of elm trees, such trees or limbs thereof shall be disposed of immediately after cutting or removal and in such a manner as to prevent the spread of Dutch Elm disease. This shall be accomplished by covering them with earth to a depth of at least six (6) inches at the off-site location where the Contractor has arranged for disposal.
- C. Where the work includes the removal and disposal of stumps of elm trees, such stumps shall be completely disposed of immediately after cutting in the manner specified above.

3.04 BACKFILLING:

- A. Fill all voids with suitable backfill in controlled eight (8) inch maximum compacted lifts flush with proposed subgrades in adjacent areas. Refer to specification SECTION 02300 EARTHWORK.

END OF SECTION

SECTION 02232

SELECTIVE CLEARING, INVASIVE SPECIES

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. The work of this Section includes the following:
 - 1. Pruning, to include all existing trees located within the designated areas of the Project. Work shall also include the removal of limbs as necessary to provide appropriate clearances for various site features, facilities, and park users.
 - 2. Removal of selected living trees and removal of all dead, dying or diseased vegetation from within the project limits in accordance with the contract documents specifications.
 - 3. Removal of invasive species and undesirable undergrowth in accordance with these specifications.
- B. Refer to the Contract Drawings for the general quantity and locations of existing trees that require pruning or removal. Trees shall be pruned in conformance with this specification. Tree removals shall be limited to areas as denoted on the plans and shall include the removal of individual trees that would impede the construction of proposed facilities or those that are dead or dying.
- C. Prospective bidders are advised to complete a site visit to review the extent of work required and to confirm existing conditions, access issues, terrain and the general nature of the work of the Section.

1.02 QUALIFICATIONS OF CONTRACTOR:

- A. This work shall be limited to individuals, partnerships and corporations who are actively engaged in the field of Arboriculture, and who demonstrate competence, experience and financial capability to carry out the terms of this project. Eligible contractors must derive a majority of their income from arboricultural work. The Owner may require proof of these qualifications.
- B. All work shall be conducted by qualified and trained personnel under the direct supervision of a Massachusetts Certified Arborist (MCA) in the Contractor's employ.

1.03 PERSONNEL:

- A. The Contractor shall submit each employee's name and title prior to the commencement of work. The Contractor shall advise the Owner of any changes in personnel assigned to this contract.
- B. A crew shall consist of one (1) tree trimmer/climber, and one (1) ground person (one of whom shall be a crew foreman). The crew foreman shall have a minimum of five (5) years climbing/pruning experience. At least one (1) crew person shall be an MCA and shall be certified in CPR.
- C. Each trimmer shall be experienced and highly qualified with the necessary tree worker skills to successfully complete the work of this Section, including the ability and training to perform aerial rescue. Said skill shall also include worker safety and ability in compliance with current OSHA and ANSI Z-133.1 Standards.

1.04 SPECIAL REQUIREMENTS:

- A. Trees: The trees to be removed shall be those shown on the plans or designated by the Engineer/Arborist.
- B. Undergrowth: All plants less than 4 inches in diameter, measured at a height of 4 feet 6 inches above the ground, shall be classified as undergrowth. All undergrowth shall be removed from areas shown on the plans, described in the special provisions, or designated by the Engineer; except for those plants designated by the Engineer to be preserved.
- C. General: When specified in the special provisions, stumps shall be treated with a herbicide immediately after cutting to prevent sprouting. The herbicide to be used, and the method and rate of application shall be as specified in the special provisions. The Contractor shall follow all applicable instructions, warnings, and safety precautions stated on the manufacturer's label, and shall comply with all laws and regulations governing herbicides that are in effect at the time of use. When work is performed properly in accordance with these specifications, no subsequent recutting of sprouts or seeding growth will be required. All trees and undergrowth cut shall be disposed of in accordance with the applicable requirements of Section 3.03 Demolition of these specifications.
- D. Dutch Elm diseased wood shall be disposed of in accordance with provisions of General Laws, Chapter 87, Section 5, and Chapter 132, Sections 8 and 11 as amended; and in accordance with any additional local regulations. All wood shall be removed from the site and be properly disposed of in accordance with state and local regulations.

- E. No burning shall be permitted on the project site.
- F. Prior to commencing work, the Contractor shall submit a plan to the Owner for legal disposal of removed materials, in conformance with State and Federal regulations.

1.05 STANDARDS AND DEFINITIONS:

- A. All pruning work shall conform to the following:
 - 1. The ANSI A300 'Standard Practices for Trees, Shrubs, and Other Wood Plant Materials' of the Secretariat: National Arborist Association, Post Office Box 1094, Amherst, New Hampshire 03031.
 - 2. American National Standards Institute (ANSI) Standard Z-133.1.
- B. The term 'Owner' shall mean the Owner's designated representative charged with carrying out the requirements of this Project – 'Landscape Architect', 'Arborist', 'Engineer', 'Planner', or 'Tree Warden' as referenced herein, rendering approvals for the Owner.
- C. The Engineer will monitor job progress throughout the project and approve all payments. A site walk will be conducted before work begins between the Contractor and the Engineer. Specific trees, undergrowth and invasive species may be identified at this time for removal/eradication.

1.06 EXAMINATION OF SITE AND DOCUMENTS:

- A. The Contractor shall be responsible for having a clear understanding of the existing site conditions and shall be responsible for fully carrying out the work of this Section, regardless of actual site conditions encountered.

1.07 ORDER OF WORK:

- A. Based on the site conference, the Contractor shall submit a schedule of work for the Owner's review and approval prior to beginning work. Unless otherwise authorized by the Owner, failure of the Contractor to comply with the approved removal schedule shall be sufficient cause to give notice that the Contractor is in default of the contract.

1.08 PROTECTION OF THE VEGETATION TO BE PRESERVED:

- A. The Contractor shall protect all existing trees, shrubs, lawns and other site features designated to remain. The placement of protection devices, such as snow fence enclosures, shall, however, be at the Contractor's discretion.

- B. Damage no plant to remain by burning, pumping water, cutting of live roots or branches, or any other means. Neither vehicles nor equipment shall be parked within the dripline of trees to remain, or where ever damage may result to trees to be saved. Construction material shall not be stored beneath trees to be saved.
- C. The Contractor shall be liable for any damage to any trees, shrub, lawn or other features to remain, and shall immediately report to the Owner. Damaged shrubs or lawns shall be restored or replaced to match existing to remain to the satisfaction of the Owner.
- D. The Contractor shall compensate the Owner for damages by installing replacement tree(s) of the size and species approved by the Owner and of sufficient quantity such that the sum of the caliper inches for replacement trees equals the total caliper inches of the damaged tree(s). Damaged shrubs shall be replaced with shrubs(s) of the same size, species, and quantity, unless determined otherwise by the Owner.
- E. Any plants that are damaged to such an extent as to destroy their value for landscape purposes shall be cut and disposed of, and grass that is damaged shall be reseeded and remulched as necessary by the Contractor at no cost to the Department when so required by the Engineer.
- F. The Contractor shall conduct his operations in such a manner to prevent injury to trees, shrubs, grass, or other types of vegetation that are to remain growing, and also to prevent damage to adjacent property.
- G. When any such injuries to trees or shrubs occur, broken branches shall be removed and rough edges of scarred areas shaped and made smooth in accordance with generally accepted horticultural practice.

1.09 USE AND CARE OF THE SITE:

- A. The Contractor shall leave the work site at the end of each working period in a condition satisfactory to the Owner.
- B. Pavements shall be swept and lawns or other surfaces raked and/or otherwise cleaned of all materials related to the work operation. Degree of clean-up required will be described by the Owner and will be based upon the character of the work area.
- C. All trimmings or any other form of debris (except diseased materials or trimmings from Elms) shall be collected and chipped. The Contractor shall remove all materials and shall dispose of such materials off site in a legal manner.

- D. The Contractor shall be fully and solely responsible for any damage to equipment or vehicles left at the site of the work. All necessary permits shall be obtained by the Contractor.

PART 2 - PRODUCTS

2.01 EQUIPMENT:

- A. Equipment necessary for this Contract shall be properly maintained and in good operating condition to the Owner's satisfaction. The Contractor shall promptly remove and replace any equipment which the Owner deems to be in unsatisfactory condition or otherwise unsuitable.
- B. A disc chipper shall be used which will process material up to twelve (12) inches in diameter.

PART 3 - EXECUTION

3.01 TREE PRUNING:

- A. Under this Section, the Contractor shall furnish all labor, materials, equipment and transportation required to complete all aspects of the work in accordance with all local, state and federal regulations in force at the same time of this contract and in accordance with tree pruning as specified herein.
- B. The work of this Section consists of all tree pruning work and related items as specified herein and includes, but is not limited to:
 - 1. Pruning throughout the designated areas and limb removal required to allow for the proper installation of all proposed improvements. Medium pruning efforts shall consist of the removal of dead, dying, diseased, interfering, objectionable and weak branches on the main trunks as well as those within the leaf area. An occasional branch one (1) inch or less in diameter may remain within the main leaf area where it is not practical to remove it.

3.02 TREE PRUNING DESCRIPTION OF WORK:

- A. Tree Pruning and trimming are generally described as the removal and disposal of limbs, branches and stubs which are either dead, potentially detrimental to the health of the tree or dangerous to pedestrians, visually deficient, interfering or otherwise objectionable as determined by the Owner.
- B. The limits of all trees to be pruned have been identified on the plans or referenced

elsewhere in this specification section.

- C. Vehicle access shall be controlled and approved by the Owner.
- D. If the Contractor discovers tree(s) which have not been designated for removal, but whose condition is such that removal is warranted, whether due to death, disease, decay, or structural weakness, such tree(s) shall not be pruned and the Contractor shall immediately report these findings in writing to the Owner and await the Owner's direction before proceeding with work on the particular tree(s) in question.
- E. All tree pruning shall be conducted in a manner that maintains the natural aesthetic characteristics of the species and variety of trees. No topping or dehorning of trees or stubbing back of branches shall be permitted. All cuts shall be made to a lateral branch that is a minimum of one-third (1/3) the size of the branch being removed, unless otherwise instructed by the Owner.
- F. The use of climbing spurs or spiked shoes shall not be permitted and their use will result in the immediate cancellation of the contract.
- G. All cuts shall be made sufficiently close to the parent stem so that wound closure can be readily started under normal conditions. Cuts shall, however, never be made through the branch collar. Slab cuts and rip cuts will result in cancellation of the contract. 6
- H. All limbs over two (2) inches in diameter to be removed shall be precut to prevent splitting. Any branches that by falling would injure existing trees to remain or other objects shall be lowered to the ground by proper ropes.
- I. On trees known to be diseased and where there is known to be danger of transmitting the disease on tools, tools shall be disinfected with alcohol after each cut between trees.
- J. Lateral branches as well as occasional branch suckers may be retained. Complete removal of secondary laterals and branch suckers resulting in the stripping of major limbs, ("lion tailing") will not be permitted.
- K. All branches and limbs shall be manually lowered to the ground via rope and pulley. This practice must be consistent with the National Arborist Association Standards for Pruning. All grade-level artifacts and landscaping must be protected from damage.

3.03 REMOVALS:

- A. The Contractor shall furnish all labor, materials, equipment and transportation

required to complete all aspects of the removals work in accordance with all local, state, and federal regulations in force at the time of this contract and in accordance with tree and stump removals as specified herein.

3.04 REMOVALS DESCRIPTION OF WORK:

- A. Removal is generally described as the removal of groups and individual trees and shrubs which interfere with the growth of more desirable types of trees; the clearing away of lesser growth that may obscure outstanding trees; and thinning out to provide space for healthy growth by the elimination of thinner, weaker trees.
- B. For the purposes of this contract, removals shall also include all species that are dead, dying, or diseased, are undesirable or are considered to be invasive, as recognized by applicable entities of the Commonwealth of Massachusetts and Massachusetts Association of Arborists.
- C. The Contractor shall adhere to the specifications and provide suitable facilities for inspecting the work. Failure of the Owner to immediately reject unsatisfactory work or to notify the Contractor of deviations from the specification shall not relieve the Contractor of responsibility to correct or remedy unsatisfactory work.
- D. The Contractor shall only work on trees as designated by the contract documents and/or the Owner. No compensation will be made for work performed on any other tree or trees.
- E. Trees designated to be removed shall be taken down and all leaves, branches and trunks of trees properly disposed of by chipping and removal from the premises.
- F. Fell trees in a manner that allows all site features and those trees to be saved undamaged.
- G. Removal of all the parts of each tree shall be completed on the same day that the tree is cut.
- H. Stumps of trees to be removed shall also be removed to eighteen (18) inches below finish grade by grinding or other means acceptable to the Owner. The void from the stump removal operations shall be filled with ordinary borrow soil to within six (6) inches of finished grade. The top six (6) inches shall be filled with screened loam, moderately tamped to prevent future settling. In grass areas, the disturbed area shall be sown with grass seed of a mix appropriate to the location, as directed by the Owner.
- I. Stumps shall not be removed within the limit of wetlands and other marked waters per the order of conditions.

- J. Excavation or grading within the branch spread of trees to be saved shall be performed only under the direction of the Owner unless otherwise required.
- K. All equipment to be used and all work to be performed must be in full compliance with all standards as promulgated by OSHA at the time of bidding, including, but not limited to those regulations concerning noise levels, protective devices and operator safety.
- L. The Contractor shall be solely responsible for pedestrian and vehicular safety and control within the work site and shall protect the public and its property from injury or damage that could be caused by the progress of the work. To this end the Contractor shall provide, erect, and maintain protective devices acceptable to the Owner, including but not limited to barricades, lights and warning signs.
- M. Any practice employed by the Contractor that is obviously hazardous as determined by the Owner shall be immediately discontinued by the Contractor upon receipt of either written or oral notice from the Owner to discontinue such practice.

3.05 SELECTIVE CLEARING AND INVASIVE SPECIES REMOVAL:

- A. The Contractor shall furnish all labor, materials, equipment and transportation required to complete all aspects of the selective clearing and invasive species work in accordance with all local, state, and federal regulations in force at the time of this contract and in accordance with selective clearing and invasive species removal as specified herein.

3.06 DESCRIPTION OF WORK-SELECTIVE CLEARING AND INVASIVE SPECIES REMOVAL:

- A. As applicable, any part of tree trunks or base of plant material located on the Location Lines shall be considered within the State Highway Limits.
- B. Densely wooded areas shall be thinned to provide space for healthy growth by eliminating thinner, weaker trees and the reduction of number of varieties.
- C. The Contractor's attention is called to the requirements for work under this item. The desired appearance to be attained in certain areas of heavy growth may require three or more operations. First, the obvious dead, dying and diseased trees and undergrowth shall be cut and cleared out of the area. This work includes removal of any previously fallen trees, branches, uprooted stumps and other debris as directed. Next, the area is to be thinned out, as directed, by removing the less desirable trees and brush which interfere with the growth of the better plant material. Finally, clear out lesser growth which may obscure outstanding trees, tree groups or scenic views.

- D. Tree up-branching and shaping under this item will be restricted to trees which have limbs and branches restricting sight distance, extending over roadways, shoulders, turn outs, etc. Up-branching or trimming will be required to produce a 6 meter minimum vertical clearance over all locations described hereinbefore, and the removal of limbs and branches involved in this operation shall be accomplished as outlined hereafter.

END OF SECTION

SECTION 02240

DEWATERING

PART 1 - GENERAL

1.01 WORK INCLUDED:

This section specifies designing, furnishing, installing, maintaining, operating and removing temporary dewatering systems as required to lower and control water levels and hydrostatic pressures during construction; disposing of pumped water; constructing, maintaining, observing and, except where indicated or required to remain in place, removing of equipment and instrumentation for control of the system.

1.02 RELATED WORK:

- A. Section 01570, ENVIRONMENTAL PROTECTION
- B. Section 02071, GEOTEXTILE FABRIC
- C. Section 02300, EARTHWORK
- D. Section 02252, SUPPORT OF EXCAVATION

1.03 SYSTEM DESCRIPTION:

- A. Dewatering includes lowering the water table and intercepting seepage which would otherwise emerge from the slopes or bottom of the excavation; increasing the stability of excavated slopes; preventing loss of material from beneath the slopes or bottom of the excavation; reducing lateral loads on sheeting and bracing; improving the excavation and hauling characteristics of sandy soil; preventing rupture or heaving of the bottom of any excavation; and disposing of pumped water.
- B. Normal dewatering is defined as using conventional pumps installed in open excavations, ditches, or sumps. Special dewatering is defined as using single or two stage wellpoints, deep wells, or eductor and ejector systems installed in drilled holes or jetted in place.

1.04 QUALITY ASSURANCE:

- A. The Contractor is responsible for the adequacy of the dewatering systems. The Contractor shall retain the services of a Professional Engineer registered in the Commonwealth of Massachusetts, experienced in dewatering systems, to independently evaluate the boring logs and any other soils information available to determine those areas that will require special dewatering techniques and to design the required system.

The Contractor's Professional Engineer shall provide sufficient on-site inspection and supervision to assure that the dewatering is carried out in accordance with their design.

- B. The dewatering systems shall be capable of effectively reducing the hydrostatic pressure and lowering the groundwater levels to a minimum of 2 feet below excavation bottom, unless otherwise required by the Engineer, so that all excavation bottoms are firm and dry.
- C. The dewatering system shall be capable of maintaining a dry and stable subgrade until the structures, pipes and appurtenances to be built therein have been completed to the extent that they will not be floated or otherwise damaged.
- D. The dewatering system and excavation support (see Section 02252) shall be designed so that lowering of the groundwater level within the work area does not adversely affect structures, utilities or wells outside of the work area.
- E. Where special dewatering is used, the Contractor shall obtain at their expense the services of a registered professional engineer to investigate, design and monitor the dewatering system. The Contractor shall also furnish materials and install at least two observation wells at each excavation area. The location of the wells shall be determined in the field by the Contractor's Engineer.

1.05 SUBMITTALS:

- A. At least two weeks prior to installing their dewatering system, Contractor shall submit the attached Certificate of Design completed and signed by Contractor, identifying the engineer responsible for design of the dewatering system. The Contractor shall also submit a schedule showing the timing of installation and operation of the dewatering system.
- B. The Contractor shall submit to the Engineer for record purposes only, the following items bearing the Contractor's Engineer's stamp and signature, and identifying the codes and specifications followed in the design.
 - 1. Plans and description of the dewatering system, including the number, location and depth of wells, wellpoints or sumps; designs of filters to prevent pumping of fine soil; method and location for filtering and disposal of pumped water; and flow capacity of proposed system.
 - 2. Locations of observation wells.
- C. The Contractor shall submit records of pump operation and groundwater elevations as required by the Owner's Engineer.

PART 2 - PRODUCTS: NOT APPLICABLE

PART 3 - EXECUTION

3.01 DEWATERING OPERATIONS:

- A. All water pumped or drained from the work shall be disposed of in a manner which will not result in undue interference with other work or damage to adjacent properties, pavements and other surfaces, buildings, structures and utilities. Suitable temporary pipes, flumes or channels shall be provided for water that may flow along or across the site of the work. All disposal of pumped water shall conform to the provisions of Section 01570 ENVIRONMENTAL PROTECTION.
- B. Dewatering facilities shall be located where they will not interfere with utilities and construction work to be done by others.
- C. Dewatering procedures to be used shall be as described below:
 - 1. Crushed stone shall encapsulate the suction end of the pump to aid in minimizing the amount of silt discharged.
 - 2. For dewatering operations with relatively minor flows, pump discharges shall be directed into straw bale sedimentation traps lined with filter fabric. Water is to be filtered through the straw bales and filter fabric prior to being allowed to seep out into its natural water course.
 - 3. For dewatering operations with larger flows, pump discharges shall be into a steel dewatering basin. Steel baffle plates shall be used to slow water velocities to increase the contact time and allow adequate settlement of sediment prior to discharge into waterways.
 - 4. Where indicated on the contract drawings or in conditions of excess silt suspended in the discharge water, silt control bags are to be utilized in catchbasins.
- D. The Contractor shall be responsible for repair of any damage caused by their dewatering operations, at no cost to the Owner.

3.02 SPECIAL DEWATERING:

- A. If conventional dewatering methods are inadequate to ensure dry and stable conditions for structural foundations, the Contractor shall be required to use special dewatering as necessary.

- B. Special dewatering techniques may consist of one or two stage wellpoint systems, deep wells, or eductor and ejector type systems. The Contractor shall utilize a system which provides proper construction conditions and prevents settlement at time of installation and upon backfilling.
- C. In areas requiring special dewatering, the Contractor shall lower the groundwater level to a minimum of 2 feet below the bottom of the final excavation grade prior to any installation and maintain that groundwater level until the excavation has been backfilled. The groundwater levels shall be monitored by the Contractor's Engineer to ensure conformance with the requirements of these specifications. Construction will not be allowed until the Owner's Engineer is satisfied that the above provisions are met.

3.03 NOISE LEVEL REQUIREMENTS:

- A. All primary dewatering equipment shall be electrically operated and shall run on commercial power. Standby equipment shall be independent of commercial power and shall provide dewatering upon primary pump or power failure.
- B. All equipment utilized by the Contractor shall conform to the Department of Environmental Protection Division of Air Quality Control regulations governed by the following policy:

"A source of sound will be considered to be violating the Department's noise regulation (310 CMR 7.10) if the source:

1. Increases the broadband sound level by more than 10 dB(A) above ambient, or
2. Produces a "pure tone" condition - when any octave band center frequency sound pressure level exceeds the two adjacent center frequency sound pressure levels by 3 decibels or more.

These criteria are measured both at the property line and at the nearest inhabited residence. Ambient is defined as the background A-weighted sound level that is exceeded 90% of the time measured during equipment operating hours. The ambient may also be established by other means with the consent of the Department."

The Contractor shall construct sound enclosures or utilize other noise reduction techniques if the equipment does not meet the noise level requirements.

END OF SECTION

(Certificate of Design follows their page)

CERTIFICATE OF DESIGN

Re: Contract Between:

OWNER: _____
(Name)

and
CONTRACTOR: _____
(Name)

on
CONTRACT: _____
(Number)

Date: _____

Title: _____

Contractor hereby certifies that _____:
(Engineer)

1. Is licensed or registered to perform professional engineering work in the state of _____;
(Location of Project)
2. Is qualified to design the _____
(Item)
specified in Section _____ of subject contract;
3. Has designed _____ before;
(Item)
4. Has prepared the design in full compliance with the applications and requirements of Section _____ of subject contract including all applicable laws, regulations, rules, and codes; and
5. The work has been signed and sealed pursuant to applicable state law.

FOR: _____
(Contractor)

BY: _____
(Signature)

(Name and Title)

Dated: _____

SECTION 02252

SUPPORT OF EXCAVATION

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This section of the specification covers wood sheeting and bracing for support of excavations. The requirements of this section shall also apply, as appropriate, to other methods of excavation support and underpinning which the Contractor elects to use to complete the work.
- B. The Contractor shall furnish, and place timber sheeting of the kinds and dimensions required, complying with these specifications, where indicated on the drawings or required by the Engineer.

1.02 RELATED WORK:

- A. Section 02300, EARTHWORK.
- B. Section 02240, DEWATERING.

1.03 QUALITY ASSURANCE:

- A. This project is subject to the Safety and Health regulations of the U.S. Department of Labor set forth in 29 CFR, Part 1926, and to the Massachusetts Department of Labor and Industries, Division of Industrial Safety "Rules and Regulations for the Prevention of Accidents in Construction Operations (454 CMR 10.0 et seq.) Contractors shall be familiar with the requirements of these regulations.
- B. The excavation support system shall be of sufficient strength and be provided with adequate bracing to support all loads to which it will be subjected. The excavation support system shall be designed to prevent any movement of earth that would diminish the width of the excavation or damage or endanger adjacent structures.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Timber sheeting shall be sound spruce, pine, or hemlock, planed on one side and either tongue and grooved or splined. Timber sheeting shall not be less than nominal 2 inches thick.

- B. Timber and steel used for bracing shall be of such size and strength as required in the excavation support design. Timber or steel used for bracing shall be new or undamaged used material which does not contain splices, cutouts, patches, or other alterations which would impair its integrity or strength.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Work shall not be started until all materials and equipment necessary for their construction are either on the site of the work or satisfactorily available for immediate use as required.
- B. The sheeting shall be securely and satisfactorily braced to withstand all pressures to which it may be subjected and be sufficiently tight to minimize lowering of the groundwater level outside the excavation, as required in Section 02240, DEWATERING.
- C. The sheeting shall be driven by approved means to the design elevation. No sheeting may be left so as to create a possible hazard to safety of the public or a hindrance to traffic of any kind.
- D. If boulders or very dense soils are encountered, making it impractical to drive a section to the desired depth, the section shall, as directed, be cut off.
- E. The sheeting shall be left in place where indicated on the drawings or ordered by the Engineer in writing. At all other locations, the sheeting may be left in place or salvaged at the option of the Contractor. Steel or wood sheeting permanently left in place shall be cut off at a depth of not less than two feet below finish grade unless otherwise directed.
- F. All cut-off will become the property of the Contractor and shall be removed by him from the site.
- G. Responsibility for the satisfactory construction and maintenance of the excavation support system, complete in place, shall rest with the Contractor. Any work done, including incidental construction, which is not acceptable for the intended purpose shall be either repaired or removed and reconstructed by the Contractor at his expense.
- H. The Contractor shall be solely responsible for repairing all damage associated with installation, performance, and removal of the excavation support system.

END OF SECTION

SECTION 02290

SEEDING

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This Section includes furnishing all labor, materials, equipment, seed, and incidental materials necessary to accomplish all grass seeding and related work, complete in place, maintained, and accepted, in accordance with the Contact Drawings and Specifications. All grassed areas disturbed by the Contractor's operations shall be repaired as herein specified.
- B. The Contractor shall bear the responsibility and cost of furnishing and applying water or any other substances, as necessary to ensure the sustainability of grass seeded areas, as part of the work of this contract.

1.02 RELATED WORK:

- A. Section 02329, TOPSOIL LOAM BORROW.

1.03 SUBMITTALS:

In accordance with requirements of general specifications, the Contractor shall submit the following to the Engineer for review and approval:

- A. Information for seed mixes including the following:
 - 1. Name and address of the seed supplier.
 - 2. Source of origin and dates of harvest for each of the various types of seed.
 - 3. Certification of seed mix composition and proportion, indicating named seed varieties by percent, percent germination, purity, and percent crop seed, percent inert matter, and percent weed seed content.
 - 4. Estimated number of seeds per pound of each type of seed in the mix
 - 5. Ingredients that comprise the hydroseed mix
 - 6. Soil amendments and fertilizers and indicated in Appendix A – Sand and Soil Amendments
- B. Information detailing proposed limestone, fertilizers, mulch materials, hydroseeding materials (as required), and slope protection material (as required) to be applied to seeded

areas. Soil test results and amendment recommendations as indicated in section 02329, Topsoil Loam Borrow.

- C. Watering, fertilizing and maintenance schedule.
- D. Marked up prints indicating the square footage of all proposed seeded areas with quantities of various soil additives and amendments, and quantities of seed for each area prior to beginning work.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. LOAM BORROW:

- 1. Loam Borrow shall be as specified in Section 02329, TOPSOIL LOAM BORROW.

B. LIMESTONE:

- 1. Lime shall be an approved agricultural limestone containing at least 50 percent total oxides (calcium oxide and magnesium oxide). The material will be ground such that 50 percent of the material will pass through a No. 100 mesh sieve and 98 percent will pass a No. 2 mesh sieve. Lime shall be uniform in composition, dry and free-flowing and shall be delivered to the site in the original sealed containers, each bearing the manufacturer's guaranteed analysis.

C. FERTILIZER:

- 1. Fertilizer shall be a complete, standard commercial fertilizer, homogenous and uniform in composition, dry and free-flowing, and shall be delivered to the site in the manufacturer's original sealed containers, each bearing the manufacturer's guaranteed analysis and marketed in compliance with State and Federal Laws. All fertilizer shall be used in accordance with the manufacturer's recommendations. Refer to Appendix A – Sand and Soil Amendments for required fertilizers. All fertilizers and soil amendments shall meet these requirements or be an approved equal.
- 2. Refer to Appendix A – Sand and Soil Amendments for required fertilization requirements.

D. SEED:

- 1. Seed shall be of an approved perennial variety mixture, the previous year's crop, clean, and high in germinating value. Weed seed content shall be less than 0.5 percent and include no noxious weeds. Seed shall be obtained from a reliable seed company and shall be accompanied by certificates of compliance relative to mixture purity and germinating value. Seed shall be furnished and delivered in new, clean,

sealed and properly labeled containers. All seed shall comply with applicable State and Federal laws. Seed that has become wet, moldy, or otherwise damaged shall not be accepted.

2. Seed for landscape lawn areas shall conform to the following requirements: Green Space Mix or equivalent. Install at a rate of 6lb/1000 s.f.

30% Falcon IV Tall Fescue
20% Dallas Tall Fescue
20% Metolius Perennial Rye
20% Diva Kentucky Blue
10% Double Time Perennial Rye

G. MULCH

1. Materials to be used in mulching seeded areas shall be free of weed seed and shall conform to the following requirements:
 - a. Straw Mulch shall consist of stalks or stems of grain after threshing.

H. HYDROSEED MULCH, TACKIFIERS AND WATER RETENTION AGENTS:

1. Wood fiber mulch for Hydroseed application shall be a manufactured product of natural wood cellulose fibers with a non-toxic green marking dye incorporated to ensure uniform distribution. Mulch shall be packed in sealed original containers, clearly labeled with brand name and manufacturer. It shall have delivered moisture content less than 12 percent.
1. Hydroseed tackifier shall be a powdered starch-based product approved by the Engineer. Hydroseed tackifier shall be applied in conjunction with the hydroseed slurry in accordance with the manufacturer's recommendations.
2. Moisture retention agent shall be a powdered starch-based product, approved by the Engineer, and shall be capable of retaining up to 400 times their weight in water. Moisture retaining agents shall be added to the hydroseed slurry in accordance with the manufacturer's recommendations. Moisture retention agent shall be 'Hydro-Gel', as manufactured by Finn Corporation, Fairfield, OH.
3. Contractor to submit mix ingredients prior to installation of hydroseed.

I. SLOPE EROSION CONTROL FABRIC:

1. Erosion control blanket shall be 100 percent biodegradable mesh with 100 percent biodegradable straw or straw/coconut fill. Fill shall be held together by biodegradable fastening. Weight shall be 0.50 pounds per square yard. Erosion control blankets shall be applied parallel to direction of water flow. The erosion control blankets shall be by North American Green, Evansville, IN or approved

equal. For slopes 4:1 or greater, erosion control blanket shall be composed of 70 percent straw 30 percent coconut fiber, Model SC150. For slopes less than 4:1, erosion control blanket shall be high velocity straw matting, Model S150.

2. Six-inch wire staples shall be placed in accordance with the manufacturer's recommendations to anchor the mesh material. Staples shall be biodegradable.

J. WATER:

1. Water shall be furnished by the Contractor, unless otherwise specified, and shall be suitable for irrigation and free from ingredients harmful to plant growth and viability. The delivery and distribution equipment required for the application of water shall be the furnished by the Contractor, at no additional cost to the Owner.

PART 3 - EXECUTION

3.01 GENERAL:

- A. All work shall be performed by skilled workers with a minimum of 2 years of sports field seeded lawn construction and establishment experience and under the full-time supervision of a qualified foreman.
- B. Seeding operations shall not begin less than 4 days after the application of lime and fertilizer and the seedbed areas are reviewed and approved by the Engineer.
- B. Seeding shall be done when soil and weather conditions permit in early spring, until June 15, or from September 10 to October 15, unless otherwise approved. If it becomes necessary for seed to be sown after June 15, provisions shall be made for supplementary water and using mulch cover over lawn areas.
- C. If there is a delay in seeding, during which weeds grow, or soil is washed out, the Contractor shall eliminate the weeds by physical means, or replace the soil before sowing the seed, without additional compensation. Immediately before seeding is begun, the soil shall be lightly raked.
- E. Seed shall be sown at the manufacturer's approved rate, on a non-windy day by machine, or as approved by the Engineer.
- F. The surface shall be kept moist by a fine spray until the seed shows uniform germination over the entire area. Wherever poor germination occurs in areas larger than 3 square feet, the Contractor shall reseed, roll, straw, and water as necessary to obtain proper germination.
- G. If there is insufficient time in the planting season to complete soil preparations, fertilizing, and seeding, permanent seeding may be left until the following planting season, at the option of the Contractor, or on order of the Engineer. In that event, a temporary cover crop shall be sown. This cover crop shall be cut and watered as necessary until the beginning of

the following planting season, at which time it shall be plowed or harrowed into the soil, the area shall be fertilized, and the permanent seed crop shall be sown as specified.

- H. Protection of all newly loamed and graded areas is required and shall be accomplished by whatever means necessary such as mulch applied with a tackifier, or by other means approved by the Engineer. The Contractor shall be responsible for the prevention of siltation in areas beyond the limit of work and for all means of protection throughout the maintenance period at no additional cost to the Owner.

3.02 BROADCAST SEEDING, PLACING MULCH AND SLOPE EROSION PROTECTION:

- A. Athletic field seeding shall be sown by slice seeding and broadcast spreader. 5lb /1,000 s.f. shall be sown by slice seeding, the remaining 1lb /1,000 s.f by broadcast spreader., or as directed by the Engineer. Seed shall be divided into 2 equal amounts and uniformly distributed in 2 applications at right angles to each other. Seed shall then be raked lightly into the soil to a depth of 1/4 inch.
- B. If mulch is not necessary the seed shall be directly firmed into the soil with a roller that will apply pressure between 75 and 100 pounds per linear foot of width.
- D. Slope erosion control blankets shall be placed as indicated on the plans or as directed by the Engineer.

3.03 HYDROSEEDING:

- A. The application of lime, fertilizer, grass seed and mulch may be accomplished in a single operation with the use of approved hydroseeding equipment. The materials shall be mixed with water in the machine and kept in an agitated state in order that the materials may be uniformly suspended in the water. The slurry shall be of such consistency that it can be sprayed from a hydroseed gun or through at least 200 feet of 1 ½ inch diameter hose. The spraying equipment shall be so designed that when the solution is sprayed over an area, the resulting deposits of lime, fertilizer, grass seed, and mulch shall be equal to the specified quantities.
- B. Prior to the start of hydroseeding, the Contractor shall furnish to the Engineer, in writing, the weights of limestone, fertilizer, grass seed, mulch, tackifier (as required) and moisture retention agent (as required) per 100 gallons of water to be used. This statement should also specify the number of square yards of seeding that can be covered with the solution specified above. If the results of hydroseeding operations are unsatisfactory, the Contractor will be required to abandon this method and to apply the lime, fertilizer, grass seed and mulch by other means.
- C. Seed shall be incorporated with the mulching material to obtain a minimum hydroseeded sown coverage of 200 pounds of the specified seed mix per acre, as recommended by the seed suppliers, or as directed by the Engineer.
- E. Wood fiber mulch shall be uniformly spread over certain selected seeded areas at the

minimum rate of 1,400 pounds per acre unless otherwise directed. Mulch shall be placed by spraying from an approved spraying machine with pressure sufficient to cover the entire area in a single operation.

- F. The Contractor shall immediately cleanup hydroseed oversprays from plant materials, pavements, furnishings, etc., to the satisfaction of the Engineer.

3.04 MAINTENANCE:

- A. The Contractor shall maintain and protect the entire seeded area, as necessary to ensure dense healthy growth, until completion of the guarantee period and final acceptance of the project, or for 60 days, whichever is longer. If lawns are planted in late summer or during the fall, maintenance shall continue through the following spring for at least 60 days. Maintenance shall include watering as specified, liming, fertilizing, removal of stones, control of weeds, insect pests and fungal pathogens, and regular mowing. Defective work shall be corrected as soon as possible after it becomes apparent and weather and season permit.
- B. The first cutting of lawn areas shall be done when the grass is between 2 ½ - 3 inches in height. The lawn shall be cut no shorter than 2 inches in height and shall be regularly mowed as necessary to maintain the above-prescribed conditions. All cuttings shall be removed from the lawn during the maintenance period and disposed of off-site. Cutting shall be accomplished with approved equipment that is weed free, clean of all herbicides and pesticides and has freshly sharpened blades. No mowing shall occur without inspection and approval of the Engineer.
- C. The Contractor shall be responsible to regularly water seeded areas with the equivalent of 1-inch minimum of rainfall per week, or as necessary to develop and sustain dense, green growth.
- D. Six weeks after turf has established, and only during the months of April, May, or September, the Contractor shall apply fertilizer as specified above, at one half the rate recommended by the initial soils laboratory tests, or as directed by the Engineer.
- E. The Contractor shall be responsible for securing all seeded areas from physical damage as necessary, including warning signs, barriers, temporary fencing, or other means of protection, through the guarantee period until final acceptance. All damaged areas shall be repaired to reestablish healthy vigorous growth of turf to the satisfaction of the Engineer, at no additional cost to the Owner. All temporary barriers shall remain the property of the Contractor and shall be removed by the Contractor upon final acceptance by the Engineer.
- F. Pavement shall always kept clean and clear of cuttings and debris during the maintenance period to the satisfaction of the Engineer.

3.05 INSPECTION AND PRELIMINARY ACCEPTANCE:

- A. At the beginning of the planting season following that in which the permanent grass crop is sown, seeded areas will be inspected. Any section not showing dense, vigorous growth shall be promptly reseeded by the Contractor at no additional cost to the Owner. The seeded areas shall be watered, weeded, cut, and otherwise maintained by the Contractor, as many times as necessary, in accordance with these specifications, until they are accepted.
- B. The Contractor shall provide written notice to the Engineer not less than 10 days before the anticipated date of inspection for preliminary acceptance. The Engineer shall recommend preliminary acceptance of the work of this Section only after completion and re-inspection of all necessary repairs, renewals, or replacements.
- G. Inspection and acceptance of seeded areas may be requested and granted in part, provided the areas for which acceptance is requested are relatively substantial in size, and with clearly definable boundaries. Acceptance and use of these areas by the Owner shall not waive any other provisions of this Contract.
- H. Refer to Appendix A – Sand and Soil Amendments

3.06 GUARANTEE:

- A. Seeded areas shall be guaranteed until final acceptance of the project, or, in the case of late summer or fall planting, the guarantee period shall extend through the following spring.
- B. When the work is accepted in part, the guarantee period shall extend from each partial acceptance to the terminal date of the last guarantee period. All guarantee periods terminate at one time.
- C. Guarantee shall not apply to the replacement of seeded lawns resulting from the removal, loss, or damage due to occupancy of the project in any part; vandalism or acts of neglect on the part of others; physical damage by animals, vehicles, etc.; and Acts of God, including but not limited to, catastrophic fire, hurricanes, riots, war, etc.
- D. In the instance of curtailment of water by local water authorities (when supply was to be furnished by the Owner), the Contractor shall furnish all necessary water by water tanker, the cost of which will be approved and paid for by the Owner.

3.07 FINAL INSPECTION AND FINAL ACCEPTANCE:

- A. At the end of the guarantee period, the Contractor shall provide written notice to the Engineer not less than 10 days before the anticipated date of final inspection for final acceptance.
- B. The Engineer shall recommend final acceptance of the work of this Section only after completion and re-inspection of all necessary repairs, renewals, or replacements.

END OF SECTION

SECTION 02300

EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

A. Work Included: Furnish all labor, supervision, equipment, supplies, and materials and perform all operations necessary to complete the work of this Section, including but not limited to the following:

1. Earth and rock excavation of all types.
2. Filling to raise grades, compaction, and grading.
3. Sheet piling, shoring, and dewatering of excavations and trenches.
4. Excavation and backfill for removal, relocation, and abandonment of existing underground utilities, foundations, and below-grade structures.
5. Preparing subgrades for structures, walls, pavements, sidewalks, and landscaping.
6. Providing, processing, placing, and compacting earth and aggregate fill materials.
7. Removal, hauling, stockpiling, re-handling, and placement of materials.
8. Off-site disposal of excess or unsuitable materials.
9. Preserving and protecting existing site features to remain, and new site improvements during the work.

1.2 PROJECT CONDITIONS

A. Site-Specific Information:

1. Site preparation and earthwork will encounter fill with varying amounts of debris and possibly cobbles and boulders within required excavation depths for site grading, foundations, slabs, utilities, and other site improvements associated with the skate park, fields, bleachers, sports lighting, and other park improvements. Organic soils may be present as well. Existing fill, organic soils, and other unsuitable soils (as determined by the engineer) shall be completely removed and replaced with Structural Fill within the zone-of-influence (defined herein) of proposed slabs, structures, and skate park features.
2. Completed explorations indicate subsurface conditions at the specific locations only, and only to the depths explored. They do not reflect subsurface conditions,

obstructions, and bedrock elevations present between exploration locations. Variation of subsurface conditions should be anticipated.

3. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

B. Geotechnical Field and Laboratory Testing:

1. The Contractor will retain the services of a geotechnical testing laboratory to conduct the laboratory analyses and field testing of soil materials required by this specification. Coordinate locations and types of field tests to be performed with the Owner's Engineer and cooperate in every way with the Owner's Engineer and testing laboratory during field testing and with collection of soil samples for laboratory testing.

C. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by the Work of this Section. A list of those Documents and Sections include, but is not limited to the following:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections, apply to this Section.
2. Section 01570, ENVIRONMENTAL PROTECTION
3. Section 02000, SUBSURFACE DATA
4. Section 02071, GEOTEXTILE FABRIC
5. Section 02240, DEWATERING
6. Section 02252, SUPPORT OF EXCAVATION

1.3 SUBMITTALS AND TESTING:

A. Material Test Reports: From a qualified independent testing agency indicating and interpreting test results for compliance of the following with requirements indicated:

1. Classification according to ASTM D 2487 and moisture content according to ASTM D 2216 of each on-site and borrow soil and/or fill material proposed for fill and backfill.
2. Laboratory compaction curve according to ASTM D 1557 for each onsite and borrow soil and/or fill material proposed for fill and backfill.

B. Prior to commencing earthwork activities, submit a work plan describing the earthwork operations including:

- a) Frequency and locations of tests and inspections.
- b) Equipment list, including excavation, material processing, grading, compaction, and moisture control equipment.
- c) Locations and methods of excavating.
- d) Handling, and stockpiling (if applicable) of excavated material, including methods to keep materials from various sources separated.
- e) Drainage and dewatering (if required).

No work shall be performed until this plan has been approved by the Owner's Engineer.

C. Supply and Quality Control Inspection Results: Submit the results of all sources of supply and quality control inspections and tests. Submittals reviewed beyond the second rejection (or required submittal) shall be provided at no cost to the Owner and shall be reviewed by the Engineer at the Contractor's expense. No work shall be performed until the Owner's Engineer has reviewed the source of supply. It is the Contractor's responsibility to submit the Supply and Quality Control Inspection Results in a timely manner to assure the project's workflow.

- 1. Backfill Materials: Submit 20-pound samples for each backfill material from each proposed source including on-site materials. Samples of off-site soil borrow for submission shall be collected in the presence of the Owner's Engineer so that the Owner's Engineer can see each borrow material at the source.
- 2. In addition, a certification statement and analytical results shall accompany each physical sample of earth materials to be imported onto the site, including but not limited to crushed stone, loam, bedding sand, gravel sub-base, common fill and structural backfill. At a minimum the certification shall state the point of origin, its past usage, name of the qualified firm and analytical laboratory that performed the material sampling and testing, and that the material is free of contaminants and do not contain contaminants that exceed the reportable concentrations (RCS-1) of the MCP. The certification shall include representative sample analysis from each point of origin of backfill to be used on the site. The sample(s) shall be analyzed by a certified laboratory for total metals (EPA priority pollutant metals), volatile organic compounds (EPA Method 8260), semi-volatile organic compounds (EPA Method 8270), petroleum hydrocarbons (EPA Method 8100), and Total PCBs and pesticides (EPA Method 8081 and 8082).
 - a. All sampling of soils for chemical testing shall be performed by a person experienced in sample collection and shall be either: 1) a Licensed Site Professional registered in the Commonwealth of Massachusetts; 2) a Professional Engineer registered in the Commonwealth of Massachusetts; 3) a professional Geologist registered in the Commonwealth of Massachusetts; 4) a certified groundwater/environmental professional; or 5) an authorized representative of the one of the persons listed above. Samples of each material shall be submitted to a chemical analytical laboratory, certified by the

Massachusetts Department of Environmental Protection.

- b. Material shall not contain asbestos.
 - 3. Submit additional samples and geotechnical and analytical test data and certifications for every 1,000 cubic yards (every 500 cubic yards for moisture density curves) of material imported or reused on-site or anytime consistency of material changes in the opinion of the Owner's Engineer. Submit associated chemical laboratory data on the imported materials throughout the course of the Work, if requested by the Owner's Engineer, to evaluate the consistency of the source or process, at no additional cost to the Owner.
 - 4. Information identifying the name of the accredited field and laboratory soil testing subcontractor proposed for documenting conformance of earthwork activities. Include examples of typical field and laboratory test result documentation from the subcontractor that are proposed for use the project. In addition to test results, the report documentation shall include the location and elevation of all tests, materials tested, a description of methods and equipment used, compaction requirements, and conformance or non-conformance. All measuring and testing equipment (MTE) used at the site shall have documentation certifying the MTE has been calibrated within the last year (or sooner if required by subcontractor quality procedures). Calibration certificates shall be provided to the Engineer at least one week prior to MTE use on site.
- D. During Construction, submit written confirmation of fill lift thickness, in-place soil moisture content, and percentage of compaction to the Owner's Engineer before placing the next lift or constructing foundations or structures.

1.4 DEFINITIONS

- A. Backfill and Fill Materials: Soil and rock material used in construction as specified herein.
- B. Structures: Buildings, light posts, slabs, bleachers, skate park features, equipment pads, manholes, catch basins, below grade vaults and equipment capsules.
- C. Unsuitable Material: Include topsoil, subsoil, existing undocumented fill, material containing organic silt, organic clay, peat, vegetation, wood or roots, stones or rock fragments over 6-inches in diameter, porous biodegradable matter, disturbed soils, debris, contaminated media, snow, ice or refuse. Unsuitable material also includes any materials not suitable for reuse as backfill as defined by the requirements of this Specification.
- D. Subgrade: the bottom surface of a trench or excavation extending to the underside of site improvements, including bedding materials for building foundations and slabs, structures, pavement subbase, or other surfacing material.
- E. Pass: a single complete coverage with compaction equipment over the entire surface of an

exposed lift or subgrade being compacted.

- F. Zone-of-Influence: Defined by a horizontal plane extending away from the outside bottom edge of the footings, slabs, or structures a distance of two feet, then by a plane that slopes down and away from the foundation at a maximum 1H:1V slope to the natural inorganic soil subgrade

1.5 QUALITY CONTROL

- A. Contractor shall assume full responsibility for quality control inspection and testing, give sufficient notice to the Owner's Engineer to permit the witnessing of the inspections or tests, and provide test results to Owner's Engineer within one day of completion.
- B. Contractor shall engage a qualified, independent testing agency to perform quality control testing and inspections. Compaction testing shall be performed at the minimum frequency specified in Section 3.3D.
- C. Source of supply. No earthwork materials will be accepted on the jobsite without written approval of submittals from the Owner's Engineer, as stated in Section 1.4.
- D. The Owner's Engineer reserves the right to perform inspections and tests at any time during the execution of the work.
- E. Notification Point: The Contractor shall give the Owner's Engineer two days' notice in advance of quality control tests and inspections.

1.6 REFERENCE STANDARDS

- A. The following standards are applicable to the work of this section to the extent referenced herein.

American Society for Testing and Materials (ASTM):

ASTM C117	Standard Test Method for Materials Finer than No. 200 Sieve in Mineral Aggregates by Washing.
ASTM C131	Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
ASTM C136	Method for Sieve Analysis of Fine and Coarse Aggregates.
ASTM D422	Standard Test Method Particle Size Analysis of Soils
ASTM D1140	Standard Test Method Particle Size Analysis of Soils Standard Test Methods for Determining the Material Finer than No. 200 Sieve in Soils by Washing.

ASTM D1556	Test Method for Density of Soil in Place by the Sand Cone Method.
ASTM D1557	Test Methods for Moisture-density Relations of Soils and Soil Aggregate Mixtures Using Ten-pound (10 Lb.) Hammer and Eighteen-inch (18") Drop.
ASTM D2216	Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soils and Rock by Mass ASTM D2487 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D2487	Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D2488	Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)
ASTM D4318	Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils
ASTM D4643	Standard Test Method for Determination of Water Content of Soil and Rock by Microwave Oven Heating
ASTM D4959	Standard Test Method for Determination of Water Content of Soil by Direct Heating
ASTM D6938	Test Methods for Density of Soil and Soil-aggregate in Place by Nuclear Methods (Shallow Depth).

Commonwealth of Massachusetts Department of Transportation (MassDOT) Standard Specification for Highways and Bridges.

Code of Massachusetts Regulations (CMR) 310 CMR 40.0000 Massachusetts Contingency Plan.

Code of Massachusetts Regulations (CMR) 520 CMR 14.00 Excavation & Trench Safety Regulation.

Massachusetts Building Code 780 CMR Ninth Edition, 2017.

1.7 EXAMINATION OF SITE AND DOCUMENTS

- A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be

allowed because of a lack of knowledge of existing conditions as indicated in the Contract Documents, or obvious from observation of the site.

- B. Plans, surveys, measurements and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and formed his own conclusions as to the full requirements of the work involved.
- C. Refer to geotechnical report titled "Geotechnical Engineering Report, Crompton Park Skate Park, Worcester, Massachusetts," dated June 10, 2020 for information on site and subsurface conditions.

1.8 EXCAVATION CLASSIFICATIONS

- A. Earth Excavation or "Excavation" consists of removing materials encountered to the subgrade elevations indicated and subsequent reuse or disposal of the materials removed. All excavation is classified as earth excavation unless it otherwise meets the classifications provided below for unauthorized excavation, additional excavation, or rock excavation.
- B. Unauthorized Excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of the Owner's Engineer. Unauthorized excavation, as well as remedial work required by the Owner's Engineer, shall be at the Contractor's expense.
 - 1. Under footings, foundations, concrete slabs, retaining walls or other structures, fill unauthorized excavations to the proper elevations with Structural Fill as defined herein. Elsewhere, backfill and compact unauthorized excavations as specified for excavations of the same class, unless otherwise required.
- C. Additional Excavation:
 - 1. When excavation has reached required subgrade elevations, notify the Owner's Engineer, who will observe subgrade conditions.
 - 2. If unsuitable bearing materials are encountered at the required subgrade elevations, carry excavations deeper and to the lateral extent as required on the drawings and as required by the Owner's Engineer. Replace excavated material as required by the Owner's Engineer.
 - 3. Removal of unsuitable material and its replacement as specified is included in the base Scope of Work and shall be included in the lump sum price. Contractor shall promptly notify the Owner and the Engineer if unsuitable material quantities represent, in the Contractor's opinion, a differing subsurface or physical condition. Any corresponding adjustment to the Contract Price and/or Contract Times shall be made in accordance with the Contract Documents.

D. Rock Excavation:

1. Rock excavation in trenches and footing excavations includes removal and disposal of materials and obstructions encountered which cannot be excavated with a 1.0 cubic yard (heaped) capacity, 42-inch wide bucket on medium-size track-mounted hydraulic excavator equivalent to Caterpillar Model 215, rated at not less than 90HP flywheel power and 30,000 lb. drawbar pull. Trenches and footing excavations more than 10-feet in width are classified as open excavation.
2. Rock excavation in open excavations includes removal and disposal of materials and obstructions encountered which cannot be dislodged and excavated with modern track-mounted heavy-duty hydraulic excavating equipment without drilling or ripping. Rock excavation equipment is defined as Caterpillar Model No. 973 or No. 977K, or equivalent track-mounted loader, rated at not less than 170 HP flywheel power and developing 40,000-lb. breakout force (measured in accordance with SAE J732C).
3. Determination of rock excavation classification will be made by the Owner's Engineer. Typical of materials classified as rock are boulders 3.0 cubic yards or more in volume, solid rock, rock in ledges, and rock-hard cementitious aggregate deposits. Intermittent drilling or ripping performed to increase production and not necessary to permit excavation of material encountered will be classified as earth excavation. Do not perform rock excavation work until material to be excavated has been cross-sectioned and classified by the Owner's Engineer. Visual observation of the completed excavation may be made by the Owner's Engineer to modify the excavation classifications. Removal of rock excavation prior to classification by the Owner's Engineer shall be considered as earth excavation unless accepted by the Owner's Engineer in writing. Such excavation will be paid based on contract unit rates for this classification.
4. Rock payment lines (if applicable) are limited to the following:
 - a. Two feet outside of concrete work for which forms are required.
 - b. In footing excavations, one foot below bottom-of-footing elevation.
 - c. One foot below bottom-of-slab elevation.
 - d. One foot outside of the vertical walls of utility structures.
 - d. In pipe trenches, depth limits shall be 6 inches below the bottom of the pipe:

Depth from Ground Surface to Invert of Pipe	Pay Width (Pipe ID)	
	0 - 24"	Over 24"
0 to 12'	5'-0"	Pipe I.D. +3'-0"

12' to 20'	7'-0"	Pipe I.D. +7'-0"
Over 20'	9'-0"	Pipe I.D. +7'-0"

- e. Rock sloping across the width of trench shall have the top of rock established at the rock elevation over the centerline of the pipe.
- f. For all other site improvements not listed above, including but not limited to landscape plantings, and roadways, the payment line for rock removal shall be the subgrade for installation of the earthen components of the site improvement.

1.9 PERMITS, CODES, AND SAFETY REQUIREMENTS

- A. Comply with all rules, regulations, laws and ordinances of the municipality, the Commonwealth of Massachusetts, and other authorities having jurisdiction over the project site or work. All labor, materials, equipment, and services necessary to make the work comply with these requirements shall be provided by the Contractor without additional cost to the Owner.
- B. Comply with the provisions of the Manual for Accident Prevention in Construction of the Associated General Contractors of America, Inc., and the requirements of the Occupational Safety and Health Administration, United States Department of Labor.
- C. The Contractor shall obtain and pay for all permits and licenses required to the complete work specified herein and shown on the Contract Drawings.
- D. The Contractor shall not close or obstruct any street, sidewalk, or passageway without written permission from authorities having jurisdiction unless otherwise indicated on the Contract Drawings. The Contractor shall conduct his operations as to minimize interference with the use of roads, driveways, or other facilities near enough to the work to be affected by the work.
- E. The Contractor shall notify "Dig Safe" at 1-888-DIG-SAFE prior to commencing any excavation work.
- F. The Contractor shall provide police details when working in roadways as required by local jurisdictional authorities. The Contractor shall pay for all details.

1.10 PROTECTION OF EXISTING CONDITIONS

- A. All work shall be executed in such a manner as to prevent any damage to existing buildings, streets, curbs, paving, service utility lines, structures at the site and adjoining properties. Protect existing improvements from damage caused by settlement, lateral movements, undermining, washout, and other hazards created by earthwork operations.
- B. Locate and mark underground utilities to remain in service before beginning the work. All costs associated with protecting, maintaining, relocating, supporting, locating,

digging test pits, etc. for all utilities shall be included in the bid price. Protect and support all existing utilities to remain in service during operations. Do not interrupt existing utilities except when authorized in writing by authorities have jurisdiction unless otherwise indicated on the Contract Drawings.

- C. When an active utility line is exposed during construction its location and elevation shall be recorded on the Record Drawings by the Contractor and both the Owner's Engineer and the Utility Owner shall be notified in writing. Active utilities existing on the site shall be carefully protected from damage or relocated as required by the work.
- D. Inactive or abandoned utilities encountered during construction operations shall be removed or abandoned in place by completely filling with grout or Controlled Density Fill in a manner to prevent voids. The location of such utilities shall be recorded on the Record Drawings.
- E. Provide barricades, fences, lights, signs, and all other safety devices required to protect the public against injury.
- F. In case of any damage or injury caused in the performance of the work the Contractor shall, at his own expense make good such damage or injury to the satisfaction of, and without cost to, the Owner. Existing streets, sidewalks and curbs damaged during the project work shall be repaired or replaced to their condition prior to commencement of earthwork operations. The Contractor shall replace, at his own cost, existing benchmarks, observation wells, monuments, and other reference points, which are disturbed or destroyed.
- G. Acceptance of any of the Contractor's plans, design calculations and methods of construction shall not relieve the Contractor of the responsibility for the adequacy of the excavation lateral support system; preventing damage to existing or new structures, utilities and streets adjacent to excavations; the safety of persons working within excavated areas and the public at large; and excavation dewatering.

1.11 DRAINAGE

- A. The Contractor shall provide, at its own expense, adequate drainage facilities to complete all work items in an acceptable manner. Drainage shall be done in a manner so that runoff will not adversely affect construction procedures or cause excessive disturbance of underlying natural ground or abutting properties.

1.12 DUST CONTROL

- A. The Contractor shall employ dust control measures to minimize the creation of airborne dust during the entire construction process and to prevent visible airborne dust from leaving the site. Standard dust control techniques shall include watering-down the site, spreading hygroscopic salts, and routine street sweeping.

- B. The acceptable limit for total airborne dust will be based on the National Primary Ambient Air Quality Standard as promulgated by the U.S. Environmental Protection Agency and as referenced by the Massachusetts Department of Environmental Protection. The Contractor shall take all necessary steps to reduce and maintain dust levels below these levels.

1.13 DISPOSAL

- A. All excess and unsuitable excavated soil shall be removed from the site and legally disposed off-site by the Contractor at no additional cost to the Owner.

PART 2 PRODUCTS

1.14 BACKFILL MATERIALS

- A. **Common Fill:** Common Fill shall be well-graded, natural inorganic soil containing no stone greater than 6 inches maximum dimension and less than approximately 20 percent fines. The materials shall be free of trash, ice, snow, tree stumps, roots, and other organic and deleterious materials. It shall be free of plastic clays, of all materials subject to decay or other materials that will corrode piping or metals. Common Fill shall have a maximum dry density of not less than 110 pounds per cubic foot. It shall be of such a nature and character that it can be compacted to the specified densities. Topsoil shall not be considered Common Fill.
- B. **Gravel Borrow:** Gravel Borrow shall consist of inert mineral soil from a natural borrow source and shall be free from any form of manmade chemical constituents. Gravel Borrow shall consist of hard, durable stone and coarse sand, free from loam and clay, surface coatings, and deleterious materials. Gradation requirements shall be determined by AASHTO-T11 and T-27 and shall satisfy the requirements listed in MassDOT Specification Section M1.03.0, Type b.
- C. **Dense Graded Crushed Stone:** Dense Graded Crushed Stone shall satisfy the requirements listed in MassDOT Specification Section M2.01.7.
- D. **Structural Fill:** Structural Fill shall satisfy the requirements of Gravel Borrow or Dense Graded Crushed Stone, above.
- E. **Clean, Free-Draining Crushed Stone:** Crushed Stone shall satisfy the requirements listed in MassDOT Specification Section M2.01.4 (3/4-inch crushed stone) unless otherwise directed. Clean, free-draining, crushed Stone separated from the surrounding soil with Filter Fabric as specified herein may be used as Structural Fill where approved by the Owner's Engineer.
- F. **Sand:** Sand shall satisfy the requirements listed in MassDOT Specification Section M1.04.

- G. **Controlled Density Fill (CDF) Type 2E:** CDF Type 2E shall consist of a cementitious hard excavatable mixture of aggregate, Portland Cement, air entraining admixtures and water. The material shall be of the type specified in Massachusetts Highway Department 1995 Standard Specifications for Highway and Bridges and 2015 Supplemental Specifications, Type 2E. Controlled density fill shall be used to abandon existing utilities or as trench backfill material around structures (not including manholes and catch basins) as directed by the Owner's Engineer if required compaction cannot be achieved with conventional earthen fill materials. Controlled density fill shall also be used around the excavation support systems as directed by the Owner's Engineer.
- H. Stabilized Stone dust surfacing shall consist of a Decomposed Granite or Crushed aggregate with a 3/8" or smaller sieve size, bound with organic-lock Stabilizer by Kafka Granite, 550 East Hwy 153 Mosinee, WI 54455, or approved equal. Installation shall be per manufacturer's recommendations to a depth of min. 3", compacted.
- I. Existing available soil materials from on-site excavations may be reused as Common Fill or for Structural Fill provided the on-site materials meet the material requirements as described above.

1.15 GEOTEXTILE FABRICS

Provide geotextile fabrics as specified in Section 02071, GEOTEXTILE FABRIC

1.16 STABALIZER BINDER

Provide stabilizer "The Original Natural Binder" by Stabilizer Solutions Inc., (602) 225.5900 or approval equal. It shall be installed per manufacturer requietemtns.

PART 3 EXECUTION

1.17 GENERAL REQUIREMENTS

- A. The Contract Drawings indicate the proposed finish alignments, elevations, and grades of the work. Establish the line and grade in close conformity with the Contract Drawings. The Owner's Engineer, however, may make minor adjustments in the field as necessary due to conditions encountered.
- B. The Contractor is responsible for establishing construction phasing, means, and methods and interim grading and temporary conditions required to attain the finish product required by the Contract Documents. The Contractor is responsible for all construction, protection, movement, and maintenance of stockpiles. Establish and maintain suitable benchmarks and grade control to accurately perform the work.
- C. Temporary excavation support shall be provided in accordance with Section 02252,

TEMPORARY SUPPORT OF EXCAVATION.

- D. Dewatering shall be provided in accordance with Section 31 02240, DEWATERING.
- E. The Contractor is responsible to provide the finish grades as shown on the Contract Drawings. The Contractor shall provide temporary erosion control throughout the construction period to maintain all constructed lawns, and to protect all existing drains, catch basins, swales, from any debris or soil entering from excavation, backfill, or erosion. Contractor shall take whatever precautions necessary to accomplish temporary erosion control such as straw bales, silt fence, erosion control fabric, or pumping, at no additional cost to the Owner.

1.18 EXCAVATION

- A. Perform all excavations and of whatever materials encountered, in a manner as required to allow for placing of temporary earth support, dewatering, forms, installation of pipe and other work, and to permit access for the purpose of observing the work. Excavations shall be to such widths as will give suitable space for the required work. Bottoms of trenches and excavations shall be protected from frost and shall be firm, dry and in an acceptable condition to receive the work. Work shall not be placed on frozen surfaces nor shall work be placed on wet or unstable surfaces.
- B. The Contractor shall segregate and stockpile separately materials that are considered suitable for on-site re-use by the Owner's Engineer from unsuitable materials and materials requiring off-site disposal. Costs associated with off-site disposal of materials that are considered suitable for re-use by the Owner's Engineer, whether mixed with unsuitable materials or not, shall be borne by the Contractor.
- C. Cobbles and boulders within dense well-bonded soils or other competent, naturally deposited soils and/or any other features man-made, man-placed, or natural may be encountered during construction. The Contractor shall implement appropriate means and methods to advance the excavation through these materials and be prepared (equipment readily available) to remove these materials should they be encountered. No separate measurement or payment will be made for removal of these materials.
- D. All excavation shall be performed in the dry. Excavation and dewatering shall be accomplished by methods, which preserve the undisturbed state of the subgrade soils.
- E. The Contractor shall follow a construction procedure, which permits visual identification of stable ground. Where groundwater and/or surface water from the reservoir are encountered, the size of the open excavation shall be limited to that which can be handled by the Contractor's chosen method of dewatering and which will allow visual observation of the bottom and backfilling with the excavation in the dry.
- F. No excavation is permitted below a line drawn downwards at 2 horizontal to 1 vertical from the underside of the closest edge of any in-place footing or utility at a higher

elevation without providing adequate sheeting and bracing (designed by a Professional Engineer in Massachusetts and retained by the Contractor) to prevent movement of the in-place footing or utility.

- G. The final excavation to subgrade should be accomplished with a smooth bladed bucket or by hand.
- H. No excavated material shall be deposited or stockpiled at any time to endanger portions of new or existing structures, either by direct pressure or indirectly by overloading areas contiguous to the operation. If there is not sufficient area available for stockpiling within the limits of the project, the Contractor will be required to furnish his own area for stockpiling.
- I. When the plans require excavation in areas in close proximity to existing buildings, roads, structures and utilities it shall be the responsibility of the Contractor at his expense to use satisfactory means and methods to protect and maintain the stability of such roads, and structures.
- J. Temporary ditches shall be made as needed to drain off surface water to avoid damaged to areas of cut or fill. Such ditches shall be maintained as required for efficient operations, at no additional cost to the Owner.
- K. The Contractor shall place a minimum of 12 inches of crushed stone wrapped in Geotextile Fabric to stabilize areas which may become disturbed as a result of rain, foot traffic, surface water runoff or groundwater seepage pressures, all at no additional cost to the Owner. The Contractor also has the option of drying materials in-place and compacting to specified densities.
- L. Provide shoring, sheeting, and/or bracing at excavations, as required, to assure complete safety against collapse of earth at the side of excavations. Provide shoring of public utility lines where exposed in the excavations in accordance with rules and regulations of the local authorities, as no additional cost to the Owner.

1.19 SUBGRADE PREPARATION

- A. The subgrades for site improvements shall be shaped to lines, grades, and cross-sections shown on the Contract Drawings. Final excavation to subgrade elevation shall be performed in a manner to prevent softening or disturbance of subgrade soils.
- B. When excavations have reached prescribed depths, subgrades shall be observed by the Owner's Engineer prior to placement of overlying materials including fill, concrete forms, rebar, and pavement or hardscape subbase materials. Observations will include proof-rolling with at least 4 passes of fully loaded, ten cubic yard dump truck over the subgrade or other acceptable compaction equipment subject to the approval of the Owner's Engineer. Where inaccessible, the Owner's Engineer may use steel rod probe, compaction test results or other means to evaluate the suitability of the subgrade

- C. All soft, disturbed, or otherwise unsuitable material shall be removed to stable natural ground as required by the Owner's Engineer. The resulting area, and all other low sections, holes, or depressions shall be brought to the required grade with accepted backfill material and the entire subgrade shaped to line, grade and cross-section and thoroughly compacted according to the requirements of Section 1.21.
- D. The completed and approved subgrades upon which topsoil is to be placed, or pavements are to be installed, shall not be disturbed by traffic of other operations and shall be maintained in a satisfactory condition until the base and finished courses are placed. The storage or stockpiling of materials on finished subgrade will not be permitted.

1.20 FROST PROTECTION AND WET WEATHER:

- A. The Contractor shall, at its own expense, keep earthwork operations clear and free of accumulations of snow as required to carry out the work.
- B. The Contractor shall protect the subgrade beneath new structures, utilities and areas of grade increases from frost penetration when freezing temperatures are expected.
- C. Silty soils are highly susceptible to softening and disturbance by construction activity during wet or freezing weather. Subgrade protection is the responsibility of the contractor and special precautions and protective measures appropriate for the weather conditions during construction shall be used during earthwork and foundation construction to preserve the integrity of subgrades. Disturbed subgrades shall be repaired at the sole expense of the Contractor.

1.21 FILLING AND BACKFILLING

- A. Backfill Material: Unless otherwise specified or directed, the following backfill material shall be placed and compacted to lines, grades, and cross-sections shown on the Contract Drawings and observed by the Owner's Engineer:
 - 1. Common Fill for all landscaped areas around the site.
 - 2. Structural Fill within the zone-of-influence below structures, slabs, and foundations as defined herein, and within two feet of finished grade below proposed pavements and hardscapes.
 - 3. In areas where the bottom of the excavation is in fine sand and silt, and is below the groundwater table, crushed stone may be placed and compacted in maximum 12-inch layers to provide a working mat and drainage layer.
 - 4. Use of uncontaminated, processed, and recycled demolition materials as backfill is limited to areas outside structures, and outside the 'zone of influence' below foundations and slabs (as defined above). Each lift shall be thoroughly compacted to at least the minimum compaction requirements stated in Section G

B. Fill Placement: Backfill shall be placed and compacted to lines, grades, and cross-sections shown on the Contract Drawings and observed by the Owner's Engineer. Compaction testing shall be performed by the Contractor's Independent Testing Subcontractor at the minimum testing frequency and the minimum compaction requirements specified in Section G.

1. Maintain backfill material with a uniform moisture content, with no visible wet or dry streaking, between plus 3 percent and minus 3 percent of optimum moisture content. The final filled soil mass shall be as uniform as possible in lift thickness, moisture content, and effort required to compact soil mass. Backfill which is too wet for use shall be stockpiled, allowed to dry sufficiently, and reused by the Contractor at no additional cost to the Owner.
2. Unless larger lifts are approved by the Owner's Engineer based on the mass and vibratory capabilities of specific compaction equipment and observed performance by the Owner's Engineer during construction, the fill thickness for each lift shall not exceed in 9-inch loose thickness.
3. All fills shall be placed in horizontal layers. Fill shall not be placed following the natural contours of the ground. Fill shall be placed starting in the lowest areas working up to finish grades in horizontal layers in the manner specified herein. Each layer of fill shall be benched into the existing slope to avoid the formation of a shear plane.
4. All crushed stone shall be separated on the top and all sides from adjacent material by geotextile fabric as specified herein.

C. Trench Backfill

1. After the utility pipe installation has been inspected and approved by the Engineer, trenches shall be backfilled as soon as practicable with specified material. All trench backfilling shall be done with care.
2. Backfill material for pipe bedding shall be deposited in the trench, uniformly on both sides of the pipe, for the entire width of the trench to the springline of the pipe. The backfill material shall be placed by hand shovels, in layers not more than 6-inches thick in loose depth, and each layer shall be thoroughly and evenly compacted by tamping on each side of the pipe to provide uniform support around the pipe, free from voids.
3. The balance of backfill shall be spread in layers not exceeding 9-inches in loose depth. Each layer shall be thoroughly compacted by mechanical methods and shall contain no rock, stones, or boulders larger than 4 inches in their greatest dimension.
4. All trench backfilling shall be done with special care and must be carefully placed so as not to disturb the work at any time; if necessary, a timber grillage or other

suitable method shall be used to break the fall of the material. The moisture content of the backfill material shall be such that proper compaction will be obtained. Puddling of backfill with water will not be permitted. Backfill within areas to receive topsoil or pavement construction shall be made to grades required to establish the proper subgrade for the placement of topsoil or pavement base courses.

5. In backfilling trenches, each layer of backfill material shall be moistened and compacted to a density as specified herein.
6. Any trenches or excavations improperly backfilled or where settlement occurs shall be reopened, to the depth required for proper compaction, then refilled and compacted with the surface restored to the required grade and condition, at no additional expense to the Owner.
7. During filling and backfilling operations, pipelines will be checked by the Owner's Engineer to determine whether any displacement of the pipe has occurred. If the observation of the pipelines shows poor alignment, displaced pipe, or any other defects they shall be remedied in a manner satisfactory to the Engineer at no additional cost to the Owner.

D. Backfilling Against Structures:

1. Backfilling against masonry or concrete shall not be done until permitted by the Owner's Engineer. The Contractor shall not place backfill against or on structures until they have attained sufficient strength to support the loads (including construction loads) to which they will be subjected, without distortion, cracking or other damage.
2. Prior to placing backfill, the areas shall be cleaned of all excess construction material and debris and the bottom of excavations shall be in a thoroughly compacted condition. In general, use Structural Fill for backfilling against structures where the finished ground surface will be pavement or sidewalks; use Common Fill where the finished ground surface will be lawn or landscaped areas.
3. Symmetrical backfill loading shall be maintained. Special care shall be taken to prevent any wedging action or eccentric loading upon or against the structures. During backfilling operations, care shall be exercised that the equipment used will not overload the structures in passing over and compacting these fills. Backfill shall be placed in 9-inches in loose depth and each layer of backfill shall be compacted thoroughly and evenly using approved types of mechanical equipment. Each pass of the equipment shall cover the entire area of each layer of backfill.
4. In compacting and other operations, the Contractor shall conduct his operations in a manner to prevent damage to structures due to passage of heavy equipment over, or adjacent to, structures, and any damage thereto shall be made good by the Contractor at no additional expense to the Owner.

- E. After backfilling trenches and excavations, the Contractor shall maintain the surfaces of backfill areas in good condition to always present a smooth surface level with adjacent surfaces. Any subsequent settling over backfilled areas shall be repaired by the Contractor immediately, and such maintenance shall be provided by the Contractor for the life of this Contract, at no additional expense to the Owner.
- F. Uniformly shape the surfaces of all areas to be graded, to the lines and grades indicated on the Contract Drawings, and as directed, including excavated and filled sections, embankments and adjacent transition areas, and all areas disturbed as a result of the Contractor's operations. The finished surfaces shall be reasonably smooth, compacted, and free from surface irregularities.

G. Unfavorable Conditions:

1. In no case shall fill be placed over material that is frozen. In no case shall frozen soil or soil material containing frost, snow or ice be placed as backfill. No fill material shall be placed, spread, or rolled during unfavorable weather conditions. When work is interrupted by heavy rains, fill operations shall not be resumed until the moisture content and the density of the previously placed fill are as specified.
2. In freezing weather, a layer of fill shall not be left in an uncompacted state at the close of the day's operations. Prior to terminating work for the day, the final layer of compacted fill shall be rolled with a smooth wheeled roller to eliminate ridges of soil left by compaction equipment.

1.22 COMPACTION

- A. Compaction Requirements: The degree of compaction is expressed as a percentage of the maximum dry density of the material at optimum moisture content as determined by ASTM Test D 1557, Method C. The compaction requirements are as follows:

Area	ASTM D1557 Density Degree of Compaction
In the zone of influence below foundations, exterior slabs, and other structural features, including all Structural Fill	95%
Pavement, foundation, and slab-on-grade base course, including all Dense Graded Crushed Stone and Gravel Borrow	95%
Structural Fill backfill below pavements and hardscape areas	95%
Trench backfill - below pavements	95%

- below landscaped areas	92%
- below structures	95%
Landscape areas	92%

Clean, free-draining crushed stone used for backfilling should be placed and compacted to a firm and stable condition by a minimum 4 passes of using approved equipment, as observed by the Owner's Engineer.

B. Moisture Control:

1. Fill that is too wet for proper compaction shall be disked, harrowed, or otherwise mixed and dried to a proper moisture content to allow compaction to the required density. If fill cannot be dried within 24 hours of placement, it shall be removed and replaced with drier fill.
2. Fill that is too dry for proper compaction shall receive water uniformly applied over the surface of the loose layer. Sufficient water shall be added to allow compaction to the required density.

C. Compaction Testing

1. In-place density tests shall be made in accordance with ASTM D1556, D2922, or D2167 as the work progresses, to determine the degree of compaction being attained by the Contractor. Any corrective work required because of such tests, such as additional compaction, or a decrease in the thickness of layers, shall be performed by the Contractor at no additional expense to the Owner. Additional in-place density testing shall be made at the Contractor's expense by the geotechnical testing laboratory. Testing locations shall be selected by the Engineer unless otherwise noted.
2. In-place density tests shall be performed at a minimum according to the following:
 - a. Under all Foundations – At subgrade, each compacted lift and base course layer, one for each independent foundation or one every 200 square feet of each lift (whichever results in more tests).
 - b. Slabs-on-Grade – At subgrade, each compacted lift and base course layer, one every 1,000 square feet of each lift.
 - c. Pavements – At subgrade, each compacted lift and base course layer, one every 2,000 square feet of each lift.
 - d. Backfill of Trenches – one test for every 100 linear feet of each lift.
 - e. General Fill – one every 5,000 square feet of each lift.

3. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify, and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

1.23 DISPOSAL OF SURPLUS MATERIALS:

- A. Surplus excavated materials, which are acceptable to the Engineer, shall be used to backfill normal excavations in rock or to replace other materials unacceptable for use as backfill. Upon written approval of the Engineer, surplus excavated materials shall be neatly deposited and graded so as to make or widen fills, flatten side slopes, or fill depressions; or shall be neatly deposited for other purposes as indicated by the Owner, within its jurisdictional limits; all at no additional cost to the Owner.
- B. Disposal of all rubble shall be in accordance with all applicable local, state, and federal regulations.
- C. No excavated material shall be removed from the site of the work or disposed of by the Contractor unless approved by the Engineer.

END OF SECTION

SECTION 02329

TOPSOIL LOAM BORROW

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This Section covers all labor, materials, and equipment necessary to furnish and place Loam Borrow and all related work as indicated on the drawings and as herein specified.
- B. Existing on-site topsoil that has been stockpiled may be re-used provided it meets these specifications. The Contractor shall be solely responsible to determine if adequate quantities of on-site topsoil exist that may potentially be reused.

1.02 RELATED WORK:

- A. Section 02300, EARTHWORK
- B. Section 02290, SEEDING
- C. Section 02930, TREES, SHRUBS, GROWDCOVERS, AND LANDSCAPING

1.03 QUALITY ASSURANCE:

- A. For each source of loam, the Contractor shall send representative samples totaling approximately 10 pounds of Loam Borrow to an approved State-certified testing laboratory.
- B. Loam shall be subject to tests for Soluble Salts (1:2 soil-water ratio), Nitrogen (including nitrate and ammonium Nitrogen), Phosphorous, Potassium, Sulfate, Calcium, Magnesium, Aluminum, and Ferric Iron concentrations.
- C. Loam shall also be tested for heavy metals concentration, which shall include Arsenic, Boron, Cadmium, Zinc, Chromium, Copper, Lead, Manganese, and Nickel.
- D. Mechanical gradation (textural analysis) as per USDA Soil Classification System and determine Organic matter content and the pH (1:1 soil-water ratio).
- E. All tests shall be at the Contractor's expense. Laboratory test results shall state whether the Loam Borrow is acceptable as a planting medium, whether it needs to be amended, or if it fails to meet accepted requirements. Test results shall also include soil amendment and fertilizing recommendations and shall be forwarded to the Engineer at least 1 month before any loaming is to be undertaken.

- F. Samples and tests shall continue to be made at the Contractor's expense until Loam Borrow to be provided is found to be acceptable to the Engineer.

1.04 SUBMITTALS:

In accordance with requirements of general specifications, the Contractor shall submit the following:

- A. One (1) electronic copy or Six (6) hard copies of information detailing the soil amendments including limestone, fertilizers, organic material amendments, and the name and address of the supplier and origin of Loam Borrow shall be submitted to the Engineer for approval.
- B. One (1) electronic copy or Six (6) hard copies of soils test results shall be submitted to the Engineer for review.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. LOAM BORROW:

1. Loam Borrow shall consist of, fertile, friable natural topsoil, typical of productive soils in the vicinity, obtained from naturally well-drained areas that have never been stripped. Loam Borrow shall be reasonably free of stumps, roots, heavy or stiff clay, stones larger than 1/2-inch in diameter, lumps, coarse sand, noxious weeds, sticks, brush or other litter.
2. Loam Borrow shall be classified as a sandy loam by the USDA textural classification system as determined by sieve and pipette or hydrometer analysis. Loam Borrow shall have the following mechanical analysis:

<u>Textural Class</u>	<u>Percent of Total Weight</u>	<u>Avg. Percentage</u>
Sand (0.05 – 2.0mm range)	50 – 80	70
Silt (0.002 – 0.05mm range)	15 – 25	20
Clay (less than 0.002mm)	5 – 10	10

3. Loam Borrow shall contain not less than 4 percent or more than 7 percent organic matter as determined by the loss of weight by ignition of oven-dried samples. Test samples shall be oven-dried to a constant weight at a temperature of 230 degrees F.4. Loam Borrow shall not be excessively acid or alkaline, and shall not contain any phytotoxic materials or unacceptable concentration levels of any substance harmful to plant growth as determined by the soils testing laboratory. Loam Borrow shall have a pH value range between 5.0 and 6.5. Maximum soluble salt

index shall be 100. The electrical conductivity (EC2) of a 1:2 soil-water suspension shall be less than or equal to 1.0 millimhos/cm. Aluminum concentration levels shall be less than 200ppm.

5. Loam Borrow shall not be worked, excavated, or delivered in a frozen or muddy condition. Soil structure shall not be destroyed through excessive and unnecessary handling or compaction.
6. Existing on-site topsoil may be re-used as Loam Borrow provided it meets these specifications.
7. All amendments to Loam Borrow shall be approved by the Engineer and shall be made in accordance with recommendations from the soils testing laboratory for use of Loam Borrow as a plant-growing medium and these specifications.

B. LIMESTONE:

Lime shall be an approved agricultural limestone containing at least 50 percent total oxides (calcium oxide and magnesium oxide). The material will be ground such that 50 percent of the material will pass through a No. 100 mesh sieve and 98 percent will pass a No. 2 mesh sieve. Lime shall be uniform in composition, dry and free-flowing and shall be delivered to the site in the original sealed containers, each bearing the manufacturer's guaranteed analysis.

C. FERTILIZER:

1. Fertilizer shall be a complete, standard commercial fertilizer, homogeneous and uniform in composition, dry and free-flowing, and shall be delivered to the site in the manufacturer's original sealed containers, each bearing the manufacturer's guaranteed analysis and marketed in compliance with State and Federal Laws. All fertilizer shall be used in accordance with the manufacturer's recommendations.
2. For Fertilizers containing Nitrogen, at least 50 percent of the nitrogenous elements shall be Urea-form or derived from organic sources and contain no less than 3 percent water-soluble Nitrogen.
3. Superphosphate shall be composed of finely ground phosphate rock as commonly used for agricultural purposes, containing not less than 18 percent available phosphoric acid.

D. ORGANIC MATERIAL AMENDMENTS:

1. Organic compost shall be a standard commercial product comprised of fully decomposed, 100 percent plant-derived, natural organic matter. Its composition shall furnish ample water holding capacity and cation exchange capacity for the retention of plant nutrients. Compost shall be free of sticks, stones, weed seeds,

roots, mineral or other foreign matter and delivered air dry. It shall be free from excessive soluble salts, heavy metals, phytotoxic compounds, and/or substances harmful to plant growth and viability. Organic compost shall have an acidity range of 4.5 to 7.0 pH.

3. Humus shall be natural humus. Its composition shall furnish ample water holding capacity and cation exchange capacity for the retention of plant nutrients. Humus shall be free of sticks, stones, weeds, roots, mineral or other foreign matter and/or toxic substances harmful to plant growth and viability. It shall be low in wood content, free from hard lumps and excessive amounts of zinc and delivered air dry in a shredded or granular form. The acidity range for humus shall be 5.5 to 7.5 pH, and the organic matter content shall be not less than 85 percent, as determined by loss on ignition. The minimum water holding capacity shall be 200 percent by weight on an oven-dry basis.
4. Manure shall be well-rotted, leached, cow manure not less than 8 months or more than 2 years old. It shall be free of sawdust, shavings, or refuse of any kind and shall not contain more than 25 percent straw. It shall contain no substances harmful to plant growth. The Contractor shall furnish information regarding chemical disinfectants, if any, that may have been used in storage of the manure.

PART 3 - EXECUTION

- 3.01 After approval of rough grading, the sub-base shall be raked to a depth of 3 inches to remove stones, rock or other foreign materials 3-inches or larger in dimension. The Engineer shall inspect the work for approval, prior to placing of Loam Borrow.
- 3.02 Loam Borrow shall be placed and spread to the required depths over the locations approved by the Engineer.
- 3.03 Lime shall be uniformly applied in accordance with the soil testing laboratory recommendations, or as required by the Engineer, at a maximum rate of 100 pounds per 1000 square feet per application, in necessary quantities to achieve the pH range requirements for Loam Borrow.
- 3.04 Fertilizer shall be uniformly applied in accordance with the soil testing laboratory recommendations, or as required by the Engineer. At slopes exceeding 25 percent gradient, fertilizer shall be applied manually in a manner approved by the Engineer. Fertilizer shall not be applied between June 15 and August 31.
- 3.05 Loam Borrow shall be worked by tilling or power raking to a minimum depth of 3-inches, thoroughly incorporating the lime and fertilizer into the soil. The Loam Borrow shall then be raked until the surface is finely pulverized and smooth and compacted with rollers, weighing between 75 and 100 pounds per linear foot of tread, to an even surface conforming to the prescribed lines, grades and depths indicated on the plans.

END OF SECTION

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TOPSOIL LOAM BORROW

SECTION 02370

EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.01 SCOPE OF WORK:

- A. Furnish all labor, materials, tools and equipment, and perform all operations necessary for erosion and sedimentation control work indicated on contract drawings and as specified herein.

1.02 RELATED WORK:

- A. Section 01562, DUST CONTROL.
- B. Section 01570, ENVIRONMENTAL PROTECTION
- C. Section 02071, GEOTEXTILE FABRICS

1.03 PROJECT CONDITIONS:

- A. Earthmoving activities in the project area shall be conducted in such a manner as to prevent accelerated erosion and the resulting sedimentation.
- B. The Contractor shall implement and maintain erosion and sedimentation control measures as shown on the contract drawings or as required by the Owner or Engineer from the start of construction until provisional acceptance of seeded areas, to effectively prevent accelerated erosion and sedimentation.

1.04 SUBMITTALS:

- A. The Contractor shall submit to the Engineer certification that the materials used for silt fence and straw-wattle construction meet the specifications.

1.05 GENERAL METHODOLOGY:

- A. Erosion and sedimentation control methods shall consider all factors which contribute to erosion and sedimentation including, but not limited to, the following:
 - 1. Topographic features of the Project area.
 - 2. Types, depth, slope and areal extent of the soils.

3. Proposed alteration of the area.
4. Amount of run-off from the Project area and the upgradient watershed areas.
5. Staging of earthmoving activities.
6. Temporary control measures and facilities for use during earthmoving.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Straw wattle shall consist of 99.9% weed-free wheat, oat, barley, or rice straw, compacted. Diameter may vary from $\pm 13\%$. Wattle netting is made of non-woven photodegradable HDPE (high density polypropylene) with a 1-year UV inhibitor.
- C. Silt Fence shall be a woven polypropylene and/or polyester material, which meets or exceeds the minimum average roll values requirements tabulated below:

Fabric Property	Test Method	Fabric Requirement
Tensile strength, lbs.	ASTM D-4632 Grab	100 minimum
Elongation at 50% minimum tensile strength	ASTM D-4632 Grab	50% maximum
Permittivity, sec^{-1}	ASTM D-4491	0.1 minimum
Apparent opening size, mm	ASTM D-4751	0.84 maximum
Ultraviolet degradation at 500 hours	ASTM D-4355	minimum 70% strength retained

- C. Mulch, if used to protect the hydroseed from erosion, shall consist of cured straw free from primary noxious weed seeds, twigs, debris and rough or

woody materials. Mulch shall be free from rot or mold and shall be acceptable to the Engineer or Owner. Alternately, mulch shall be specially processed cellulose homogeneous fiber containing no growth or germination-inhibiting factors. Processed cellulose fiber shall be manufactured in such a manner that after addition and agitation in slurry tanks with water, the fibers in the material become uniformly suspended to form a slurry when sprayed on the ground. The material shall allow homogeneous absorption and percolation of moisture. The manufacturer to show the air-dry weight content shall mark each package of the cellulose fiber. Mulch shall be utilized on all newly graded subgrade and topsoil areas that cannot be seeded within five (5) days.

PART 3 - EXECUTION

3.01 CONSTRUCTION SEQUENCE:

- A. Construction of erosion control measures as depicted on drawings will be completed and inspected prior to any site work.
- B. Sediment barriers shall be used at locations shown on the drawings. Sediment barriers are temporary berms, diversions, or other barriers that are constructed to retain sediment on-site by retarding and filtering stormwater runoff.
- C. All temporary erosion control measures will be maintained throughout the course of site construction activities until provisional acceptance of the site vegetation by the Engineer or Owner, at which time the Contractor shall remove all remaining temporary erosion control structures, and properly dispose of accumulated sediment on-site in areas approved by the Owner.
- D. The Engineer or Owner may order additional erosion and sediment controls be installed. The Contractor shall comply with Engineer or Owner's request and immediately install the required controls.
- E. The contractor shall inspect all erosion control measures after any type of storm event to ensure they are in proper working order.

3.02 CONSTRUCTION METHODS:

- A. Silt fences and/or straw wattles shall be installed at the site down gradient of work areas as required by Owner or Engineer in the field. The silt fence shall be installed in accordance with manufacturer's instructions. Straw wattles shall be placed at locations shown on the contract drawings, where erosion is noticed throughout the construction duration or approved by the Engineer. The base of all straw wattles and silt fencing shall be embedded to the depths shown on the contract drawings.

- B. Straw mulch, if used, shall be applied at a rate of 100-lbs/1000 ft².
- C. On slopes, the Contractor shall provide protection against washouts by an approved method. Any washout, which occurs either in the Contractor's work area or in areas topographically below his work, shall be regraded and reseeded at the Contractor's expense until an accepted vegetative stand is established.

END OF SECTION

SECTION 02371

RIPRAP

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This Section covers riprap for slope protection, drainage swales, level separator bays, pipe extension protection and pipe ends, complete.
- B. Grading and compaction of earth slopes and other slope preparation for the riprap are included under other sections of the specification.

1.02 RELATED WORK:

- A. Section 02300, EARTHWORK.
- B. Section 02071, GEOTEXTILE FABRIC.

1.03 REFERENCES:

- A. The following standard forms a part of these specifications and indicates minimum standards required:
 - 1. Commonwealth of Massachusetts Highway Department Standard Specifications for Highways and Bridges.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Stone for pipe ends, drainage swales, level separator bays, and pipe extension protection shall be Reused from Existing Stone on site. Any additional stone required shall be angular and shall be in accordance with MHD Specification Section M2.02.3, Stone for Pipe Ends. The stone shall be light and dark beige in color.
- B. GEOTEXTILE FABRIC:

Geotextile fabric shall be Soil Reinforcement Fabric as specified in Section 02071, GEOTEXTILE FABRIC.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Geotextile fabric shall be installed where shown on the drawings, prior to placing the riprap.
- B. Riprap for slope protection and pipe ends shall be placed on the prepared slope or area in a manner which will produce a reasonably well-graded mass of stone with the minimum practicable percentage of voids and a maximum void of 12 inches.
- C. Riprap shall be placed to its full course thickness in one operation and in such a manner as to avoid displacing the underlying material. Placing of riprap in layers or by dumping into chutes or by other similar methods likely to cause segregation will not be permitted.
- D. Riprap stones shall be placed and distributed such that there will be no large accumulation of either the larger or smaller stones in any given area.
- E. It is the intent of these specifications to produce compact riprap protection in which all required sizes of stone are placed in the proper proportions. Hand placing or rearranging of individual stones by mechanical equipment shall be utilized to the extent necessary to secure the desired results.
- F. All proposed riprap areas shall be a minimum 12" deep.

END OF SECTION

SECTION 02515

SERVICE CONNECTIONS (WATER SERVICES)

PART 1 - GENERAL

1.01 WORK INCLUDED:

This section covers the furnishing and installation of new water service connections and the repair, replacement, and/or transfer of existing water service connections as shown on the drawings, as specified herein, and as required by the Engineer.

1.02 RELATED WORK:

- A. Section 02080, DUCTILE IRON PIPE AND FITTINGS
- B. Section 02745, PAVING
- C. Section 02290, SEEDING
- D. Section 02329, TOPSOIL LOAM BORROW

1.03 REFERENCES:

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

American Society for Testing and Materials (ASTM)

ASTM	B88	Seamless Copper Water Tube
ASTM	B584	Copper Alloy Sand Castings for General Applications
ASTM	D2737	Polyethylene (PE) Plastic Tubing

American Water Works Association (AWWA)

AWWA	C800	Water-Service Line Fittings
AWWA	C651	Disinfecting Water Mains
AWWA	C901	Polyethylene Pressure Pipe & Tubing, 1/2-inch through 3-inch for Water Service

Federal Specifications (FS)

FS	WW-T-799C	Tube, Copper, Seamless
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1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01330
SUBMITTALS, SUBMIT THE FOLLOWING:

Manufacturer's literature of the materials of this section for review.

PART 2 - PRODUCTS

2.01 SERVICE PIPING:

Note: Contractor shall refer to city of Worcester Standards for all service piping and fitting standards as superseding the below specifications.

- A. Piping for buried copper water services shall be continuous Type K annealed seamless copper water tubing conforming to ASTM B88 Standard Specification for Seamless Copper Water Tube or U.S. Federal Specification WW-T-799C for Tube, Copper, Seamless. Tubing shall be 1-inch diameter unless otherwise indicated.
- A. Piping for buried polyethylene (PE 4710) water services shall conform to ASTM D2737 and be as specified in AWWA C901. Polyethylene piping shall be designed for 200 psi minimum service and tested at 330 psi for 1,000 hours or greater. The tubing shall be copper O.D. size and be suitable for use with standard industry brass compression fittings without special adapters. Stainless steel insert stiffeners shall be provided for use with all compression joint connections.
- B. Couplings, if required, for existing to new service pipe connections shall have compression connections on the inlet and compression connections on the outlet. Couplings shall be made of brass as specified in AWWA C800. All brass components that come into contact with potable water shall be made from either CDA/UNS Brass Alloys C89520 or C89833 and shall not contain more than twenty five hundredths of one percent (0.25% or less) total lead content by weight. The lead leach limit of the coupling shall be 5 parts per billion (ppb). Couplings shall be NSF/ANSI 61 Annex F and Annex G and NSF/ANSI 372 certified by an ANSI accredited organization and shall be stamped or embossed with a mark or name indicating that the product is manufactured from a low-lead alloy, as specified above.

2.02 CORPORATION STOPS:

- A. Corporations stops shall be made of brass as specified in AWWA C800. All brass components that come into contact with potable water shall be made from either CDA/UNS Brass Alloys C89520 or C89833 and shall not contain more than twenty five hundredths of one percent (0.25% or less) total lead content by weight. The lead leach limit of the corporation stops shall be 5 ppb. Corporation stops shall be NSF/ANSI 61 Annex F and Annex G and NSF/ANSI 372 certified by an ANSI accredited organization and shall be stamped or embossed with a mark or name indicating that the product is manufactured from a low-lead alloy, as specified above.

- B. Corporation stops shall be approved for use with City of Worcester Standard pipe materials. The inlet shall have AWWA taper thread (CC) connections and the outlet shall have compression connections (Per City of Worcester Standards)
- C. Service clamps shall be installed with all corporation stops 2-inches and larger in size and with all corporation stops installed in PVC pipe. Clamps shall be all bronze, ductile iron or stainless steel, double strap, AWWA taper thread (CC) with O-ring seal.
- D. Corporation stops shall be by Ford Meter Box Co., Inc., Wabash, IN; Red Hed Manufacturing Co., Lincoln, RI; Mueller Co., Decatur, IL; or approved equal (Per City of Worcester Standards).

2.03 CURB STOPS:

- A. Curb stops shall be of brass as specified in AWWA C800. All brass components that come into contact with potable water shall be made from either CDA/UNS Brass Alloys C89520 or C89833 and shall not contain more than twenty five hundredths of one percent (0.25% or less) total lead content by weight. The lead leach limit of the curb stops shall be 5 ppb. Curb stops shall be NSF/ANSI 61 Annex F and Annex G and NSF/ANSI 372 certified by an ANSI accredited organization and shall be stamped or embossed with a mark or name indicating that the product is manufactured from a low-lead alloy, as specified above.
- B. Curb stops shall be per City of Worcester Standards connections.
- C. Curb stops shall be by Red Hed Manufacturing Co., Lincoln, RI; Ford Meter Box Co., Inc., Wabash, IN; Mueller Co., Decatur, IL; or approved equal (Per City of Worcester Standards).

2.04 CURB BOXES:

- A. The cast iron box shall be the sliding Buffalo type with Arch* pattern or Minneapolis* pattern base (Per City of Worcester Standards). Minimum inside diameter of the upper section shall be 1-1/2-inch for 3/4-inch and 1-inch curb stops and 2-inch for 1-1/2-inch and 2-inch curb stops. Curb box lid shall have brass pentagonal nut* or shall be Erie pattern*.
- B. Boxes shall be equipped with 30-inch stationary extension rods with pinned connections to the curb stop. (Per City of Worcester Standards)

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Where new water mains are being installed and existing water services are to be transferred to the new main, the Contractor shall discontinue the existing water services by shutting down the corporation stop at the old water main, unless specifically

otherwise required by the Engineer. The Contractor shall take special care to minimize the interruption of existing water service.

- B. The Contractor shall tap a new corporation stop, cut the existing service piping and connect the new service piping to the old service piping using an approved coupling at a point between the main and the existing curb stop and box.
- C. Where transfers are to be made and the existing curb stop and box cannot be utilized or a new curb stop and box is required, the Contractor shall connect the new service piping to the existing service piping using an approved coupling approximately 12-inches from the curb stop on the building side of the stop.
- D. Where transfers are being made and the existing service is of lead, galvanized steel, or iron, the service shall be replaced to the curb stop and box unless otherwise required. If required, the curb stop and box shall be replaced as specified above.
- E. Curb stops and boxes shall be set plumb, flush with the ground or paved surface, and centered with the box located directly over the stop. The box shall be set on a concrete block or flat stone. Earth fill shall be carefully tamped around the boxes to a distance of 4 feet on all sides of the box or to the undisturbed face of the trench, if less than 4 feet.
- F. Curb stops shall be operational and accessible at all times during construction and warranty period. The Contractor shall verify the proper operation of all curb stops in the presence of the Engineer and/or Owner following completion of the project and prior to the acceptance of substantial completion.
- G. All services shall be installed at **5 feet 0 inches of cover** unless otherwise required by the Engineer.
- H. Service connections shall be tested and disinfected in accordance with AWWA standards.

END OF SECTION

SECTION 02516

BACKFLOW PREVENTER

PART 1 - GENERAL

1.01 SCOPE OF WORK:

- A. The Contractor shall install Backflow Preventer and furnish and install Pressure Regulator in place in accordance with the Contract Drawings.
- B. Service lines, internal features and other related water work shall be accomplished in accordance with the requirements this specification and all relevant details and plans.

1.02 REFERENCE STANDARDS AND SPECIFICATIONS:

- A. Reference to specific standards, specifications and tests of the following technical societies, organizations, and governmental bodies may be made in the contract documents.
 - 1. AASHTO - American Association of State Highway and Transportation Officials (tests or specifications). AASHTO or AASHO
 - 2. ASTM - American Society for Testing and Materials.
 - 3. Mass. Standard Specs. - Latest edition of the Standard Specifications for Highways, Bridges and Waterways, 1988 Edition, the Commonwealth of Massachusetts, Department of Public Works, hereinafter referred to as "the Massachusetts Standard Specifications."
 - 4. AWWA - American Waterworks Association.

1.03 SHOP DRAWINGS:

- A. Submit shop drawings and manufacturer's cuts per Submittal Requirements of these Specifications.

PART 2 – MATERIALS:

2.01 BACKFLOW PREVENTER & PRESSURE REGULATOR IN CABINET

- A. All backflow preventers shall be supplied by the town and will be 2” Reverse Pressure devices, Watts #009-M2Q2, or approved equal.
- B. All pressure regulators shall be standard and conform to AWWA standards.

2.02 CEMENT CONCRETE

- A. Forms, reinforcing, and cement concrete cast in place for all backflow preventer/electric control cabinets shall conform to Section 03300.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Include all necessary transportation, shipping and handling as necessary to properly and completely install the backflow preventer and pressure regulator in accordance with the contract drawings, town, and manufacturer requirements.

3.02 CONCRETE BASE

- A. Install concrete base in conformance with the Contract Details. Pitch at edges for positive drainage.

END OF SECTION

SECTION 02518

TRACER TAPE

PART 1 - GENERAL

1.01 WORK INCLUDED:

This section covers the furnishing, handling and installation of tracer tape, as called for on the drawings.

1.02 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01330 SUBMITTALS, SUBMIT THE FOLLOWING:

- A. Manufacturer's literature on the materials, colors and printing specified herein, shall be submitted to the Engineer for review.
- B. Tape samples shall also be submitted to the Engineer for review.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

Tracer tape shall be by Reef Industries, Houston, TX; Empire Level, Mukwonago, WI; Pro-Line Safety Products Co., W. Chicago, IL; or approved equal.

2.02 TRACER TAPE:

- A. Tracer tape shall be at least 3-inches wide.
- B. Tracer tape for non-ferrous pipe or conduit shall be constructed of a metallic core bonded to plastic layers. The metallic tracer tape shall be a minimum 5-mil thick and must be locatable at a depth of 18-inches with ordinary pipe locaters.
- C. Tracer tape for ferrous pipe or conduit shall consist of multiple bonded plastic layers. The non-metallic tracer tape shall elongate at least 500% before breaking.
- D. The tape shall bear the wording: "BURIED DRAIN LINE BELOW" (with "DRAIN" replaced by "WATER", "SEWER", "ELECTRICAL", "GAS", "TELEPHONE", or "CHEMICAL" as appropriate), continuously repeated every 30-inches to identify the pipe.
- E. Tape colors shall be as follows, as recommended by the American Public Works Association (APWA):

Electric	Red
Gas & Oil	Yellow
Communications	Orange
Water	Blue
Sewer & Drain	Green
Chemical	Red (not APWA)

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Tracer tape shall be installed directly above the pipe or conduit it is to identify, approximately 12-inches below the proposed ground surface.
- B. The Contractor shall follow the manufacturer's recommendations for installation of the tape, as approved by the Engineer.

END OF SECTION

SECTION 02622

PERFORATED POLYETHYLENE DRAINAGE PIPE

PART 1 - GENERAL

1.01 WORK INCLUDED:

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

1.02 RELATED WORK:

- A. Section 02300, EARTHWORK
- B. Section 02252, SUPPORT OF EXCAVATION

1.03 REFERENCES:

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

American Society for Testing and Materials (ASTM)

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

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

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

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01330 SUBMITTALS, SUBMIT THE FOLLOWING:

- A. Manufacturer's literature on the materials of this Section.
- B. Manufacturer's certification that the product was manufactured, tested, and supplied in accordance with this specification shall be furnished to the Engineer on request.

1.05 DELIVERY, STORAGE AND HANDLING:

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

PART 2 - PRODUCTS

2.01 GENERAL

- A. This Section applies to high density polyethylene corrugated pipe with an integrally formed smooth interior. It is applicable to nominal sizes 4- through 36-inch diameter.
- B. The nominal size for the pipe and fittings is based on the nominal inside diameter of the pipe.
- C. The pipe and fittings shall be free of foreign inclusions and visible defects. Fittings may be either molded or fabricated. Fittings supplied by manufacturers other than the supplier of the pipe shall not be permitted without the approval of the Engineer. The ends of the pipe shall be cut squarely and cleanly so as not to adversely affect joining.
- D. When perforated pipe is specified, the perforations shall be cleanly cut so as not to restrict the inflow/outflow of water and uniformly spaced along the length and circumference of the pipe. Dimensions of the perforations shall be as stated in AASHTO M252.
- E. Joints shall be made with split couplings, corrugated to engage the pipe corrugations, and shall engage a minimum of 4 corrugations, 2 on each side of the pipe joint. Where required by the Engineer, a neoprene gasket shall be utilized with the coupling to provide a soil-tight joint.
- F. Pipe sizes 4- through 10-inches shall conform to AASHTO M252. Pipe sizes 12- through 36-inches shall conform to AASHTO M294.
- G. Pipe sizes 4- through 6-inches shall conform to ASTM F405. Pipe sizes 8- through 15-inches shall conform to ASTM F667.

2.02 SYNTHETIC PROTECTIVE WRAP:

- A. Provide a synthetic protective piping wrap where called for in the details that will admit fine silt and clay and retain sands and coarse silts.
- B. The synthetic protective wrap shall have the following characteristics:
 - 1. Non-toxic, non-irritating.
 - 2. Inert in soil.
 - 3. Non-biodegradable.
 - 4. Resist alkalis and acids.
 - 5. Not affected by freezing or thawing.
 - 6. Air permeability shall be a minimum of 500 cubic feet per minute per square foot.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. The pipe shall be installed as shown on the drawings and in accordance with the requirements of ASTM D2321.
- B. Installation of pipe and protective wrap shall be per the manufacturer's recommendations as approved by the Engineer.
- C. If protective wrap is not scheduled for immediate installation, the Contractor shall protect the pipe from sunlight ultra violet rays.
- D. Material for pipe support is specified under Section 02300, EARTHWORK.
- E. Backfill shall be as shown on plans and specified in Section 02300.
- F. Backfill material shall be compacted to 95 percent of maximum density according to ASTM D 1557.

END OF SECTION

SECTION 02624

HIGH DENSITY POLYETHYLENE PIPE (HDPE)

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This Section covers furnishing, handling, laying, joining and installation of HDPE piping, fittings and appurtenances.
- B. The Contractor shall furnish and install the various pipelines and appurtenant work as indicated on the Contract Drawings and as specified herein, or as reasonably required to produce a complete, proper, and functional installation in accordance with the intent of these Contract Documents.

1.02 RELATED WORK:

- A. Section 02300, EARTHWORK
- B. Section 02631, PRECAST MANHOLES AND CATCH BASINS

1.03 REFERENCES:

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

American Water Works Association (AWWA)

AWWA	C906-90	Polyethylene PE Pressure Pipe and fittings, 4 in. through 63 in., for Water Distribution
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American Society for Testing and Materials (ASTM)

ASTM	D1248	Specifications for Polyethylene Plastics Molding and Extrusion Materials.
ASTM	D2837	Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.
ASTM	D3350	Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
ASTM	F714	Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.

Plastic Pipe Institute (PPI)

PPI TR-3 Policies and Procedures for Developing Hydrostatic Design Stresses
for Thermoplastic Pipe Materials.

1.04 QUALITY ASSURANCE:

- A. All pipe and fittings shall be inspected and tested at the factory as required by the standard specifications to which the material is manufactured. The Contractor shall furnish in duplicate to the Engineer sworn certificates providing evidence of such tests.
- B. The Owner reserves the right to have any or all pipe, fittings, and special castings inspected and/or tested by an independent service at either the manufacturer's plant or elsewhere. Such inspection and/or tests shall be at the Owner's expense.
- C. Deflections in horizontal alignment will not be permitted at joints without written consent of the Engineer. If approved, deflections shall not exceed one-half the manufacturer's recommendation.
- D. When requested by the Engineer, the Contractor shall ensure that a qualified representative of the manufacturer shall be present at the jobsite for the first day of pipe laying, to assure that proper procedures are followed.
- E. The Engineer shall be notified in advance when the location of an existing pipeline conflicts with the proposed location of the Work.
- F. Pipe and fittings of the same type shall be products of a single manufacturer.
- G. All piping shall be of the type and size shown on the drawings and described in this section of the Specifications.

1.05 DELIVERY, STORAGE, AND HANDLING:

- A. Pipes and fittings shall be carefully handled when loading and unloading. Pipes shall be lifted by hoists or lowered on skidways in such a manner as to avoid shock.
- B. HDPE pipe shall be protected from exposure to sunlight (unless restrained in racks) to prevent bowing of the pipe due to expansion and contraction. Such protection shall consist of canvas covering, or other material, as recommended by the manufacturer. Plastic sheets, which may allow excessive temperatures to develop where the pipe is stored, shall not be used.

1.06 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

- A. Shop drawings shall consist of manufacturer's scale drawings or catalog cuts including descriptive literature and complete characteristics, specifications, and code requirements. Shop drawings shall be submitted for the HDPE pressure pipe, type of joints, fittings, and couplings, in accordance with the specifications.

PART 2 - PRODUCTS

2.01 HIGH-DENSITY POLYETHYLENE (HDPE) PIPE AND FITTINGS:

- A. All HDPE pipe and fittings shall be manufactured from virgin polyethylene resin, PE 3408, and shall conform to ASTM D3350.
- B. All polyethylene fittings shall have a pressure rating equal to or higher than the pressure rating of the pipe.
- C. All HDPE fittings at the manholes shall have ANSI Class 150 316 stainless steel backing rings.
- D. Unless noted otherwise, all pipe and fittings shall be SDR 21 rated at 80 psi.
- D. All piping and valves shall be supported by the size and style supports shown in the drawings, or an approved equal.
- F. Pipe shall be homogeneous throughout; free from voids, cracks, and other defects; as uniform as commercially practicable in color, density, and other physical properties.
- G. Pipe surfaces shall be free from nicks, scratches, and other blemishes. The joining surfaces of pipe shall be free from gouges and other imperfections that could cause leakage at joints.
- H. Fittings for transition from the HDPE main to the PVC building service shall be one of the following, or an approved equal, as recommended by the pipe manufacturer:
 - 1. Electrofusion saddles as manufactured by Central Plastics.
 - 2. Conventional fusion saddles as manufactured by Central Plastics, Philips Driscopipe, or Plexco.
 - 3. INSERTA TEE as manufactured by Fowler Manufacturing Co.

For fused saddles, transition couplings for HDPE to PVC shall be submitted for approval.

2.02 PERFORATED HIGH-DENSITY POLYETHYLENE (HDPE) PIPE:

- A. All perforated HDPE pipe shall be manufactured and have the characteristics of the solid HDPE pipe specified above and meet perforation requirements of ASTM F810.

- B. Pipe perforations shall consist of two ¼-inch diameter holes, 5-inches o.c throughout the length of the pipe. The holes shall be drilled on the bottom side of the pipe, at 60 degrees on each side of the vertical centerline.

PART 3 - EXECUTION

3.01 INSPECTION BEFORE INSTALLATION:

- A. Each length of pipe and each fitting shall be carefully inspected prior to being lowered into the trench. All materials not meeting the requirements of these specifications, or otherwise found defective or unsatisfactory by the Engineer, shall be rejected and immediately marked and removed from the jobsite by the Contractor.
- B. Bedding, sub-bedding, and other trench conditions shall be carefully inspected prior to laying pipe. All conditions shall be made available to the Engineer for inspection.

3.02 PIPE INSTALLATION:

- A. Pipe interiors, fitting interiors, and joint surfaces shall be thoroughly cleaned prior to installation. Pipes and fittings shall be maintained clean. For HDPE pipe, a clean cotton cloth shall be employed for cleaning; polyester-type materials shall not be used as they may melt during fusion procedures.
- B. Pipes shall be installed in the locations and to the required lines and grades shown on the drawings and provided in these Specifications, using an approved method of control.
- C. Excavations shall be maintained free of water during the progress of the Work. No pipes shall be laid in water, nor shall there be any joints made up in water.
- D. If any defective pipe is discovered after being placed, removal and replacement with sound pipe will be required at no additional cost to the Owner.

3.03 HDPE PIPE JOINING:

- A. HDPE pipe should be joined by butt-fusion methods, having a completely uniform and monolithic pipe interior according to the fusion joining procedures as instructed by the manufacturer.
- B. Each individual performing fusion joining shall have had at least one year of experience in the use of the fusion procedure.
- C. Inspection of joints shall be performed by a person qualified by training or experience to evaluate the acceptability of HDPE joints made under the applicable joining procedures.

- D. The pipe sections shall be joined at ground level to a length recommended by the manufacturer, such that when pulling the pipe into position alongside the trench, maximum allowable stress is not exceeded. Use appropriate materials and equipment, as recommended by the HDPE pipe manufacturer, when pulling butt-fused pipe sections alongside the trench, to prevent pipe damage.
- E. HDPE pipe boots shall be provided on all entrance piping in manholes.

END OF SECTION

SECTION 02629

RAISING AND/OR RESETTING OF MANHOLE FRAME AND COVER

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This Section covers raising and/or resetting of sewer manhole frame and cover. The work includes raising, resetting, and/or adjusting of structures to line and grade.

1.02 RELATED WORK

- A. Section 01014, SCOPE AND SEQUENCE OF WORK
- B. Section 02631, PRECAST MANHOLES AND CATCH BASINS

PART 2 - PRODUCT

2.01 SEWER COVER:

- A. The Manhole cover shall be supplied by East Jordan Iron Works, Brockton, MA., Catalog Number (frame and cover) 1056Z UND Frame LC239 or approved equal (approximate weight of frame and cover = 450 pounds).

PART 3 - EXECUTION

3.01 RAISING AND/OR RESETTING OF MANHOLE FRAME AND COVER:

- A. In areas where bituminous pavement exists, existing sewer manhole castings shall be raised to the proper grade where indicated on the contract drawings or as required by the Engineer.
- B. Cut around manhole castings a minimum of 8-inches from casting. Excavate and remove old masonry to such a depth as required by the Engineer and rebuild masonry below the bottom of the casting. Backfill with mortar or bituminous concrete. Place high, early strength concrete or bituminous concrete collar, as required, to approximately 1-1/2-inches below the raised casting grade.
- C. The Contractor shall provide a top course approximately 1-1/2-inches thick and shall match existing surrounding grades and pavement materials. The Contractor shall provide a watertight seal between the masonry work and the casting.

3.02 INSTALLATION OF MANHOLE FRAME AND COVER:

- A. Where necessary, replacement covers, and frames shall be furnished and installed in-place by the contractor. The cover and frame shall provide a watertight seal.

END OF SECTION

SECTION 02631

PRECAST MANHOLES AND CATCH BASINS

PART 1 - GENERAL

1.01 WORK INCLUDED:

This Section covers all precast manholes, catch basins, and outlet control structures complete, including, but not limited to, bases, walls, cones, mortar, inverts, frames and covers.

1.02 RELATED WORK:

- A. Section 02300, EARTHWORK
- B. Section 02745, BITUMINOUS CONCRETE PAVEMENT
- C. Section 02775, CONCRETE SIDEWALKS
- C. Section 03302, FIELD CONCRETE

1.03 SYSTEM DESCRIPTION:

- A. Precast sections shall conform in shape, size, dimensions, materials, and other respects to the details indicated on the drawings or as required by the Engineer.
- B. All manholes, catch basins, and outlet control structures shall have concrete bases. Concrete bases shall be precast unless otherwise specified. Invert channels shall be formed of brick and mortar upon the base.
- C. Catch basins shall have a 4-foot deep sump unless otherwise specified.
- D. Riser and cone sections shall be precast concrete.

1.04 REFERENCES:

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

American Society for Testing and Materials (ASTM)

ASTM A48 Gray Iron Castings

ASTM C32 Sewer and Manhole Brick

ASTM C144	Aggregate for Masonry Mortar
ASTM C207	Hydrated Lime for Masonry Purposes
ASTM C478	Precast Reinforced Concrete Manhole Sections
ASTM C923	Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes
ASTM C1244	Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test.

American Association of State Highway and Transportation Officials (AASHTO)

AASHTO M198 Joints for Circular Concrete Sewer and Culvert Pipe Using
Flexible Watertight Gaskets

Occupational Safety and Health Administration

OSHA 29 CFR 1910.27 Fall Prevention Protection

1.05 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01330
SUBMITTALS, SUBMIT THE FOLLOWING:

- A. Manufacturer's literature of the materials of this section.
- B. Test reports as required by the Engineer.

PART 2 - PRODUCTS

2.01 PRECAST CONCRETE SECTIONS:

- A. All precast concrete sections shall conform to ASTM C478 with the following exceptions and additional requirements:
 - 1. The wall thickness of precast sections shall be as designated on the drawings, meeting the following minimum requirements:

<u>Section Diameter (Inches)</u>	<u>Minimum Wall Thickness (Inches)</u>
48	5
60	6
72	7
84	8

2. Type II cement shall be used except as otherwise approved.
 3. Sections shall be steam cured and shall not be shipped until at least five days after having been cast.
 4. Minimum compressive strength of concrete shall be 4000 psi at 28 days.
 5. No more than two lift holes may be cast or drilled in each section.
 6. The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on the inside of each precast section.
 7. Acceptance of the sections will be based on material tests and inspection of the completed product.
 8. Circumferential steel reinforcement in walls and bases shall be a minimum of 0.12 sq. in./lin. ft. for 4-foot diameter sections and 0.15 sq. in./lin. ft. for 5- and 6-foot diameter sections. Reinforcing shall extend into tongue and groove.
- B. Conical reducing sections shall have a wall thickness not less than 5-inches at the bottom and wall thickness of 8-inches at the top. Conical sections shall taper from a minimum of 48-inches diameter to 24 or 30-inches diameter at the top, as shown on the drawings.
- C. Except where insufficient depth of cover dictates the use of a shorter base, bases shall be a minimum of 4 feet in height.
- D. Slab top sections and flat riser sections (Grade Rings) shall conform to the contract drawings, with particular attention focused upon the reinforcing steel and be designed to meet or exceed an HS-20 Loading requirement.
- E. The tops of the bases shall be suitably shaped by means of accurate ring forms to receive the riser sections.
- F. Precast sections shall be manufactured to contain wall openings of the minimum size to receive the ends of the pipes, such openings being accurately set to conform with line and grade of the sewer or drain. Subsequent cutting or tampering in the field, for the purpose of creating new openings or altering existing openings, will not be permitted except as required by the Engineer.
- G. The exterior surfaces of all precast manhole bases, walls, and cones shall be given a minimum of one shop coat of bituminous damp proofing.
- H. The Engineer reserves the right to reject any unsatisfactory precast section and the rejected unit shall be tagged and removed from the job site immediately.

- I. The Engineer may also require the testing of concrete sections as outlined under Physical Requirements in ASTM C478 with the Contractor bearing all testing costs.

2.02 BRICK MATERIALS:

- A. Brick shall be sound, hard, and uniformly burned brick, regular and uniform in shape and size, of compact texture, and satisfactory to the Engineer. Bricks shall comply with ASTM C32, for Grade SS, hard brick, except that the mean of five tests for absorption shall not exceed 8 percent by weight.
- B. Rejected brick shall be immediately removed from the work and brick satisfactory to the Engineer substituted.
- C. Mortar shall be composed of Portland cement, hydrated lime, and sand in which the volume of sand shall not exceed three times the sum of the volumes of cement and lime. The proportions of cement and lime shall be as required by the Engineer and may vary from 1:1/4 for dense hard-burned brick to 1:3/4 for softer brick. In general, mortar for Grade SS Brick shall be mixed in the volume proportions of 1:1/2:4-1/2; Portland cement to hydrated lime to sand.
- D. Cement shall be Type II Portland cement as specified for concrete masonry.
- E. Hydrated lime shall be Type S conforming to ASTM C207.
- F. The sand shall comply with ASTM C144 specifications for "Fine Aggregate," except that all the sand shall pass a No. 8 sieve.

2.03 FRAMES, GRATES, COVERS AND STEPS:

- A. Castings shall be of good quality, strong, tough, even-grained cast iron, smooth, free from scale, lumps, blisters, sand holes, and defects of every nature which would render them unfit for the service for which they are intended. Contact surfaces of covers and frame seats shall be machined to prevent rocking of covers.
- B. All castings shall be thoroughly cleaned and may be subject to a careful hammer inspection at the Engineer's discretion.
- C. Castings shall be ASTM A48 Class 30B or better.
- D. The surface of the manhole covers shall have a diamond pattern with the cast words "WATER," "DRAIN" or "SEWER," whichever is appropriate.
- E. Manhole frames with 26-inch covers for 24-inch openings shall be 475 pounds minimum by EJ No. 2110 (formerly LK110A); Neenah Foundry Co. R1720; Quality Water Products, Style 40; or approved equal.

- F. Catch basin frames and 23-7/8-inch square grates with 2-inch square openings shall be 8-inches in height minimum. They shall be Neenah Foundry Co. No. R3588-A; Quality Water Products No. 45-600; EJ 5548Z 5520M; or approved equal.
- G. Grates and/or covers for PVC drain manholes and area drains shall be 18-inch round, as manufactured by Nyloplast, or approved equal. Structures identified on the plans as vehicular, shall conform to manufacturers recommendations for asphalt installation.

2.04 MANHOLE ACCESSORIES:

- A. Gasket materials shall be top grade (100% solids, vulcanized) butyl rubber and shall meet or exceed AASHTO M-198.
- B. Couplings at the manhole-pipe interface shall be made with a rubber seal system (with or without stainless steel straps) meeting the requirements of ASTM C923 and recommended for this type of connection.
- C. Stubs installed as specified and indicated on the drawings shall be short pieces of the same class pipe as that entering the manhole and shall have either stoppers or end caps as shown on the drawings. Stoppers or end caps shall be especially designed for that application.

2.05 PVC AREA DRAINS AND PVC DRAIN MANHOLES:

- A. PVC structures shall be manufactured by Nyloplast or approved equal.
- B. PVC area drains shall have sumps for capture of debris and sediment.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. PRECAST SECTIONS:

1. Precast bases shall be supported on a compacted level foundation of crushed stone, as specified in Section 02300, EARTHWORK, at least 6-inches thick, but shall vary to the depth necessary to reach sound undisturbed earth.
2. Precast reinforced concrete sections shall be set vertical and with sections in true alignment.
3. Butyl rubber joint sealant shall be installed between each concrete section. Catch basin sections do not require joint sealant if so indicated on the drawings.
4. All holes in sections used for handling the sections shall be thoroughly plugged with mortar. Mortar shall be one part cement to 1-1/2 parts sand, mixed slightly

damp to the touch (just short of "balling"), hammered into the holes until it is dense and an excess of paste appears on the surface, and then finished smooth and flush with the adjoining surfaces.

B. BRICK WORK:

1. Bricks shall be moistened by suitable means, as required, until they are neither so dry as to absorb water from the mortar nor so wet as to be slippery when laid.
2. Each brick shall be laid as a header in a full bed and joint of mortar without requiring subsequent grouting, flushing or filling, and shall be thoroughly bonded as directed.

C. CASTINGS:

1. Cast iron frames, grates and covers shall be as specified. The frames and covers shall be set by the Contractor to conform accurately to the grade of the finished pavement, existing ground surface, or as indicated on the drawings. Frames shall be adjusted to meet the street surface.
2. Cast iron manhole frames and covers not located in paved areas shall be set 6-inches above finished grade, at a height as required by the Engineer, or as indicated on the drawings. The top of the cone shall be built up with a minimum of 1 course and a maximum of 5 courses of brick and mortar used as headers for adjustment to final grade.
3. Frames shall be set concentric with the top of the concrete section and in a full bed of mortar so that the space between the top of the concrete section or brick headers and the bottom flange of the frame shall be filled and made watertight. A thick ring of mortar extending to the outer edge of the concrete shall be placed all around the bottom flange. The mortar shall be smoothly finished to be flush with the top of the flange and have a slight slope to shed water away from the frame.
4. Covers and/or grates shall be left in place in the frames, for safety reasons, except while work is being performed.

D. ACCESSORIES:

1. Accessories shall be installed in accordance with manufacturer's instructions.
2. Stubs shall be set accurately to the dimensions indicated on the drawings. Stubs shall be sealed with suitable watertight plugs.

3.02 LEAKAGE TESTS:

A. Leakage tests shall be made by the Contractor and observed by the Engineer on each manhole. The test shall be by vacuum or by water exfiltration as described below:

B. VACUUM TEST:

1. The vacuum test shall be conducted in accordance with ASTM C1244. Test results will be judged by the length of time it takes for the applied vacuum to drop from 10 inches of mercury to 9 inches. If the time is less than that listed in Table 1 of ASTM C1244, the manhole will have failed the test. Test times from Table 1 are excerpted below.

TABLE 1

Minimum Test Times for Various Manhole Diameters

<u>Depth (Feet)</u>	<u>Diameter (Inches)</u>		
	48	60	72
	<u>Times (Seconds)</u>		
0-12	30	39	49
12-16	40	52	67
16-20	50	65	81
20-24	59	78	97
26-30	74	98	121

2. If the manhole fails the initial test, the Contractor shall locate the leaks and make proper repairs. Leaks may be filled with a wet slurry of accepted quick setting material. If the manhole should again fail the vacuum test, additional repairs shall be made, and the manhole water tested as specified below.

C. WATER EXFILTRATION TEST:

1. After the manhole has been assembled in place, all lifting holes shall be filled and pointed with an approved non-shrinking mortar. All pipes and other openings into the manhole shall be suitably plugged and the plugs braced to prevent blow out. The test shall be made prior to placing the shelf and invert. If the groundwater table has been allowed to rise above the bottom of the manhole, it shall be lowered for the duration of the test.
2. The manhole shall be filled with water to the top of the cone section. If the excavation has not been backfilled and observation indicates no visible leakage, that is, no water visibly moving down the surface of the manhole, the manhole may be satisfactorily water-tight. If the test, as described above, is unsatisfactory as determined by the Engineer or if the manhole excavation has been backfilled, the test shall be continued. A period may be permitted if the Contractor so wishes, to allow for absorption by the manhole. At the end of this period, the manhole shall

be refilled to the top of the cone, if necessary, and a measuring time of at least 8 hours begun. At the end of the test period, the manhole shall be refilled to the top of the cone, measuring the volume of water added. This amount shall be extrapolated to a 24-hour loss rate and the leakage determined based on depth. The leakage for each manhole shall not exceed one gallon per vertical foot for a 24-hour period. If the manhole fails this requirement, but the leakage does not exceed 3 gallons per vertical foot per day, repairs by approved methods may be made as required by the Engineer to bring the leakage within the allowable rate of one gallon per foot per day. Leakage due to a defective section or joint or exceeding the 3 gallon per vertical foot per day, shall be cause for rejection of the manhole. It shall be the Contractor's responsibility to uncover the rejected manhole as necessary and to disassemble, reconstruct or replace it as required by the Engineer. The manhole shall then be retested and, if satisfactory, interior joints shall be filled and pointed.

3. No adjustment in the leakage allowance will be made for unknown causes such as leaking plugs, absorption, etc. It shall be assumed that all loss of water during the test is a result of leaks through joints or through the concrete. Furthermore, the Contractor shall take any steps necessary to assure the Engineer that the water table is below the bottom of the manhole throughout the test.
4. If the groundwater table is above the highest joint in the manhole, and there is no leakage into the manhole, as determined by the Engineer, such a test can serve to evaluate water-tightness of the manhole. However, if the Engineer is not satisfied with the results, the Contractor shall lower the water table and carry out the test as described hereinbefore.

3.03 CLEANING:

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

END OF SECTION

SECTION 02745
HOT MIX ASPHALT

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Under this Section, the Contractor shall furnish all necessary labor, materials, equipment, and transportation necessary to construct the following:
 - 1. The bituminous concrete pavement for all roadways shall be composed of materials as specified herein and shall be constructed on a prepared base course to the depth, grade and cross-section shown on the plans, as specified herein and as directed by the Engineer.
 - 2. Bituminous concrete pavement for roadways shall be composed of a one and one half (2) inch bituminous concrete binder course, and a one and one half (2) inch bituminous concrete dense mix course.
 - 3. Any reference to hot mix asphalt (HMA) on the plans or in the specifications shall relate to this section.

1.02 REFERENCE STANDARDS AND SPECIFICATIONS

- A. Reference to the standards, specifications, and tests of technical societies, organizations and governmental bodies are made in the Contract Documents.
 - 1. AASHTO - American Association of State Highway and Transportation Officials (tests or specifications).
 - 2. ASTM - American Society for Testing and Materials.
 - 3. Mass. Standard Specs. - Latest edition of the Standard Specifications for Highways, Bridges and Waterways, 1988 Edition, MASSDOT, hereinafter referred to as "The Massachusetts Standard Specifications."
- B. Peastone for surface treatments shall be washed and free of all dirt and other deleterious materials that impede the adhesion qualities of the system.

PART 2 - MATERIALS

2.01 BITUMINOUS CONCRETE PAVEMENT

- A. Bituminous Concrete Pavement shall consist of binder mix and dense mix courses constructed to the thickness shown on the plans and shall conform to the relevant

provisions of Sections 460 and (M3.11.03) of the MASSDOT, Standard Specifications for Highways and Bridges, 1988 Edition, unless specified otherwise hereinafter.

2.03 BITUMIN

- A. Asphalt emulsion or bitumen for application of the stone surface treatment shall conform to the relevant provisions of Sections M3.01.0, M3.03.0, M3.03.1 and M3.02.0 of the MASSDOT, Standard Specifications for Highways and Bridges, 1988 Edition.

PART 3 - EXECUTION

3.01 BITUMINOUS CONCRETE PAVEMENT

- A. The bituminous mixtures shall be placed on the approved base only when, in the opinion of the Engineer, the course is sufficiently dry and weather conditions are suitable.
- B. Where walls, curbing, or other suitable permanent supports are not present, the Contractor shall secure proper alignment and adequate compaction of the binder and surface courses as shown on the Contract Drawings and finish all edges with a neat, tamped edge.
- C. The pavement shall be placed in two (2) courses as shown on the Contract Drawings. Each course shall be spread and finished as required in the Massachusetts Department of Public Works, Standard Specifications for Highways and Bridges, Section 460.63, 1988 edition.
- D. After completion, the bituminous concrete courses shall conform to the thickness shown on the Contract Drawings, smooth and even and of a dense and uniform structure. When tested with a sixteen (16) foot straight edge placed parallel to the centerline of the pavement, there shall be no deviation from a true surface more than one-quarter (1/4) inch.

PART 4 - GUARANTEE/WARRANTY

- 4.01 The pavement shall be guaranteed against defects in workmanship or quality for a period of one (1) year after final acceptance.

END OF SECTION

SECTION 02773

CURBING

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. Fabricate, furnish and install precast concrete and granite curbing, as indicated on the Drawings and as specified.

1.02 RELATED SECTIONS:

- A. Section 02220 – DEMOLITION
- B. Section 03300 – CAST-IN-PLACE CONCRETE

1.03 REFERENCES:

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01420 - REFERENCES.
 - 1. ASTM C 131 - Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
 - 2. Commonwealth of Massachusetts Department of Transportation (MassDOT): Standard Specifications for Highway and Bridges

1.04 SUBMITTALS:

- A. Submit the following under provisions of these specifications:
 - 1. Submit complete shop drawings of each curb type and size for Architect's approval.

1.05 QUALITY ASSURANCE:

- A. Unless otherwise indicated, concrete curb materials and construction shall conform to the applicable portions of MHD's Standard Specifications Section 500, "Curb and Edging."

1.06 DELIVERY, STORAGE, AND HANDLING:

- A. Curb units shall be delivered to the job adequately protected from damage during transit.
- B. Curb shall be protected against staining, chipping, and other damage. Cracked, badly chipped, or stained units will be rejected and shall not be employed in the work.

PART 2 - PRODUCTS

2.01 GRANITE CURB- VERTICAL:

- A. Granite for vertical curb, radius curb, corners, curb inlet and transition curb shall be engineering grade structural granite conforming to ASTM C615 requirements. Sizing of curb and comers shall be as shown on the Drawings. Granite curb shall be Type VA-4 as per the "Standard Specification."
- B. Granite shall be of smooth splitting character and free from seams which impair its structural integrity. Natural variations characteristic of the deposit will be permitted. Granite shall come from an approved quarry.
- C. Cement mortar shall meet requirements of Section M4, Paragraph M4.02.15 of the Standard Specifications. Color shall be "natural" to match color of curb.
- D. Concrete shall be 4,000 psi concrete as specified under Section 03300 CONCRETE, herein.
- E. Processed gravel fill as specified under Section 02355 GRAVEL BORROW, herein.

2.03 HOT MIX ASPHALT CURB

- A. Curb shall conform to Subsection M3.12.0 of the latest edition of the MassDOT Standard Specifications for Highways and Bridges.

PART 3 – EXECUTION

3.01 GRANITE CURBS:

- A. Furnish and install new granite curb and reset existing granite curb removed and stockpiled for reuse, herein. Curb shall be set straight, plumb and as shown on the Drawings.
- B. Curb shall be set in a concrete cradle in a trench excavated to a width of twenty-four inches (24"). The subgrade of the trench shall be at a depth below proposed finish grade of the curb equal to six inches (6") plus the depth of the curb stone. Base course shall then be filled with processed gravel fill to proper level to support curb at final grade and thoroughly tamped.
- C. Place curb units in accurate line, each piece butting the next with joint spacing no larger than one-quarter inch (1/4). Final points shall be joined by closure pieces made to order. No curb shall be cut in the field. After alignment, the curb shall be carefully backfilled as shown on the Drawings. Extreme care shall be taken not to disturb alignment.
- D. Patch street pavement as required.

3.02 BITUMINOUS CONCRETE CURB:

- A. Replacement of bituminous concrete curbs shall be in accordance with Section 500 of the latest edition of the MassDOT Standard Specification for Highways and Bridges and all amendments thereto. The curbing shall have a 6-inch reveal unless otherwise required by the Engineer.
- B. Unless modified herein, installation shall conform to Section 501.64 of the MassDOT Standard Specifications for Highways and Bridges.
- C. When indicated on the plans, or as directed, drainage openings shall be made through the curb at the elevations and of the size required.

END OF SECTION

SECTION 02775

CONCRETE SIDEWALKS

PART 1 - GENERAL

1.01 WORK INCLUDED:

The Contractor shall furnish all labor, materials, equipment, and incidentals required to sidewalks and/or construct new or replacement hot mix asphalt or cement concrete sidewalks where required or where existing sidewalks are disturbed by the Contractor, as shown on the drawings, and described herein. The Contractor shall also furnish all materials and install ADA accessible ramps where shown on the drawings or as required by the Engineer.

1.02 RELATED WORK:

- A. Section 02300, EARTHWORK
- B. Section 02773, CURBING

1.03 REFERENCES:

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

Massachusetts Department of Transportation (MassDOT)
Standard Specifications for Highways and Bridges

1.04 SUBMITTALS:

- A. In accordance with Section 01330, SUBMITTALS, the Contractor shall submit shop drawings and/or materials specifications for each component of the work to be performed under this section of the Specifications.

1.05 SYSTEM DESCRIPTION:

- A. CEMENT CONCRETE SIDEWALKS AND WHEELCHAIR RAMPS:
 - 1. Except as otherwise indicated, cement concrete sidewalks and ADA accessible ramps shall be constructed in accordance with the requirements of Section 701, Sidewalks, Wheelchair Ramps and Driveways, of the latest edition of the MassDOT Standard Specifications for Highways and Bridges, and all amendments thereto.

2. ADA accessible ramps shall be installed in new sidewalks at intersections in accordance with 521 CMR. When curbs or sidewalks are constructed or reconstructed on one side of the street, curb cuts shall also be installed on the opposite sides of the street, where there is a pedestrian path of travel. Curb cuts shall be located within the crosswalk and/or the pedestrian path of travel.
- C. Water boxes, manhole frames, and all other castings shall be carefully set to the proposed finished grade.
- D. Sidewalks shall not be less than 48-inches in width, excluding curbing. An unobstructed path of travel shall be provided which is at least 36-inches clear, excluding curbing.

PART 2 - PRODUCTS

2.01 CEMENT CONCRETE SIDEWALKS AND ADA ACCESSIBLE RAMPS

- A. Cement concrete sidewalks shall be constructed with air entrained Cement Concrete with a minimum compressive strength of 4000 psi at 28 days.
- B. Cement concrete shall conform to the requirements of MassDOT M4.02.

PART 3 - EXECUTION:

3.01. CEMENT CONCRETE SIDEWALKS AND ADA ACCESSIBLE RAMPS:

- A. Concrete for sidewalks and wheelchair ramps shall be a minimum of 4-inches thick. At driveways, the sidewalks shall be 6-inches thick.
- B. The subgrade for the walk or driveway shall be shaped to a true surface conforming to the proposed slope of the walk, thoroughly rolled at optimum moisture content and tamped with a power roller weighing not less than one ton and not more than 5 tons. All depressions occurring shall be filled with suitable material and again rolled or tamped until the surface is smooth and hard.
- C. After the subgrade has been prepared as hereinbefore specified, a subbase of gravel borrow at optimum moisture content shall be placed, thoroughly rolled by a power roller, and tamped. The gravel borrow shall be a minimum of 8-inches in thickness.
- D. The forms for sidewalks shall be smooth, free from warp, strong enough to resist springing out of shape, and deep enough to conform to the thickness of the proposed walk. All mortar or dirt shall be completely removed from forms that have been previously used. The forms shall be well staked, thoroughly braced, and set to the established lines with their upper edge conforming to the grade of the finished walk. The finished walk shall have sufficient pitch from the outside to the edge of the walk to provide for surface

drainage. This pitch shall be 1.5% Maximum unless otherwise required by the Engineer. Before the concrete is placed, the subbase for sidewalks shall be thoroughly dampened until it is moist throughout but without puddles of water.

- E. Concrete shall be conveyed from the place of mixing to the place of deposit in such a manner that no mortar will be lost, and the composition of the mix shall be uniform, showing neither excess nor lack of mortar in any one place. The consistency shall be such that water will float to the surface under heavy tamping. The concrete shall be placed as close to its final position as practicable and thoroughly consolidated, with precautions taken not to overwork it while it is still plastic. The concrete shall be thoroughly spaded along the forms or screeds to eliminate voids and honeycombs at the edges. Retempering of concrete will not be permitted.
- F. Concrete shall be placed in alternate slabs not exceeding 30 feet in length. Slabs shall be separated by transverse preformed expansion joint filler ½-inch thick. The surface of all concrete sidewalks shall be uniformly scored into block units of not more than 40 square feet. The depth of the scoring shall be at least one quarter of the thickness of the sidewalk.
- G. When concrete sidewalks are constructed adjacent to curbing, building foundations, retaining walls, light pole bases or fixed structures, ½-inch thick premolded joint filler shall be used between the newly constructed sidewalk and the structure.
- H. Finishing of the concrete surface shall be done by experienced and competent cement finishers as soon as is practicable. Finishing shall be delayed until all bleed water and water sheen has left the surface and the concrete has begun to stiffen. The concrete surface shall be finished as directed with a steel trowel or wood float to give a smooth, uniform, and attractive surface finish and uniformly scored into block units or areas of not more than 36 square feet. Following this, the Contractor shall draw a nylon push broom lightly over the surface to produce a non-slip surface. Application of neat cement to the surface to hasten hardening is prohibited.
- I. The Contractor shall protect the newly placed concrete surface against vandalism and marking or defacing and must stand ready to replace any blocks which, in the opinion of the Engineer, are excessively marked or defaced, at no additional cost to the Owner. When completed the walks shall be kept moist and protected from traffic and weather for at least 3 days.
- J. Adequate protection shall be provided where temperatures of 40°F or lower occur during placing of concrete and during the early curing period. The minimum temperature of fresh concrete after placing and for the first 3 days shall be maintained above 55°F. In addition to the above requirements, an additional 3 days of protection from freezing shall be maintained.

END OF SECTION

SECTION 02801

SITE IMPROVEMENTS

PART 1 - GENERAL

- 1.01 RELATED DOCUMENTS: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- 1.02 WORK INCLUDED:
- A. Provide site improvements in the locations shown or as described herein, complete with anchorages and associated site work.
- 1.03 RELATED SECTIONS:
- Division 2 Section "Earthwork" for excavation and grading related to site improvements.
Division 3 Section "Cast-In-Place Concrete" for anchorages.
- 1.04 SUBMITTALS:
- A. Contractor shall submit catalog information on site improvements for review by Architect.

PART 2 - PRODUCTS

- 2.01 BENCHES
- A. Benches (11) shall be Model # 117-60 as manufactured by Dumor, Inc. P.O.Box 142, Mifflintown, PA 17059, (800) 598-4018, www.dumor.com.
- B. Refer to contract drawings for locations. All final locations are to be approved in the field by the Engineer.
- 2.02 ADA WARNING MAT
- A. ADA warning mats shall meet requirements of MassDOT Construction standard E107.6.5 and City of Worcester standards.
- 2.03 SHADE SHELTER
- A. Shade Shelter (1) shall be Model #RAM-16'X24', multi-rib as manufactured by Polygon, 4240 136th Ave Holland, MI 49424, (616) 399-1963, www.polygon.com, or an approved equal.
- B. Refer to contract drawings for location. Final location is to be approved in the field by the Engineer.
- C. Metal Roofing shall be 24-gauge, galvalume coated and Kynar 500 painted.
- D. To be installed per manufacture requirements. Manufacture engineering shall

- determine required baseplate design after engineering package is ordered.
- E. Final color shall be determined during the submittal phase of construction with the City.

2.04 TRELLIS

- A. Trellis (5) shall be Model #DB-74: 12'X6', Steel Trellis collection as manufactured by Poligon, 4240 136th Ave Holland, MI 49424, (616) 399-1963, www.poligon.com, or an approved equal.
- B. Refer to contract drawings for locations. All final locations are to be approved in the field by the Engineer.
- C. All steel components shall be powder coated in the following manner:
 - a) Shot blasted to near white condition (SSPC SP-10).
 - b) Washed and sealed in a phosphate spray.
 - c) Prime-coated with poli-5000 high.
 - d) Performance powder applied epoxy.
 - e) Top-coated with super-durable TGIC.
 - f) Polyester powder and oven cured.
- D. Color shall be black.
- E. Refer to contract drawings for locations.
- F. All final locations are to be approved in the field by the Engineer.

2.05 PICNIC TABLE

- A. Picnic tables (4 total) shall be Model #299-60-1HS, 6' ADA steel picnic table (2) and Model #299-60-HS, 6' steel picnic table, as manufactured by Dumor, Inc. P.O.Box 142, Mifflintown, PA 17059, (800) 598-4018, www.dumor.com, or an approved equal.
- B. Picnic tables shall be furnished with the surface mount footing option, item expansion bolted to the concrete pad in conformance with manufacturer's recommendations.
- C. Color shall be black.
- D. Refer to contract drawings for locations. All final locations are to be approved in the field by the Engineer.

2.06 TRASH RECEPTACLES

- A. Trash Receptacles (2) shall be model 157-32SH-BT as manufactured by Dumor, Inc. P.O.Box 142, Mifflintown, PA 17059, (800) 598-4018, www.dumor.com, or approved equal. Trash Receptacles shall be 36-gallon model with polyethylene liner, constructed of stainless steel with baked-on polyester powder finish. Color shall be selected by the Engineer. Trash receptacle shall have hinged side access door. Trash Receptacles shall be surface mounted, and all hardware shall be marine-grade stainless steel conforming to AISI Type 304 and ASTM A193 latest requirements.
- B. Receptacles shall be furnished with the surface mount footing option, such that each receptacle is expansion bolted to the concrete pad in conformance with manufacturer's recommendations.

2.07 INTERPRETIVE SIGNAGE

- A. Interpretive signs (2) shall be Model: 45 degree NPS Style Traditional Pedestal, 30'X 48', surface mounted, as manufactured by Fossil Industries 44 Jefryn Boulevard Deer Park, NY 11729, (631) 254.9200, or approved equal.
- a) Sign shall be of solid, composite panels to be fire retardant, impervious to moisture, UV radiation, scratching, impact, and graffiti. UV inhibitor shall have a 10-year min. warranty for outdoor applications.
 - b) Laminate shall be manufactured with a smooth sub-surface image printed with 12-color high-definition printing technology and bonded with a 3/4" total panel thickness. Laminate shall be a Custom High Pressure Decorative Laminate consisting of decorative surface papers, impregnated with melamine resins, bonded under heat and pressure to kraft papers impregnated with phenolic resins
 - c) Finish shall be semi-gloss with a reflectivity of 30 +/- 5 units.
 - d) Each panel shall be mounted on a black powder coated aluminum pedestal, surface mounted with a 45-degree viewing angle and a height of 44.5" +/- at the mounting point. Pedestal shall be Fossil Industries NPS-C45 with cross support at top and bottom or approved equal.
 - e) Post shall be 4"x4" aluminum.
 - f) Bottom Plate shall be 6" x 6" with 5/8" surface-mounting holes.
- B. Owner shall provide graphics to the contractor. Contractor shall coordinate the timing for final development of graphics and installation with the manufacturer.

2.08 STORAGE SHED

- a) Storage Sheds (2) shall be Modern Style, size 6'x12', as manufactured by Urban Sheds, 6 Pleasant St. Malden Ma 02148, <https://www.urban-sheds.com/>, (888) 217-5549, or approved equal.
- b) Siding shall be Lap Siding-LP Smartside (50-year guarantee). Siding color shall be "Software (SW 7074), trim color shall be white, roof color shall be light gray, and roof material shall be architectural-30-year shingles. Final colors to be confirmed by the owner's representative prior to manufacture.
- c) Roof shall be Style modern; Side wall height shall be high shed (104.5" Interior high wall), and roof overhang large.
- d) Doors shall be 6' double door, color "poised taupe" (SW 6039) with galvanized hinges, and a double door pressure-treated ramp.
- e) Flooring shall be framed shed floor (used with blocking or crushed stone) to be confirmed by Landscape architect and client before order. Floor joist shall be 16" spacing or less.
- f) Vents (2) shall be gable vent color white, one on each side, color white.
- g) 30-year structural guarantee by manufacture.
- h) Contractor shall provide a mockup drawing by manufacture for approval.

2.09 TRENCH DRAIN

- A. Trench drain shall Model: ACO Power Drain - S200K iron edged channel system with bolt-down longitudinal grate (ADA), 9.35"W x 19.68"L x .98"D, as manufactured by ACO Polymer Products, Inc. www.acodrain.us or approved equal.

2.10 STORAGE BOX

- A. Storage Box shall be 60 in. x 24 in. Site vault Chest by Crescent Jobox or approved equal. Storage box shall have gas-spring assisted lid lift, textured powder coat finished steel structure with fully welded seams, inset handles, and a minimum of 3 latch points for the locking mechanism. Padlock to be supplied by the Owner.

2.11 MOUNTING HARDWARE:

- A. All bolts, screws, nuts, washers, and other mounting hardware required for the installation of surface mounted site furnishings shall be stainless steel. All surface mounted site furnishes shall be installed in accordance with manufacturer's recommendations.

PART 3 - EXECUTION

- 3.01 Benches shall be placed as required by the Owner.

- 3.02 The installer shall examine previous work, related work, and conditions under which this work is to be performed and notify the Contractor in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means installer accepts substrates, subgrades, previous work, and conditions.

- 3.03 The Contractor shall be responsible for timing the delivery of all site improvement elements to minimize on-site storage time prior to installation. All stored materials must be protected from weather, careless handling, and vandalism.

- 3.04 Contractor shall anchor all site element stanchions to cement concrete pad using approved bolts and/or anchoring devices.

- 3.05 Cleaning, repair, and protection.

- A. Repair minor damage to eliminate all evidence of repair. Remove and replace work that cannot be satisfactorily repaired.
- B. Provide temporary protection to ensure that the work will be without dirt, stains, damage, or deterioration at time of final acceptance. Clean up stains and spills as they occur. Remove protections and clean as necessary immediately before final acceptance.

- C. Upon completion of the work and before acceptance, the Contractor shall remove and dispose of in an approved manner all surplus materials, rubbish, etc. which the Contractor may have accumulated during the work and shall leave the site in a clean and orderly condition. The Contractor shall not abandon any material at or near the site regardless of whether it has any value.

END OF SECTION

SECTION 02820

PREFABRICATED ORNAMENTAL FENCE AND GATES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The work under this Section consists of furnishing and installing steel picket fence and steel picket gates with posts, sleeves and appurtenances as shown on the drawings and as specified herein including all labor, materials and equipment necessary to finish the work complete in place.

1.02 REFERENCE STANDARDS

- A. References herein to any technical society, organization, group or body are made in accordance with the following abbreviations:

ASTM American Society for Testing Materials

AWS American Welding Society

CPSC Consumer Product Safety Commission

1.03 SHOP DRAWINGS

- A. The Contractor shall submit complete manufacturer's shop drawings which shall include the horizontal layout and vertical alignment for the proposed installation to the Engineer for approval. Field verify all post sleeve spacing prior to fabrication. No material may be ordered prior to receiving written approval from the Owner's Representative.

1.04 SAMPLES

- A. The Contractor shall supply representative samples, in factory-sealed containers, of the cold galvanizing compound (for touch up ONLY) and the finish paint and primer, if necessary. Also, provide samples of other fencing materials and hardware as the Engineer requests.
- B. The Contractor shall submit finished samples of all parts of the fences for the Owner's Representative review and approval. The workmanship and finish of the completed fences shall equal the approved samples.

PART 2 – MATERIALS

The fence must meet the requirements of the commercial ornamental steel fence system of the Ameristar® Aegis Plus® (Majestic™) design or approved equal as manufactured by Master Halco 63 Manley St. W. Bridgewater, MA 02379 (800) 969-1669 or Anchor Fence, 1015 East Market Street Daly City, CA 94014(650) 757-2140 or other approved equal

2.01 STEEL MEMBERS

- A. Posts shall be carbon steel structural tubing conforming to ASTM Designation A500.
 - 1. Material for fence pickets shall be 3/4" square x 17 Ga. tubing
 - 2. Sleeves for fence posts shall be 3" x 3" x 1/2" thickness steel square tube weighing 20.88 lbs./ft.
- B. Galvanizing:
 - 1. Hot-dip galvanize all items under this section in compliance with ASTM A 123, ASTM A 153, or ASTM A 386. Provide minimum 1.5 oz./ft.² zinc coating. Galvanize after fabrication.
 - 2. Following galvanizing, each item shall receive surface grinding to remove lumps, sags or spikes resulting 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.
- C. Pickets, top and bottom rails and crossbars and hinge assemblies, called for on the drawings, shall conform to ASTM Designation A36.
- D. Bolts, nuts, washers and any other fasteners shall conform to ASTM Designation A307.
- E. Post caps shall be cast iron or steel in the sizes required, finished in conformance with all other fence elements. Caps shall be as manufactured by Julius Blum & Co., Inc., Carlstadt, New Jersey; Boundary Fence and Railing Systems, Inc. Richmond Hill New York; Monumental Iron Works, Inc., Baltimore, Maryland; or approved equal. All caps are to be coated with a minimum 3.0 mil thickness of liquid galvanizing compound by dipping.
- F. All gates shall be equipped with a positive type latching device capable of retaining the gate in a closed position and have provision for a padlock. Two (2) decorative gates will also have a Gate Lock with Mortise Cylinder and handle, and strike, as manufactured by Locinox, 460 Windy Point Dr Glendale Heights IL 60139 - USA 877-LOCINOX

salesusa@locinox.com, or approved equal. Latches shall permit operation from either side of gate and must be approved by the Landscape Architect prior to the installation

- G. Double gates: Provide locking cane-bolt style drop rod to hold inactive leaf. Provide gate stop pipe to engage center drop rod. Provide locking device and padlock eyes as an integral part of the latch, requiring one padlock for locking both gate leaves.

2.02 FINISH

- A. Cold galvanizing compound shall be a single component zinc rich compound yielding a dry film of at least 85% pure zinc. Galvanizing compound shall meet or exceed the requirements of Federal Specification MIL-P-21035, TT-P-641d primer for zinc rich compounds.
- B. Finish color coating shall be Color Galvanized Black as provided by Duncan Galvanizing, Inc., or approved equal.

2.03 CEMENT CONCRETE

- A. Cement concrete for footings and edgings shall conform to Section 03300 of these Specifications.

PART 3 - EXECUTION

3.01 FENCE FABRICATION, GALVANIZING FINISHING AND ERECTION

- A. The fence sections shall be shop fabricated in strict conformance to the sizes and dimensions called for on the approved shop drawings and in accordance with these specifications, all as field verified by the Contractor.
- B. All welding shall be by arc welding process conforming to the latest AWS Specifications. All welds shall be as designated on the drawings, shall be ground smooth to a neat finish and shall be watertight with care to minimize locked-up stresses and distortion due to heat. All welds shall be made on bare, clean metal equal to "white" metal.
- C. After fabrications, all steel surfaces shall be thoroughly cleaned of all mill scale, rust, dirt, weld flux, weld splatter and other foreign matter by power wire brushing or sand blasting.
- D. Prime and finish all materials in accordance with industry requirements. Galvanizing shall provide a visually acceptable substrate for applied coatings, and be free of lumps, globules, or heavy deposits which will interfere with intended use or esthetic appearance of materials.

- E. Field erection of the fabricated fence sections shall be as called for on the drawings. The fence rails shall be parallel to the walk and the fence posts and pickets shall be set plumb, when the fence is erected into its final position.
- G. Surfaces that are abraded or damaged during field erection or from which galvanizing compound has been damaged shall be thoroughly wire brushed and cleaned, removing all loose and cracked coating, after which the surface shall be painted with two (2) coats of the approved cold galvanizing compound.

3.02 TOUCHUP PAINTING

- A. After erection, all rust spots, scratches or abrasions in the galvanized surface shall be repaired with finish surfacing treatments that are compatible with factory applied color galvanizing applications and satisfactory in all regards to the Engineer.

END OF SECTION

SECTION 02820

BLACK VINYL CLAD CHAIN LINK FENCE

PART 1 - GENERAL

1.01 SCOPE OF WORK:

- A. The work under this Section consists of furnishing and installing vinyl coated chain link fence fabric and hardware and framework of various heights as shown on the Contract Drawings and as specified herein including all labor, materials and equipment necessary to finish the work complete in place.
- B. The work also includes the baseball field backstop, fencing and dugouts fencing.

1.02 REFERENCE STANDARDS:

- A. References herein to any technical society, organization, group or body is made in accordance with the following abbreviations:
 - 1. ASTM American Society for Testing Materials
 - 2. AWS American Welding Society

1.03 QUALITY ASSURANCE:

- A. All fencing shall conform to the specifications of the Chain Link Fence Manufacturer's Institute and as specified herein.

1.04 SUBMITTALS:

Per Section SPECIAL CONDITIONS of these Specifications, submit:

- A. Three (3) samples, approximately 3" long or 6" square of fabric material, post sections and typical accessories.
- B. Shop drawings or catalog cuts including details illustrating fence height, fence post spacing, and sizes of posts, rails, braces, footings, gates and all accessories.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Deliver material in manufacturer's original packaging with all tags and labels intact and legible. Handle and store material in such a manner as to avoid damage.

PART 2 - MATERIALS

2.01 VINYL CLAD STEEL POSTS, RAILS AND BRACES:

A. General:

1. All fence pipe for posts, rails, and all braces and appurtenances shall be vinyl clad, schedule 40 round, seamless hot dip galvanized pipe conforming to ASTM-A-120-1 or approved equal.
2. All structural shapes shall be vinyl clad and galvanized in conformance with ASTM Designation A123.
3. All vinyl clad materials shall be fusion bonded in accordance with ASTM-F668 Class 2B.
4. All vinyl clad post, rails and braces shall be color black.

B. End, Corner and Pull Posts:

1. Fence up to and including 5'-0" in height: 2.375" O.D. pipe, 3.65 lbs. per linear foot.
2. Fence over 5'-0" in height: 2.875" O.D. pipe, 5.79 lbs. per linear foot.
3. Fence over 10'-0" in height: 4.00" O.D. pipe, 9.11 lbs. per linear foot.
4. Maximum Spacing 10'-0" on Center.

C. Line Posts (10'-0" Maximum Spacing):

1. Fence up to 5'-0" in height: 1.90" O.D. pipe, 2.28 lbs. per linear foot.
2. Fence over 5'-0" in height: 2.375" O.D. pipe, 3.12 lbs. per linear foot.
3. Fence over 10'-0" in height: 2.875" O.D. pipe, 5.79 lbs per linear foot.

D. Gate Posts:

1. Gate posts for single leaf gates six (6) feet or less in width: 2.875" O.D. pipe, 4.64 lbs. per foot min.
2. Gate posts for single leaf gates six (6) to twelve (12) feet in width: 4.00" O.D. pipe, 6.56 lbs. per foot.

E. Rails:

1. All rails shall be 1.66" O.D. pipe weighing 2.27 lbs. per linear foot furnished in manufacturer's standard lengths of approximately 21'-0" with outside sleeve type couplings, at least six (6) inches long for each joint – one (1) coupling in each five (5) to have expansion spring. Provide means for attaching rails securely to each corner, pull and end post. Rails shall form continuous brace from end to end of each run of fence.

F. Post Bracing Assembly:

1. 1.66" O.D. pipe weighing 2.27 lbs. per linear foot (for horizontal braces). Provide at each side of corner and pull posts and at end posts for fence six (6) feet or higher.

2.02 CHAIN LINK FABRIC (VINYL CLAD) AND PRIVACY SCREEN:

- A. Chain Link fence fabric shall be factory coated 6-gauge core wire (or 9-gauge in Dugouts and certain circumstances as indicated on the details) with a min .02-inch-thick coating of plasticized polyvinyl-chloride applied by the fusion method over a thermoset plastic bonding agent. The bond shall exhibit equal or greater strength than the cohesive strength of the vinyl. All cut ends shall be coated with vinyl at the factory. Fabric shall be **1-3/4"** mesh and black in color. **ADD #2**
- B. Top and bottom of fabric shall have knuckled selvage, both sides.
- C. If applicable vertical PVC slats shall be included at the park perimeter fence installation as designated on the drawings. Vertical PVC slats shall be provided in the heights required to extend to the full height of the fence installation, as referenced on the drawings. PVC slats shall be furnished in a black color and be equal or greater to the "Winged Slat" system manufactured by Hoover Fence, available at HooverFence.net or Tel (330) 358-2335, or an approved equivalent product.

2.03 FITTINGS AND ACCESSORIES (VINYL CLAD):

- A. All accessories shall be vinyl clad in accordance with paragraph 2.01 above and galvanized in conformance with ASTM Designation A153.

B. Post Caps:

Furnish and install tight fitting pressed steel or malleable iron caps, designed as a weather tight closure cap. Provide one (1) pass-through looped cap for each line post, and one (1) acorn style cap for each end or corner post. Where top rail is used, provide looped cap tops to permit passage of top rail.

C. Tension Bars:

1. One (1) piece lengths equal to full height of fabric with minimum cross section of 3/16" x 3/4", conforming to ASTM Designation A123. Provide one (1) stretcher bar for each end post and two (2) for each corner and pull post.
2. Tension bands and brace bands, if utilized, shall be 7/8" x 12 gauge beveled, galvanized, sized to fit pipe sizes and furnished with galvanized fasteners. Galvanizing shall conform with ASTM Designations A123 or A153 as they pertain.

D. Rail Clamps:

1. Rail clamps shall be standard clamps (boulevard clamps) furnished complete with fasteners with ASTM Designation A153.

E. Fabric Bands for Tying Fabric:

1. Fabric shall be attached using a BAND-IT band and buckle system.
2. Bands shall be 0.020" thickness, 200/300 series stainless steel 1/2" wide bands, with a minimum breaking strength of 850 lbs., 1/2" band capacity ear-lock design buckles to be manufactured with 0.050" thick material, 201/301 series stainless steel.

- F. Fittings, lugs, clamps and other accessories shall be steel conforming to ASTM Designation F626 and galvanized in conformance with ASTM Designation A15.

2.04 ANCHORING CEMENT:

- A. Cement for anchoring posts in sleeves embedded in concrete walls shall be "POR-ROK", as manufactured by Hallemite (Lehn and Fink Industrial Products, Division of Sterling Drugs, Inc.), Montage, New Jersey, or approved equal.
- B. "Sika Cola-Due" by the Sika Co.
- C. "Five Star Grout" the Five Star Co.

2.05 CEMENT CONCRETE:

- A. Cement concrete for post footings shall conform to Section 03300 of these Specifications.

PART 3 - EXECUTION

3.01 POST INSTALLATION:

- A. Install new vinyl coated chain link fence in the location(s) shown on the Contract Drawings, and as approved by the Landscape Architect.
- B. Excavation for post footings as herein before specified in Section 02300 of these Specifications, shall be in firm undisturbed or compacted soil. Post footing diameters vary according to post sizes required and are in accordance with attached details. Excavate hole depths six (6) inches lower than post bottom with bottom of posts set not less than thirty-six (36) inches below surface when in firm, undisturbed soil. Where ledge is encountered, the Contractor shall notify the Landscape Architect to determine method of installation. Payment for any additional work required when installations are in ledge shall be in accordance with methods described in SPECIAL CONDITIONS of these Specifications.
- C. Place concrete around posts in a continuous pour, tamp for consolidation. Check each post for vertical and top alignment and hold in position during placement and finishing operation. Crown the top of the concrete footings to pitch water away from posts.
- D. Under concrete pavement, tops of footings are to be finished smooth and are to pitch one (1) inch from the posts to the outside edge of the foundation.
- D. In mower strip locations, form top twelve (12) inches square and finish to match mower strip with 1/4" pitch away from posts.
- E. If applicable, top of fence footings at players' benches and cement concrete mower strips shall terminate six (6) inches below pavement finish grade.

3.02 FENCE ERECTION:

- A. Top and Bottom Rails:
 - 1. Top and bottom rails shall form a continuous brace from end to end of each fence run. In addition, all end and corner posts shall be braced to the nearest line post with center brace rails. Outside sleeve type top rail coupling shall be placed a maximum of twelve (12) inches from line posts.
- B. Middle Rails:
 - 1. All chain link fencing ten (10) feet or more in height shall have a continuous middle rail.
- C. Brace Assemblies:

1. Furnish and install braces and appurtenances so posts are plumb when diagonal rod is under proper tension. All "tension" assemblies shall conform to ASTM 567 and the MASS DOT Standard Specifications Section M.8.09.

D. Fabric:

1. The fabric shall be installed on the "public" or "sports field" side of the fence.
2. All fabric shall be aligned so that the top row of the fabric mesh is tied to the top rail, and so that the bottom selvage of fabric mesh stands one (1) inches above the finish grade of the lawns, pavements or concrete wall grade and that the bottom row of the fabric mesh is tied to the bottom rail.
3. Fabric shall be properly stretched and securely fastened to the posts and rails, and between posts the top and bottom of the fabric shall be fastened to the horizontal braces as herein specified and approved by the Landscape Architect. Fabric shall be stretched uniformly taut and as tight as possible, true to line and grade and complete in all details. Install tension bars at corners.
4. The fabric shall be fastened to end and corner posts with tension bars and stretcher bar bands spaced at one (1) foot intervals.

E. Stretcher Bars:

1. Thread through fabric and secure to posts with approved metal bands spaced not over twelve (12) inches O.C.

F. Fabric Bands:

1. Fabric Bands shall be placed at the intervals indicated on the details and securely fastened to all fence posts.
2. All bands shall be pulled tight a raw ends of steel bands shall be secured in buckle by folding ear tabs around steel bands as per manufacturer's recommended installation procedure. No sharp edges shall protrude from band-it buckles. When applicable, band will be PVC coated, color to match fabric and framework.

G. Fasteners:

1. Install nuts for tension band and hardware bolts on side of fence opposite fabric side unless required otherwise by the Landscape Architect.

3.03 GATE FRAMES (WHERE APPLICABLE):

- A. Gate frames shall be galvanized steel 1.90" O.D. standard weight pipe, 2.72 pounds per linear foot. Gates shall be fabricated using welded construction with all welds ground smooth and coated with 3.0 mil. thickness of cold galvanizing compound. Gates must be properly braced to eliminate any possible sagging condition. For gates over eight (8) feet in height, provide additional horizontal and vertical interior members to ensure proper strength.
- B. Fabric shall be installed with hook bolts and tension bars on all four (4) sides and attached to gate frame at twelve (12) inches on center.
- C. Hardware materials shall be hot dipped galvanized steel. All moveable parts (e.g., hinges, latch, keeper, and drop bar) shall be field coated with PVC touch-up paint, provided by the manufacturer.
- D. Hinges shall be of sufficient structural strength and design to support gate leaf and to permit easy and trouble-free operation. Non-lift-off type hinge design shall permit the gate to swing 180 degrees inward or outward in accordance with the Contract Drawings
- E. All gates shall be equipped with a positive type latching device capable of retaining the gate in a closed position and have provision for padlock. Latches shall permit operation from either side of gate and must be approved by the Landscape Architect prior to the installation. Refer to details for latch device.
- F. Gate keepers shall be provided for each gate leaf over five (5) feet wide. Gate keeper shall consist of mechanical device for securing free end of gate when in fully open position.
- F. Double Gates:
 - 1. Provide drop rod to hold inactive leaf. Provide gate stop pipe to engage center drop rod. Provide locking device and padlock eyes as an integral part of the latch, requiring one padlock for locking both gate leaves.
- H. Gate Installation:
 - 1. Check gate posts for vertical alignment and maintain in position during placement and finishing operations.
 - 2. Set keeper, stops, sleeves into concrete.
 - 3. Install gates plumb, level and secure for full opening without interference.
 - 4. Attach hardware by means which will prevent unauthorized removal.

5. Adjust hardware for smooth operation.

3.03 FINISH PROTECTION:

- A. During the fence installation, care shall be taken to avoid damaging the vinyl clad or galvanized surfaces of the fence components. All scratches and abrasions shall be thoroughly corrected in a manner satisfactory to the Landscape Architect before final acceptance.

END OF SECTION

SECTION 02821

TEMPORARY CHAIN LINK FENCE

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. The Contractor shall provide all labor, materials, and appurtenances necessary for the installation, maintenance and dismantling of 8-foot temporary fencing.
- B. The Contractor shall be responsible for securing the site from trespassers.

1.02 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01330 SUBMITTALS, SUBMIT THE FOLLOWING:

- A. Manufacturer's literature of the materials specified herein.
- B. Shop drawings of the temporary fence and gates.
 - 1. Shop drawings shall indicate layout of temporary fencing, location and size of gates, existing pavement and roads, and other site-specific conditions. Prepare drawing after site observation and verification of existing conditions.

PART 2 - PRODUCTS-GALVANIZED

2.01 TEMPORARY CHAIN LINK FENCING:

- A. Unless otherwise indicated, type of 8-foot temporary chain link fencing shall be Contractor's option. Following types are acceptable:
 - 1. New materials or previously used salvaged chain link fencing in good condition.
 - 2. Posts: Galvanized steel pipe of diameter to provide rigidity. Post shall be suitable for setting in concrete footings, driving into ground, anchoring with base plates, or inserting in precast concrete blocks.
 - 3. Fabric: Woven galvanized steel wire mesh. Provide in continuous lengths to be wire tied to fence posts or prefabricated into modular pipe-framed fence panels.
- B. Gates: Provide gates of the quantity and size indicated on the Contract Drawings or required for functional access to Site.
 - 1. Fabricate of same material as used for fencing.

2. Vehicle gates:

- a. Minimum width: 20 feet to allow access for emergency vehicles.
- b. Capable of manual operation by one person.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. The fence and gates shall be erected by skilled mechanics in accordance with the recommendations of the manufacturer and these specifications. These specifications shall take precedence over the recommendations of the manufacturer if any discrepancy exists between them.
- B. Posts
 - 1. Maximum post spacing shall be 10-feet. Post spacing shall be uniform and posts shall be plumb.
 - 2. Drive posts, set in holes and backfill, or anchor in precast concrete blocks.
 - 3. For soft and unstable ground conditions, cast concrete plug around post.
 - 4. Posts over pavement: Use steel post plates or precast concrete blocks.
 - 5. Gate posts: Use bracing or concrete footings to provide rigidity for accommodating size of gate.
 - 6. Temporary terminal posts shall be securely connected to existing fence posts to prevent site access/trespassing.
- C. Securely attach wire fabric to posts. Maximum area of unbraced fence fabric shall not exceed 1,500 square feet.
- D. Install with required hardware.
- E. Fabric shall be stretched taut, with the bottom edge following the existing grade, and shall be a continuous mesh between terminal posts. Each span of fabric shall be attached independently at terminal posts. Where terminal posts do not have provisions for weaving fabric to posts, stretcher bars shall be placed through the end weave of the fabric and secured to the post with bar bands spaced not more than 15-inches apart on the post. Temporary terminal posts shall be secured to existing fence posts to prevent Site access/trespassing.

- F. Fabric shall be attached with ties to line posts at intervals of not more than 14-inches (and to the top railing and braces at intervals not exceeding 24-inches).
- G. The bottom tension wire shall be interlaced in the weave of the fabric, pulled taut and fastened to terminal posts.

3.02 MAINTENANCE AND REMOVAL:

- A. Maintain fencing in good condition. If damaged, immediately repair.
- B. Remove temporary fencing upon completion of Work or when no longer required for security or control. Backfill holes and compact. Holes in pavement shall be surfaced to match existing paving. Repair damage caused by installation of temporary fencing.

END OF SECTION

SECTION 02824

PERMANENT BARRIER FENCE (WOOD GUARD RAIL)

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. The Contractor shall furnish and install either a permanent barrier fence as shown on the drawings or as required by the Engineer. The fence shall be installed as specified herein.

PART 2 - PRODUCTS

2.01 MATERIAL:

- A. The permanent barrier fence shall be as shown in the s. The fence shall be fabricated of treated Southern Yellow Pine, or equal, timbers with 8-inch by 8-inch posts and 4-inch by 10-inch rails.
- B. All timber shall be sound, straight, well seasoned and dressed to American Standard dressed sizes.
- C. All timber members shall be impregnated with Wolmanized "CCA-Type 2" or "FCAP" pressure treatment, or "Cellon" pressure treatment as per Koppers Co., Inc., or Osmose "K-33" pressure treatment as per Osmose Wood Preserving Co. of America, Inc., or equal, which shall meet or exceed Federal Specification TT-W-550.
- D. Treatment shall be applied in a closed cylinder by vacuum pressure process in strict accordance with recommended practices of the American Wood Preservers Association and the latest edition of Federal Specification TT-W-571, which states retention of dry salts, should be 0.42 lbs./c.f. of wood.
- E. All timber shall be shop fabricated with all holes pre-drilled for on-site assembly using 5/8-inch diameter bolts as required.
- E. All bolts; washers, nuts, etc. shall be in accordance with the requirements of AASHTO-M183 and shall be galvanized, after fabrication, to meet the requirements of ASTM A153.

2.02 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01330 SUBMITTALS, SUBMIT THE FOLLOWING:

- A. Manufacturers literature verifying the pressure treatment method specified herein.
- B. Details for the barrier fence components and erection instructions.

PART 3 - EXECUTION

3.01 FABRICATION:

- A. All timber shall be shop fabricated, with all holes pre-drilled for on site assembly, using 5/8-inch diameter bolts as required.
- B. All bolts, washers, nuts, etc. shall be in accordance with the requirements of AASHTO-M183 and shall be galvanized after fabrication to meet the requirements of ASTM A153.

3.02 INSTALLATION:

- A. The barrier fence shall be installed after construction of all other phases of work is completed.
- B. The fence shall be installed with all required hardware and the posts shall be firmly anchored in the soil to the depth indicated on the contract drawings, with adjacent area firmly compacted or finished per contract drawings.

END OF SECTION

SECTION 02829

STEEL BARRIER GATE

PART 1 – GENERAL

1.01 WORK INCLUDED:

- A. Furnish and install a Barrier Gate in the location(s) indicated on Drawings.

1.02 RELATED WORK:

- A. Section 02300 - EARTHWORK
- B. Section 03302 - FIELD CONCRETE

1.03 SYSTEM DESCRIPTION:

- A. The Contract Drawings show the character and extent of the work to be performed and provided but does not attempt to show all methods, materials and details of construction, etc. Supplementary components customarily necessary to complete an item, though such parts are not definitely shown or specified, shall be included as part of the gate.

1.04 REFERENCES:

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

American Society of Testing and Materials

ASTM	A36	Structural Steel
ASTM	A53	Pipe, Steel, Black and Hot-Dipped Zinc-Coated Welded and Seamless
ASTM	A153	Zinc Coating (Hot-Dip) on Iron and Steel Products

American Welding Society

AWS	Code Standard for Arc and Gas Welding
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1.05 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01330 SUBMITTALS, SUBMIT THE FOLLOWING:

- A. Before fabricating or assembling of any components, the Contractor shall submit shop drawings for all work included in this section.

PART 2 – PRODUCTS:

2.01 MATERIALS:

- A. Steel pipe shall be Schedule 40 and the size as indicated on the Drawings.
- B. Steel pipe shall conform to ASTM A53.
- C. Steel shapes, plates and bars shall conform to ASTM A36.
- C. Posts, bar gate and diagonal brace diameters shall be as shown on the drawings.
- D. Finish shall be galvanized and painted black. No site welding or painting on site shall be allowed.

PART 3 – EXECUTION

3.01 QUALITY ASSURANCE;

- A. Barrier Gate shall be complete in accordance with this section and the contract Drawings.
- B. All intersecting pipe joints shall be shop fillet welded.

3.02 INSTALLATION:

- A. Barrier Gate shall be installed at the location(s) indicated on the Contract Drawings and in accordance with this section.
- B. The gate components shall be assembled as shown on the drawings, welded all sides and ground smooth, galvanized, and painted prior to delivery to the site.
- C. The posts shall be encased in concrete foundations as shown on the drawings.
- D. A padlock shall be furnished to the Owner, and if applicable, keyed to the Owner's standard requirements.

3.03 PAINTING:

- A. All exposed pipe and appurtenances to be painted with Zinc Rich Primer plus one coat of Catalyzed Epoxy and a finish coat of Acrylic Polyurethane by Tnemec Co. or approved equal.

3.04 CLEAN-UP:

- A. Remove all excess materials from the work-site when completed with the Barrier Gate installation.

END OF SECTION

SECTION 02831

SEGMENTAL RETAINING WALL SYSTEM

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. Work shall consist of designing, furnishing all materials, labor, equipment, and installation of the segmental retaining wall system in accordance with these specifications and to the lines, grades, and dimensions shown on the plans.

1.02 RELATED WORK:

- A. Section 01330, SUBMITTALS
- B. Section 02300, EARTHWORK

1.03 REFERENCE STANDARDS

- A. The Massachusetts Highway Department Standard Specifications for Highways and Bridges Construction.
- B. Segmental Retaining Wall Units
 - 1. ASTM C 1372 - Standard Specification for Segmental Retaining Wall Units
 - 2. ASTM C 140 - Standard Test Methods of Sampling and Testing Concrete Masonry Units
- C. Geosynthetic Reinforcement
 - 1. ASTM D 4595 - Tensile Properties of Geotextiles by the Wide-Width Strip Method
 - 2. ASTM D 5262 - Test Method for Evaluating the Unconfined Creep Behavior of Geosynthetics
 - 3. GRI:GG1 - Single Rib Geogrid Tensile Strength
 - 4. GRI:GG5 - Geogrid Pullout
- D. Soils
 - 1. ASTM D 698 - Moisture Density Relationship for Soils, Standard Method
 - 2. ASTM D 422 - Gradation of Soils
 - 3. ASTM D 424 - Atterberg Limits of Soil

SEGMENTAL RETAINING WALL SYSTEM

- E. Drainage Pipe
 - 1. ASTM D 3034 - Specification for Polyvinyl Chloride (PVC) Plastic Pipe
 - 2. ASTM D 1248 - Specification for Corrugated Plastic Pipe
- F. Engineering Design
 - 1. “NCMA Design Manual for Segmental Retaining Walls”, Second Edition
- G. Where specifications and reference documents conflict, the Engineer shall make the final determination of applicable document.

1.04 DESIGN CRITERIA

- A. The following soil parameters shall be assumed for the final design unless otherwise shown on the plans or specified by the Engineer:

	Unit Weight (pcf)	Internal Friction Angle, degrees	Cohesion
Reinforced Fill	120	30	0
Retained Soil	120	30	0
Foundation Soil	120	30	0

- B. Precast sections shall be designed to withstand earth loads due to soil plus live loads due to vehicular traffic (H20 loading). Design and construction of each section shall meet the requirements of ACI 318 and the AASHTO Load Factor.
- C. Should the actual soil conditions observed during construction differ from those assumed for the design, design shall be reviewed by the Wall Design Engineer at the Engineer's direction.
- D. The design for the final retaining wall plans shall be prepared and sealed by a professional Civil Engineer licensed in the Commonwealth of Massachusetts. The design analysis shall consider the external stability against sliding and overturning, internal stability, facial stability of the reinforced soil mass, and external global stability and shall be in accordance with acceptable engineering practice and these specifications. The internal and external stability analysis shall be performed in accordance with the “NCMA Design Manual for Segmental Retaining Walls”, using the recommended minimum factors of safety in this manual.

SEGMENTAL RETAINING WALL SYSTEM

- E. The design of the geosynthetic reinforcement shall take into consideration the effects from obstructions.
- F. Minimum embedment: the minimum wall embedment shall be the greater of 0.5 feet or the following:

Level Slope in Front $H'/20$

3H:1V Slope in Front $H'/10$

2H:1V Slope in Front $H'/10$

where H' is the exposed height of the wall.

- G. While vertical spacing between geosynthetic reinforcement layers may vary, it shall not exceed 2.0 feet maximum in the wall design.
- H. The geosynthetic reinforcement placement in the wall design shall have 100 percent continuous coverage parallel to the wall face. Gapping between horizontally adjacent layers of geosynthetic (partial coverage) will not be allowed.

1.05 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

- A. Material Submittals: The Contractor shall submit six (6) sets manufacturers' literature and certifications two weeks prior to start of work stating that the SRW units and geosynthetic reinforcement meet the requirements of Section 2 of this specification.
- B. Design Submittal: The Contractor shall submit six (6) sets of detailed design calculations and final retaining wall plans for approval at least two weeks prior to the beginning of wall construction. All calculations and drawings shall be prepared and sealed by a professional Civil Engineer licensed in the Commonwealth of Massachusetts.

1.06 DELIVERY AND STORAGE:

- A. Contractor shall check materials upon delivery to assure that specified type and grade of materials have been received and proper color and texture of SRW units have been received.
- B. Contractor shall store and handle materials in accordance with manufacturer's recommendations and in a manner to prevent deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breaking, chipping or other causes.

SEGMENTAL RETAINING WALL SYSTEM

- C. Contractor shall protect materials from damage. Damaged materials shall not be incorporated into the retaining wall.

PART 2 - PRODUCTS

A. CONCRETE SEGMENTAL RETAINING WALL UNITS

1. SRW units shall be Redi-Rock LedgeStone Wall System as manufactured by Redi-Rock International, or an approved equal.
2. Color shall be integral to the concrete, New England mix or similar.
3. Texture on the face of the block shall be ledgeStone, weathered edge or approved equal, all exposed vertical faces shall have this textured finish.
4. SRW units shall provide a minimum weight of 110 psf of wall face area.
5. If connectors are used by the SRW supplier to interconnect the SRW units, they shall meet the requirements of the manufacturer.
6. SRW units shall be sound and free of cracks or other defects that would interfere with the proper placing of the unit or significantly impair the strength or permanence of the structure. Cracking, crazing, spalling, pitting, seam-bulges/bumps/blisters or excessive chipping may be grounds for rejection. Units showing cracks longer than 1/2" shall not be used within the wall. Units showing chips visible at a distance of 30 feet from the wall shall not be used within the wall. Units with concrete form seams raised greater than 1/4" or causing uneven stacking of units shall be sanded smoothed or not used within the wall.
7. Concrete used to manufacture SRW units shall have a minimum 28 days compressive strength of 4,000 psi and a maximum moisture absorption rate, by weight, of 8% as determined in accordance with ASTM C1372. Compressive strength test specimens shall conform to the saw-cut coupon provisions of ASTM C140.
8. SRW units' molded dimensions shall not differ more than + 1/8 inch from that specified, in accordance with ASTM C1372.
9. SRW units shall weigh no less than 250 lbs per standard block.
10. Color shall be integral to the concrete- final color shall be determined during the submittal phase of construction with the town.

2.02 GEOSYNTHETIC REINFORCEMENT

- A. Geosynthetic reinforcement shall consist of geogrids or geotextiles manufactured as a soil reinforcement element. The type, strength, and placement location of the

SEGMENTAL RETAINING WALL SYSTEM

reinforcing goesynthetic shall be determined by the Engineer providing the wall design and as shown on the approved segmental retaining wall plans.

- B. Detailed test data shall be submitted to the Engineer for approval and shall include the following:
 - 1. Tensile strength in accordance with ASTM D 4595 or GRI GG-1.
 - 2. Creep in accordance with ASTM D 5262.
 - 3. Site damage and durability in accordance with GRI GG-4.
 - 4. Pullout in accordance with GRI GG-5 or GRI GT-6
 - 5. Connection test data in accordance with NCMA SRWU-1.

2.03 LEVELING PAD

- A. Material for the leveling pad shall consist of crushed stone meeting the requirements of Section M2.01.3 or M2.01.4 of the Massachusetts Highway Department Standard Specifications for Highways and Bridges Construction and shall be a minimum of 6 inches in depth unless otherwise shown on the Contract Drawings. The leveling pad must extend a minimum of 6 inches from both the front and back faces of the block unless otherwise shown on the Contract Drawings. Lean concrete with a strength of 200-300 psi and three inches thick maximum may also be used as a leveling pad material with approval by the Engineer.

2.04 DRAINAGE AGGREGATE

- A. Drainage aggregate shall be crushed stone meeting the requirements of Section M2.01.4 of the Massachusetts Highway Department Standard Specifications for Highways and Bridges Construction.

2.05 DRAINAGE PIPE

- A. The drainage collection pipe shall be a perforated or slotted PVC, or corrugated HDPE pipe. The drainage pipe may be wrapped with a geotextile to function as a filter.
- B. Drainage pipe shall be manufactured in accordance with ASTM D 3034 and/or ASTM D 1248.

2.06 REINFORCED BACKFILL

- A. The reinforced backfill shall be free of debris. Unless otherwise noted on the approved segmental retaining wall plans prepared by the Wall Design Engineer,

SEGMENTAL RETAINING WALL SYSTEM

the reinforced material shall consist of Type B Gravel Borrow in accordance with Section M1.03.0 of the Massachusetts Highway Department Standard Specifications for Highways and Bridges Construction.

2.07 GEOTEXTILE FABRIC

- A. Geotextile fabric shall meet the requirements of Type II in accordance with Section M9.50.0 of the Massachusetts Highway Department Standard Specifications for Highways and Bridges Construction.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Contractor's field construction supervisor shall have demonstrated experience and be qualified to direct all work at the site.

3.02 EXCAVATION

- A. Contractor shall excavate to the lines and grades shown on the project grading plans. Contractor shall take precautions to minimize over-excavation. Over-excavation shall be filled with compacted backfill material as directed by the Engineer, at the Contractor's expense.
- B. Contractor shall verify location of existing structures and utilities prior to excavation. Contractor shall ensure all surrounding structures are protected from the effects of wall excavation. Excavation support, if required, is the responsibility of the Contractor

3.03 FOUNDATION PREPARATION

- A. Following the excavation, the foundation soil shall be examined by the Engineer to assure actual foundation soil strength meets or exceeds the assumed design bearing strength. Soils not meeting the required strength shall be removed and replaced with material, as directed by the Engineer.
- B. Foundation soil shall be proof rolled and compacted to 95% standard Proctor density and inspected by the Engineer prior to placement of leveling pad materials.

3.04 LEVELING PAD CONSTRUCTION

- A. Leveling pad shall be placed as shown on the final, approved P.E. sealed retaining wall drawings. The leveling pad shall have a minimum thickness of 6 inches. The

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leveling pad should extend laterally at least a distance of 6 inches from the toe and heel of the lower most SRW unit unless shown otherwise on the Contract Drawings.

3.05 SRW UNIT INSTALLATION

- A. All SRW units shall be installed at the proper elevation and orientation as shown on the final, approved P.E. sealed wall drawings or as directed by the Wall Design Engineer. The SRW units and geosynthetic reinforcement shall be installed in accordance with the manufacturer's recommendations.
- B. First course of SRW units shall be placed on the leveling pad with the aesthetic surface facing out. The units shall be leveled side-to-side, front-to-rear and with adjacent units, and aligned to ensure intimate contact with the leveling pad.
- C. Prior to placement of next course, the level and alignment of the units shall be checked and corrected, where needed.
- D. Layout of curves and corners shall be installed in accordance with the wall plan details or in general accordance with SRW manufacturer's installation guidelines. Walls meeting at corners shall be interlocked by overlapping successive courses.
- E. Broken, chipped, stained or otherwise damaged units shall not be placed in the wall unless they are repaired and the repair method and results are approved by the Engineer.

3.06 GEOSYNTHETIC REINFORCEMENT PLACEMENT

- A. All geosynthetic reinforcement shall be installed at the proper elevation and orientation as shown on the final, approved P.E. sealed retaining wall drawings, or as directed by the Wall Design Engineer.
- B. At the elevations shown on the final plans, (after the units, drainage material, and backfill have been placed to this elevation) the geosynthetic reinforcement shall be laid horizontally on compacted infill.
- C. Geosynthetic reinforcement layers shall be one continuous piece for their entire embedment length. Overlapping of the geosynthetic in the design strength direction (perpendicular to the wall face) shall not be permitted. Along the length of the wall, horizontally adjacent sections of geosynthetic reinforcement shall be butted in a manner to assure 100 percent coverage parallel to the wall face.
- D. Tracked construction equipment shall not be operated directly on the geosynthetic reinforcement. A minimum of 6 inches of backfill is required prior to operation

SEGMENTAL RETAINING WALL SYSTEM

of tracked vehicles over the geosynthetic. Turning should be kept to a minimum. Rubber-tired equipment may pass over the geosynthetic reinforcement at slow speeds (less than 5 mph).

- E. The geosynthetic reinforcement should be installed under tension. The nominal tension shall be applied to the reinforcement and secured in place with staples, stakes or by hand tensioning until reinforcement is covered by six inches of fill.

3.07 DRAINAGE MATERIALS

- A. Drainage aggregate shall be installed to the line, grades, and sections shown on the final P.E. sealed retaining wall drawings. Drainage aggregate shall be placed to the minimum thickness shown on the Contract Drawings between and behind units.
- B. Drainage collection pipes shall be installed to maintain gravity flow of water outside the reinforced soil zone. The drainage collection pipe shall daylight at an elevation lower than the lowest point of the pipe within the aggregate drain.
- C. The main collection drain pipe, just behind the block facing, shall be a minimum of 3 inches in diameter. The secondary collection drain pipes should be sloped a minimum of 2% to provide gravity flow into the main collection drain pipe. Drainage laterals shall be spaced at a maximum 50 feet spacing along the wall.

3.08 BACKFILL PLACEMENT

- A. The reinforced backfill shall be placed as shown in the final, approved wall drawings in the maximum compacted lift thickness of 10 inches and shall be compacted to a minimum of 95% of standard Proctor density (ASTM D 698) at moisture content within 2% of optimum. The backfill shall be placed and spread in such a manner as to eliminate wrinkles or movement of the geosynthetic reinforcement and the SRW units.
- B. Only hand-operated compaction equipment shall be allowed within 3 feet of the back of the wall units. Compaction within the 3 feet behind the wall units shall be achieved by at least three (3) passes of a lightweight mechanical tamper, plate, or roller.
- C. At the end of each day's operation, the Contractor shall slope the last level of backfill away from the wall facing and reinforced backfill to direct water runoff away from the wall face.

SEGMENTAL RETAINING WALL SYSTEM

- D. At completion of wall construction, backfill shall be placed level with final top of wall elevation. If final grading, paving, landscaping, and/or storm drainage installation adjacent to the wall is not placed immediately after wall completion, temporary grading and drainage shall be provided to ensure water runoff is not directed at the wall nor allowed to collect or pond behind the wall until final construction adjacent to the wall is completed.

3.09 CONSTRUCTION ADJACENT TO COMPLETED WALL

- A. The Contractor is responsible for ensuring that construction adjacent to the wall does not disturb the wall or place temporary construction loads on the wall that exceed design loads, including loads such as water pressure, temporary grades, or equipment loading. Care should be taken by the Contractor to ensure water runoff is directed away from the wall structure until final grading and surface drainage collection systems are completed.

END OF SECTION

SECTION 03100

CONCRETE FORMWORK

PART 1 - GENERAL

1.01 WORK INCLUDED:

This section of the specifications covers the furnishing and installation of forms for cast-in-place concrete.

1.02 RELATED WORK:

- A. Section 03200, CONCRETE REINFORCEMENT
- B. Section 03300, CAST-IN-PLACE CONCRETE

1.03 REFERENCES:

The following standards form a part of this specification:

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 301 Standard Specifications for Structural Concrete

ACI 347 Recommended Practices for Concrete Formwork

U.S. ARMY CORPS OF ENGINEERS (CE)

CE 03300 Cast-in-Place Concrete

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Forms for exterior and interior surfaces which will be exposed to view after the work is completed, whether such surfaces are painted or unpainted, shall be new plywood stock, steel, tempered masonite, or other materials which will provide smooth concrete surfaces without subsequent surface plastering. Plastic or plastic-faced forms shall not be used, except with the prior approval of the Engineer.
- B. Form Ties
 - 1. Provide factory-fabricated, adjustable length, removable or snap off metal form ties, designed to prevent form deflection and to prevent spalling of concrete surfaces upon removal.

2. Provide ties so that the portion remaining within concrete after removal of exterior parts is at least 1-1/2 inches from the outer concrete surface. Provide form ties, which will not leave a hole larger than one inch diameter in the concrete surface.
- C. Form release agent shall be a non-staining, non-yellowing, non-toxic liquid free from kerosene and resins of the type recommended by the manufacturer of the forming system being used such as EZ strip by L&M Construction Chemicals, Omaha, NB and "Magic Kote" by Symons Corp., Des Plaines, IL or approved equal.
- D. Where steel adjacent to vertical faces of forms cannot be otherwise secured, mortar doughnuts shall be used to prevent steel from lying too close to the finish vertical faces of the concrete.

PART 3 - EXECUTION

3.01 PREPARATION:

Surfaces of forms to be in contact with concrete shall be greased with non-staining form release compound. Wetting will not be accepted as a substitute. Approval of the Engineer shall be obtained before use of coated materials or liners in lieu of form release compound, except as modified herein.

3.02 CONSTRUCTION:

- A. For concrete surfaces which will be visible after completion of the structure, painted or unpainted, the type and the precise location of form ties, nails joints between form members, and any other features which will leave a visible trace in the finished concrete, will be subject to the approval of the Engineer.
- B. Formwork shall be so constructed, braced, or tied that the formed surfaces of the concrete will be perfectly true, smooth, and to the dimensions shown on the drawings. All forms used for circular sections shall be true arcs as indicated on the drawings. Short chords will not be acceptable. Form line shall present an uninterrupted surface conforming to radii indicated on the drawings.
- C. Forms shall be sufficiently tight to prevent leakage of mortar, and when necessary shall have temporary openings as required for thorough cleaning, and as required for introduction of concrete to avoid excessive free fall. Panels damaged in stripping or otherwise shall not be reused.
- D. Unless otherwise noted on the design drawings, forms shall be filleted and chamfered at all sharp corners and exposed edges with a 3/4-inch chamfer. Chamfer shall not be used where masonry or other material will subsequently be installed flush with one of the adjacent surfaces of the concrete. Where a wash or slope is indicated on the drawings no additional chamfer is required.

3.03 REMOVAL OF FORMS

A. REMOVING FORMS AND SUPPORTS:

1. Removal of forms shall take place in accordance with ACI 347, Section 3.6. Except as otherwise specifically authorized by the Engineer, forms shall not be removed until the concrete has aged for the following number of day-degrees or attained 50 percent strength. (Day-degrees equals the total of number of days times the average daily air temperature at the surface of concrete. For example, 5 days at a daily average temperature of 60°F. equals 300 day-degrees.)

<u>Location</u>	<u>Day-Degrees</u>
Beams and Slabs	500
Walls and Vertical Surfaces	200

- B. Where beams, girder, columns, walls and similar vertical forms are adequately supported on shores, the side forms may be removed after 24 hours of cumulative curing time provided the side forms support no loads other than the lateral pressure of the plastic concrete. Cumulative curing time represents the sum of time intervals, not necessarily consecutive, during which the temperature of the air surrounding the concrete is above 50 deg. F in accordance with American Concrete Institute standards.
- C. Shoring shall not be removed until the concrete has attained at least 70 percent of the specified strength and sufficient strength to support safely its own weight and the construction live loads upon it.
- D. Forms shall be removed in such a manner as not to impair safety and serviceability of the structure. Concrete exposed by form removal shall have sufficient strength not to be damaged by the removal operation.

END OF SECTION

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 WORK INCLUDED:

This section of the specification covers the furnishing and installation of reinforcement for cast-in-place concrete.

1.02 RELATED WORK:

- A. Section 03300, CAST-IN-PLACE CONCRETE

1.03 SYSTEM DESCRIPTION:

Materials and construction shall conform to ACI 318 and ACI 350 unless otherwise noted on the design drawings or modified herein.

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

- A. The Contractor shall furnish the Engineer with complete checked, reinforcing steel shop drawings and bar lists. Shop drawing shall include grade of steel used as well as splice lengths.
- B. Mill test reports shall accompany drawings. Fabrication shall not commence until the drawings and mill test reports have been released by the Engineer.

1.05 REFERENCES:

- A. The following standards form a part of these specifications:

American Concrete Institute (ACI)

ACI SP-66 ACI Detailing Manual

ACI 318 Building Code Requirements for Concrete

American Society for Testing and Materials (ASTM)

ASTM A185 Standard Specification for Welded Steel Wire Fabric for Concrete Reinforcement

ASTM A497 Specification for Welded Deformed Steel Wire Fabric for Concrete Reinforcement

ASTM A615 Deformed Billet-Steel Bars for Concrete Reinforcement

ASTM A775 Epoxy-coated Reinforcing Steel Bars

ASTM A884 Epoxy-coated Welded Wire Fabric

American Welding Society (AWS)

AWS 12.1 Recommended Practices for Welding Reinforcing Steel, Metal Inserts and Connections in Reinforced Concrete Construction

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Steel reinforcing bars shall conform to ASTM A615, Grade 60, and A775 if epoxy-coated bars are specified.
- B. Welded steel wire fabric shall conform to ASTM A185 or ASTM A497 and ASTM A884 if epoxy-coated fabric is specified. Gauge and spacing of wires shall be as indicated on the drawings.
- C. Reinforcing steel shall be detailed in accordance with ACI SP-66 modified as applicable to conform to ACI 318.
- D. Reinforcement shall be accurately formed to the dimensions indicated on the drawings. Bars shall be shipped to the site with bars of the same size and shape, fastened in bundles with securely wired-on metal identification tags listing both size and mark.
- E. Any bar showing cracks after bending shall be discarded.
- F. Steel failing to meet the requirements of this specification, or the drawings will be rejected and shall be removed from the site immediately.

PART 3 - EXECUTION

3.01 STEEL INSTALLATION:

- A. 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. When there is a delay in depositing concrete after reinforcement is in place, bars shall be reinspected and cleaned as necessary.
- B. After forms have been oiled, but before concrete is placed, all steel shall be securely wired in the exact position called for, and shall be maintained in that position until all concrete is placed and compacted. Chair bars and supports shall be provided in a number and arrangement satisfactory to the Engineer.
- C. Concrete blocks having a minimum bearing area of 2-inches by 2-inches and equal in quality to that specified for the slab, shall be used for supporting reinforcing bars for slabs on grade. Wood blocks, stones, brick chips, etc., shall not be used to support reinforcement.
- D. Metal supports shall be of types that will not penetrate the surface of formwork or slab and which will not show through or stain surfaces that are to be exposed to view, painted or unpainted.
- E. Welding of reinforcing bars will be permitted only where permission of the Engineer has been obtained in advance. Such welding shall be performed only under conditions established by the Engineer, and in accordance with AWS 12.1.
- F. Reinforcement, which is to be exposed for a considerable length of time after having been placed, shall be painted with a heavy coat of cement grout, if required by the Engineer.

END OF SECTION

SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 WORK INCLUDED:

This Section covers all concrete and all related items necessary to place and finish the concrete work.

1.02 RELATED WORK:

- A. Section 02300, EARTHWORK
- B. Section 03200, CONCRETE REINFORCEMENT
- C. Items furnished under other Sections and installed under this Section include, but are not limited to:

Items embedded in concrete, including anchors, sleeves, floor drains, castings, frames for hatches, angles, nosings, and other miscellaneous metals.

1.03 REFERENCES:

- A. The following standards form a part of these specifications:

American Concrete Institute (ACI)

- ACI 301 Structural Concrete for Buildings
- ACI 302 Recommended Practice for Concrete Floor and Slab Construction
- ACI 304 Recommended Practice for Measuring, Mixing, Transporting, and Replacing Concrete
- ACI 305 Recommended Practice for Hot Weather Concreting
- ACI 306 Recommended Practice for Cold Weather Concreting
- ACI 318 Building Code Requirements for Reinforced Concrete
- ACI 347 Recommended Practice for Concrete Formwork

American Society for Testing and Materials (ASTM)

ASTM	C33	Concrete Aggregates
ASTM	C39	Compressive Strength of Cylindrical Concrete Specimens
ASTM	C42	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM	C87	Effect of Organic Impurities in Fine Aggregate on Strength of Mortar
ASTM	C94	Ready-Mixed Concrete
ASTM	C143	Standard Method for Slumps of Portland Cement Concrete
ASTM	C150	Portland Cement
ASTM	C171	Sheet Materials for Curing Concrete
ASTM	C231	Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM	C260	Air-Entraining Admixtures for Concrete
ASTM	C309	Liquid Membrane-Forming Compounds for Curing Concrete
ASTM	C494	Chemical Admixtures for Concrete
ASTM	D1751	Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)
ASTM	D1752	Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

- A. Six sets of shop drawings of the materials specified herein shall be submitted to the Engineer for review.
- B. Six copies of the statement of materials constituting the design of mixes which satisfy the specified strength for each size aggregate as required by ASTM C94 shall be submitted to the Engineer within one week following award of the contract.
- C. Provide one copy of the "Certificate of Delivery" for each load of concrete as it arrives on the site, under the provisions of ASTM C94.

PART 2 - PRODUCTS

2.01 CONCRETE:

- A. Concrete conforming to the requirements listed below shall be used where indicated on the drawings. Unless otherwise indicated, or approved by the Engineer, concrete shall be the 4,500 psi mix.

TABLE

Minimum Comp. Strength at 28 days (psi)	Maximum Water/Cement ratio (gallons per bag of cement)*	Cement Factor: 94 lb. Bags per cubic yard minimum**
3000	0.59 (6.9)	5.5
4000	0.48 (5.6)	6.5
5000	0.40 (4.7)	7.4

* Based on air-entrained concrete. If non-air-entrained concrete is called for, the listed maximum water/cement ratios may be increased slightly, as approved by the Engineer. The water is the total water in the mix, including free water on the aggregate.

** These are minimum amounts; increase as necessary to meet mix requirements.

- B. Concrete shall conform to ASTM C94. One copy of the Certificate of Delivery required by ASTM C94 shall be delivered to the Engineer immediately upon arrival of each load of concrete at the site. The Contractor shall be responsible for the design of the concrete mixtures.
- C. Standard compression tests of all proposed mixes shall be made by the testing laboratory or other satisfactory evidence shall be presented that the design mixes will attain the minimum strengths listed on the design drawings or called for herein, within the limitations of the ACI Code. No concrete shall be delivered to the job site until the Engineer has approved the design mixes.
- D. All concrete (unless otherwise directed) shall contain an air-entraining agent. Air entrained concrete shall have an air content by volume of 3 to 6 percent for 1-1/2-inch aggregate and 4 to 8 percent for 3/4-inch aggregate. The air content shall be the responsibility of the testing laboratory and in accordance with ASTM C231.
- E. All concrete shall contain a mid-range water reducer to minimize cement and water content of the mix, at the specified slump, in accordance with ASTM C494.

- F. Slump for all concrete shall be from 3-inch to 4-inch, except for concrete using a superplasticizer, when the maximum slump shall be 8 inches. Any concrete having a slump greater than 4 inches (8 inches with superplasticizer) shall be promptly removed from the site.
- G. No calcium chloride or admixtures containing calcium chloride shall be added to the concrete. No admixture other than those specified shall be used in concrete without the specific written permission of the Engineer in each case.
- H. No additional water, except for the amount indicated by the design mix shall be added to the concrete without the prior permission of the Engineer.

2.02 CEMENT:

- A. The cement shall be an approved brand of American manufactured Portland Cement, Type II conforming to ASTM C150. The brand name and type of cement proposed for use shall be submitted to the Engineer for approval immediately following award of contract. Only one color of cement, all of the same manufacture, shall be used for the work.
- B. When the use of high-early-strength Portland cement (Type III) is permitted by the Engineer the same strength requirements shall apply, but the indicated strengths shall be attained in 7 days instead of 28 days.

2.03 ADMIXTURES:

- A. Air entraining agent shall be in accordance with ASTM C260.
- B. Water reducing agent shall be a mid-range water reducer meeting ASTM C494, Type A.
- C. Water reducing agent-retarder shall be in accordance with ASTM C494, Type D.
- D. Superplasticizer agent shall be in accordance with ASTM C494, Type F or Type G and contain no more than 0.1% chloride ions. Product may be plant added or field added based on the best application considering distance, temperature and time.

2.04 AGGREGATES:

- A. Except as otherwise noted, aggregate shall conform to the requirements of ASTM C33.
- B. Fine aggregate shall consist of washed inert natural sand conforming to the requirements of ASTM C33.
- C. Coarse aggregate shall consist of well-graded crushed stone or washed gravel conforming to the requirements of ASTM C33.

- D. The following designated sizes of aggregate shall be the maximum employed in concrete.

2-inch for mass concrete

1½-inch for reinforced sections 18-inch and over in thickness

¾-inch for reinforced and un-reinforced sections less than 18-inch thickness.

2.05 WATER:

Water for concrete shall be potable, free from injurious amounts of oil, acid, alkali, organic matter and other deleterious substances.

2.06 NON-METALLIC SHRINKAGE RESISTANT GROUT

- A. Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time. The minimum ultimate compressive strength of the grout shall be 5000 psi at 7 days and 7500 psi at 28 days.

2.07 CURING MATERIALS:

- A. Curing compound shall be a curing/hardener compound such as Acurion by AntiHydro, Sikaguard Cure/Hard by Sika, Super Diamond Clear by Euclid or approved equal.
- B. Curing paper shall be a fiber-reinforced laminated Kraft bituminous product conforming to the requirements of ASTM C171.

2.08 JOINT FILLER:

1. Preformed joint filler strip shall conform to ASTM D1751 or D1752, having a thickness as indicated on the drawings.
2. Fillers shall be provided in pieces of the full thickness required. Use of multiple layers of thin pieces to make-up the full thickness will not be permitted.

2.09 JOINT SEALANT:

Joint sealant for construction and control joints shall be a two-part polysulfide base sealant conforming to Thiokol's Building Trade Performance Specification, Class A (self-leveling), Type II (hardness: 35-45 Shore A).

PART 3 - EXECUTION

3.01 GENERAL:

Under no circumstances shall concrete that has set or partially set before placing be used; and no re-tampering of concrete or grout will be permitted.

3.02 PREPARATION:

- A. Before placing concrete, forms and the space to be occupied by the concrete shall be thoroughly cleaned, and reinforcing steel and embedded metal shall be free from dirt, oil, mill scale, loose rust, paint or other material which would tend to reduce the bond.
- B. Earth, concrete, masonry, or other water-permeable material against which concrete is to be placed shall be thoroughly saturated with water immediately before concrete is placed. No concrete shall be placed until the consolidation of the ground and the arrangement and details of forms and reinforcing have been inspected and approved by the Engineer.
- C. When joining fresh concrete to concrete which has attained full set, the latter shall be cleaned by chipping and washing off all dirt and scum and laitance. It then shall be moistened prior to placing new concrete.
- D. Concrete surfaces that act as a seat for structural members (other than those resting on grout) shall be troweled to an extremely flat and level surface. If necessary, such surfaces shall be ground off to achieve the required flatness and level.
- E. Fill concrete on top of concrete shall be placed in the locations indicated on the drawings or designated by the Engineer. Before fill concrete is placed, the following procedures shall be used to prepare surfaces; all dirt, scum and laitance shall be removed by chipping and washing. The clean, roughened base surface shall be saturated with water, but shall have no free water on the surface. A coat of 1:2 cement-sand grout, approximately 1/8-inch thick, shall be well scrubbed into the thoroughly dampened concrete base. The concrete fill shall be placed immediately, before grout has dried or set. Fill concrete shall be brought to the lines and grades shown on the drawings or approved by the Engineer.
- F. Concrete for thrust and anchor blocks shall be placed against undisturbed earth and wooden side forms shall be used to provide satisfactory lines and dimensions. Felt roofing paper shall be placed to protect joints. No concrete shall be placed so as to cover joints, bolts or nuts, or to interfere with the removal of the joints. Minimum bearing areas and dimensions shall be as shown on the drawings.

3.03 MIXING:

- A. Concrete shall be ready-mixed, or transit-mixed, as produced by equipment acceptable to the Engineer. No hand-mixing will be permitted. Adding water in controlled amounts during the mixing cycle shall be done only with the express approval of, and under the direction of, the Engineer.

- B. Ready-mix or transit-mixed concrete shall be transported to the site in watertight agitator or mixer trucks loaded not in excess of rated capacities for the respective conditions as stated on the nameplate. Discharge at the site shall be within 1-1/2 hours after cement was first introduced into the mix. Central mixed concrete shall be plant-mixed a minimum of 1-1/2 minutes per batch and then shall be truck-mixed or agitated a minimum of 8 minutes. Agitation shall begin immediately after the pre-mixed concrete is placed in the truck and shall continue without interruption until discharge. Transit-mixed concrete shall be mixed at mixing speed for at least 10 minutes immediately after charging the truck, followed by agitation without interruption until discharged.
- C. All central plant and rolling stock equipment and methods shall conform to the latest Truck Mixer and Agitator Standards of the Truck Mixer Manufacturers' Bureau of the National Ready-Mixed Concrete Association, as well as ACI 304 and ASTM C94.
- D. Attention is called to the importance of dispatching trucks from the batching plant so that they shall arrive at the site of the work just before the concrete is required, thus avoiding excessive mixing of concrete while waiting or delays in placing successive layers of concrete in the forms.

3.04 INSTALLATION/APPLICATION/ERECTION:

A. PLACING:

1. No concrete shall be placed by pumping methods without the prior written approval of the Engineer. Should the Contractor be allowed to place concrete by pumping methods, procedures, mix design of concrete, and all other precautions shall be in accordance with ACI 304.2R and as approved by the Engineer.
2. Concrete shall be placed in alternate areas, as defined by the construction and control joints indicated on the design drawings. A minimum of 3 days shall elapse between placement of adjacent sections.
3. Segregation of the concrete shall be prevented during handling; should any segregation occur, the concrete should be remixed before it is placed. Concrete shall be placed in the forms in horizontal layers not over 1 to 2 feet thick. Concrete shall not be allowed to drop freely more than 4 feet. If the free drop to the point of placement must exceed 4 feet, the Contractor shall obtain the approval of the Engineer for the proposed method of depositing the concrete. The concrete shall not be required to flow over distances greater than 3 feet in any direction in the forms or on the ground, unless otherwise permitted by the Engineer.
4. Unless otherwise noted, the work begun on any day shall be completed in daylight of the same day.

5. "Cold Joints" are to be avoided, but if they occur, they are to be treated as bonded construction joints.
6. Chutes for conveying concrete shall be of U-shaped design and sized to insure a continuous flow of concrete. Flat (coal) chutes shall not be employed. Chutes shall be metal or metal-lined, and each section shall have approximately the same slope. The slope shall not be less than 25 nor more than 45 degrees and shall be such as to prevent segregation of the ingredients. The discharge end of the chute shall be provided with a baffle plate or spout to prevent segregation. If the discharge end of the chute is more than 5 feet above the surface of the concrete in the forms, a spout shall be used and the lower end maintained as near the surface of deposit as practicable. When the operation is intermittent, the chute shall discharge into a hopper. Chutes shall be thoroughly cleaned before and after each run, and the debris and any water shall be discharged outside the forms. Concrete shall not be allowed to flow horizontally more than 5 feet.
7. Concrete during and immediately after depositing shall be thoroughly compacted by means of suitable tools. Internal type mechanical vibrators shall be employed to produce the required quality of finish. Vibration shall be done by experienced operators under close supervision and shall be carried on long enough to produce homogeneity and optimum consolidation without permitting segregation of the solid constituents or "pumping" or migration of air. All vibrators shall be supplemented by proper wooden spade puddling adjacent to forms to remove included bubbles and honeycomb. This is essential for the top lifts of walls. All vibrators shall travel at least 10,000 rpm and be of adequate capacity. At least one vibrator shall be used for every 10 cubic yards of concrete per hour. In addition, one spare vibrator in operating condition shall be on the site.
8. Concrete slabs on the ground shall be well-tamped into place and foundation material shall be wet, tamped, and rolled until thoroughly compacted prior to placing concrete.
9. Concrete shall be deposited continuously in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams and planes of weakness within the section. If a section cannot be placed continuously, construction joints may be located at points as provided for in the drawings or approved by the Engineer.
10. Chutes, hoppers, spouts, adjacent work, etc., shall be thoroughly cleaned before and after each run, and the water and debris shall not be discharged inside the form.

B. CONCRETE PLACING DURING COLD WEATHER:

1. Concrete shall not be placed on frozen ground, and no frozen material or material containing ice shall be used. Materials for concrete shall be heated when concrete is mixed, placed, or cured when the mean daily temperature is below 40°F, or is

expected to fall to below 40°F, within 72 hours, and the concrete after placing shall be protected by covering, heat, or both. No accelerant shall be used to prevent freezing.

2. The temperature of concrete surfaces shall not be permitted to drop below 50°F. for at least 7 days after placement of the concrete.
3. All details of Contractor's handling and protecting of concrete during freezing weather shall be subject to the approval and direction of the Engineer. All procedures shall be in accordance with provisions of ACI 306.

C. CONCRETE PLACING DURING HOT WEATHER:

1. Concrete just placed shall be protected from the direct rays of the sun and the forms and reinforcement just prior to placing shall be sprinkled with cold water. The Contractor shall make every effort to minimize delays which will result in excessive mixing of the concrete after arrival on the job.
2. During periods of excessively hot weather (90°F, or above) ingredients in the concrete shall be cooled insofar as possible and cold mixing water shall be used to maintain the temperature of the concrete at permissible levels all in accordance with the provisions of ACI 305. Any concrete with a temperature above 90°F, when ready for placement will not be acceptable, and will be rejected.
3. Temperature records shall be maintained throughout the period of hot weather giving air temperature, general weather conditions (calm, windy, clear, cloudy, etc.) and relative humidity. The record shall include checks on temperature of concrete as delivered and after placing in forms. Data should be correlated with the progress of the work so that conditions surrounding the construction of any part of the structure can be ascertained.

D. PIPES AND EMBEDDED METALS:

1. Special care shall be taken to bring the concrete into solid contact with pipes and iron work embedded in the walls and floors, particularly underneath and around all pipes where a head of water exists, making watertight joints.
2. In general, such embedded items are not shown on the structural design drawings. Design drawings of the other trades shall be consulted for their location and details.
3. Anchor bolt location, size and details shall be verified with the equipment manufacturers certified drawings before installation.
4. Anchor bolts, reglets, sleeves, edge angles and similar embedded items will be provided, delivered to the site under other Sections of the specification, for installation under this Section.

5. Where edge angles, etc., have nuts welded on to receive machine screws, the threads of the nuts shall be protected from concrete, and the concrete shall be excluded from the space to be occupied by the screw, by the use of wood plugs or other effective means.
6. Inserts required for hanging mechanical and electrical items will be provided and installed in the forms under the mechanical and electrical Sections of the specification.
7. Should the Contractor be allowed to leave openings in the concrete for pipes or ironwork, to await the arrival of items that would delay the prosecution of the work, the openings shall be subject to the approval of the Engineer. Appropriate construction joints shall be provided. In filling any such openings with concrete, a mixture of 1: 1-1/2: 3 shall be used and a watertight bond shall be secured between the old and new concrete.
8. In bolting miscellaneous items to concrete after the concrete has set, expansion bolts of an approved pattern and type shall be used. The Contractor shall submit to the Engineer, for approval, the types of expansion bolts. Expansion bolts shall not be used until they are approved.

E. CURING:

1. Concrete curing shall be performed as specified in ACI 301 and as stated herein. All curing procedures shall have prior approval of the Engineer.
2. Concrete Floors

Concrete floors which are to receive paint, concrete fill, mortar setting beds, grout fill, or any other subsequent finish shall be cured by one of the following procedures immediately after completion of placement and finishing:

- a. Ponding or continuous sprinkling.
- b. Application of absorptive mats or fabric kept continuously wet.
- c. Application of sand kept continuously wet.
- d. Application of waterproof sheet materials conforming to ASTM C171.
- e. Application of curing compounds conforming to ASTM C309, if it can be demonstrated to the Engineer's satisfaction that the compound is applicable and that it will not prevent bonding of the subsequent finish to be received. Compound shall be placed at a rate of 200 square feet per gallon, in two applications perpendicular to each other.

3. Curing procedure shall be continued for at least 7 days.
 - a. Moisture loss from surface placed against metal or wood forms shall be minimized by keeping forms wet until removal.
 - b. Curing shall be continued for at least 7 days. When forms are removed during the curing period, surfaces shall be cured by spraying or by the use of a curing compound as previously specified.
 - c. Surfaces shall be protected from traffic or damage until surfaces have hardened sufficiently. If necessary, 1/2-inch thick plywood sheets shall be used to protect the exposed surface.

F. BRACING AND SUPPORTS:

1. All concrete members shall be adequately and safely supported and braced until the permanent supports and braces are installed.
2. Backfilling against exterior walls shall not be done until supporting slabs are in place and have attained 70 percent of design strength, otherwise walls shall be braced against earth lateral pressure, using a system approved by the Engineer.
3. Backfilling against retaining walls shall not commence until the wall concrete has reached its 28 day strength.

G. REMOVING FORMS AND SUPPORTS:

1. Removal of forms shall take place in accordance with ACI 347, Section 3.6. Except as otherwise specifically authorized by the Engineer, forms shall not be removed until the concrete has aged for the following number of day-degrees or attained 50 percent strength. (Day-degrees equals the total of number of days times the average daily air temperature at the surface of concrete. For example, 5 days at a daily average temperature of 60°F. equals 300 day-degrees.)

<u>Location</u>	<u>Day-Degrees</u>
Beams and Slabs	500
Walls and Vertical Surfaces	200

2. Shores under beams and slabs shall not be removed until the concrete has attained at least 70 percent of the specified cylinder strength and also sufficient strength to support safely its own weight and the construction loads upon it.

H. PATCHING:

1. Defective concrete and honeycombed areas as determined by the Engineer shall be chipped down reasonably square and at least one-inch deep to sound concrete

by means of hand chisels or pneumatic chipping hammers. Irregular voids or surface stones need not be removed if they are sound, free of laitance, and firmly imbedded in the parent concrete, subject to Engineer's final inspection. If honeycomb exists around reinforcement, chip to provide a clear space at least 1-inch wide all around the steel. For areas less than 1-1/2 inches deep, the patch may be made following the procedure for filling form tie holes, described in the subsection below, using adequately dry (non-trowelable) mixtures to avoid sagging. Thicker repairs will require build-up in 1-inch layers on successive days. Unless otherwise indicated, thicker repairs shall be made with Vertipatch mortar mixture blended with Acryl-Set, both by Master Builders, Inc., Cleveland, Ohio, or approved equal.

2. For concrete areas exposed to serious abrasion and/or impact forces, the Engineer may order the use of grout with a non-shrink metallic aggregate (Embeco by Master Builders, Inc.; Ironite by Fox Industries, Madison, IL; or approved equal) as an additive in the proportions listed below:

Material	Small Patches		Large Formed Patches	
	Volumes	Weights	Volumes	Weights
Cement	1.0	1.0	1.0	1.0
Metal Aggregate	0.15	0.25	0.2	0.33
Sand	1.5	1.5	1.5	1.0
Pea Gravel	--	--	1.5	1.5

I. FINISHING OF FORMED SURFACES:

1. All concrete which is to be left exposed to view shall be scraped to remove projecting imperfections left by voids in the forms.
2. In addition to scraping, exterior exposed concrete shall be covered with a cement-base plaster mix. The mix shall consist of Thoroseal Plastic Mix and Acryl 60, as manufactured by Standard Drywall Products, Miami, FL, or approved equal. It shall be mixed and applied in accordance with the manufacturer's recommendations.
3. To permit satisfactory finishing, forms shall be removed from the vertical faces of the concrete as early as is possible without damaging the surface. Immediately after stripping forms, any fins or projections left by the forms shall be chipped off, and the surfaces rubbed smooth.
4. Form tie holes and other voids and faults shall be patched. Voids shall be cleaned out, roughened, thoroughly wetted, coated with neat cement paste, and filled with mortar of cement and sand in the same proportions, materials, and color as used in

the concrete. The surface of the patch shall be flush with the surrounding surface after finishing operations are complete. Surface shall be kept continuously damp until patches are firm enough to be rubbed without damage.

5. Rubbing shall be performed while the surface is wet using a carborundum or cement sand brick, to achieve a smooth uniform, even textured finish. Patched and chipped areas shall be blended to match as closely as possible the appearance of the rest of the surface. No cement wash or plastering will be permitted, and no mortar shall be used except as required above.
6. Where finishing is performed before the end of the curing period, concrete shall under no circumstances be permitted to dry out, and shall be kept continuously moist from time of placing until end of curing period, or until curing membrane is applied.

J. CONCRETE FLOOR FINISHING REQUIREMENTS:

1. Unless designated otherwise, concrete floors shall have a troweled finish as specified in Section 11.7 of ACI 301. Troweled finishes shall conform to the requirements of "Class A Tolerances," Section 11.9 as specified in ACI 301.

K. TESTING:

1. The Contractor shall provide all field testing and inspection services, and shall pay for all such services. The Engineer shall approve the testing laboratory and shall inform the Contractor when samples are to be taken for testing. The Contractor shall forward all test results to the Engineer as soon as they are available.
 - a. The Testing Laboratory shall conform to the requirements of ASTM E-329 as modified in 780 CMR R1 in the State Building Code. They shall be licensed by the State Board of Building Regulations and Standards.
2. At least one slump test shall be performed from each truck load of concrete. The sample for slump shall be taken from the middle third of a truck load. Air content tests shall be made at the discretion of the Engineer. If the measured slump or air content falls outside the specified limits, a check test shall be made immediately on another portion of the same sample. In the event of a second failure, the concrete shall be considered to have failed the requirements of the specification and shall be immediately removed from the jobsite to be discarded.
3. The Contractor shall advise the Engineer of his readiness to proceed with concrete placement at least one working day prior to each placement. The Engineer will inspect the preparations for concrete, including the preparation of previously placed concrete, the reinforcing, and the alignment and tightness of formwork. No placement shall be made without the prior approval of the Engineer.

4. A minimum of four standard compression test cylinders shall be made and tested for each 100 cubic yards or fraction thereof for each type and design strength of concrete from each day's placement of concrete. One cylinder shall be tested at 7 days and two cylinders at 28 days. The fourth cylinder from each set shall be kept until the 28 day test report on the second and third cylinders in the same set has been received. The Engineer reserves the right to require test cylinders to be made for each truckload of concrete if the nature of the project or project experience indicates such additional tests are required for proper control of concrete quality; such tests will be at the Owner's expense.
5. The strength level shall be considered satisfactory so long as the averages of all sets of three consecutive strength test results equal or exceed the specified strength f_c , and no individual strength test (average of two cylinders) result falls below the specified strength f_c by more than 500 psi.
6. In the event the average compressive strength of the two 28 day cylinders do not achieve the required level, the Engineer may elect to test the fourth cylinder immediately or test it after 56 days.

L. FAILURE TO MEET REQUIREMENTS:

1. The Engineer shall have the right to reject concrete represented by low strength tests or to agree to further testing of the concrete. Rejected concrete shall be promptly removed and replaced with concrete conforming to the specification. The decision of the Engineer as to whether substandard concrete is to be accepted or rejected or additional tests shall be conducted shall be final. All direct and indirect costs associated with further curing and testing of the concrete shall be at the Contractor's expense. All costs associated with removing rejected concrete, placing new concrete, and conducting tests on new concrete shall be at the Contractor's expense.
2. If the Engineer agrees to consider further curing and/or testing of the concrete before making a final decision, the Contractor shall submit a detailed plan to the Engineer, including proposed criteria for acceptance of the concrete. The plan may include additional curing of the concrete, drilling and testing of cores, load testing of the structure, or a combination.
3. If additional curing is permitted before further inspection and testing, the Contractor shall provide any necessary materials and labor to further cure the suspect concrete.
4. If drilling and testing of cores is permitted, the Contractor shall be responsible for obtaining the cores, including provision of ladders, scaffolding, and such incidental equipment as may be required. If additional curing is permitted, cores shall be drilled after the curing period, and shall be in accordance with ASTM Methods C39 and C42. The Contractor shall repair all core holes to the satisfaction of the Engineer.

5. The burden of proof, including, but not limited to the work of cutting and testing the cores, inspection, evaluation, engineering, repair of the holes, or removal and replacement of the concrete in question, and all associated costs therefor, shall be at the expense of the Contractor.
6. If load testing of the concrete is permitted, and if not otherwise indicated, slabs or beams under load test shall be loaded with their own weights plus a superimposed load of 2 times the design live load. The load shall be applied uniformly over the portion being tested in the approved manner and left in position for 24 hours. The structure shall be considered satisfactory if deflection "D" in feet, at end of 24-hour period, does not exceed the following value:

$$D \text{ equals } 0.001 (L \times L)/t$$

in which "L" is span in feet, "t" is depth of slab, or beam in inches. If deflection exceeds "D" in the above formula, the concrete shall be considered faulty unless within 24 hours after removal of the load, the slab, or beam under test recovers at least 75 percent of the observed deflection.

7. If the suspect concrete still fails to meet specification requirements, the Engineer shall have the right to reject the concrete, have it removed and replaced, in accordance with paragraph 5 above, or to require mechanical strengthening of the concrete to satisfy project requirements. The Contractor shall submit a removal and replacement plan for review by the Engineer.

END OF SECTION

REINFORCED CEMENT CONCRETE FENCE STRIP (MOWER STRIP)

- 3.01 Excavation shall conform to Section 02300 of these Specifications.
- 3.02 Placement and compaction of processed gravel shall conform to Section 02300 of these Specifications.
- 3.03 Placement of reinforcing steel shall conform to Section 03300 of these Specifications. coordinate with fencing sections; cast cement concrete against post footings, tool joints, and expansion joints.
- 3.04 Placement and Finish of Cement Concrete: The concrete shall be placed in such quantity that after being thoroughly consolidated in place it shall be six (6) inches or twelve (12) inches in depth as designated on the plans and details unless otherwise called out specifically in the plans. No finishing operation shall be performed until all bled water and water sheen has left the surface and the concrete has started to stiffen. After water sheen has disappeared, edging operations where required shall be completed. All tool marks and form marks shall be eliminated on all visible surfaces. After edging and jointing operations, the surface shall be floated with aluminum or magnesium floats. If necessary, tooled construction joints and edges shall be rerun to maintain uniformity.
- 3.05 Curing of cement concrete shall conform to Section 03300 of these Specifications.

END OF SECTION

SECTION 05500
MISCELLANEOUS METALS

PART 1 -GENERAL

1.01 WORK INCLUDED:

- A. This section of the specification covers all miscellaneous metal items required for the work, except as specified elsewhere.
- B. All miscellaneous metalwork shall be fabricated as detailed or approved and shall be installed complete with all necessary anchors, anchor bolts, eye bolts, guides, bolts and other accessories.
- C. In general, site and shop fabricated items are included under this section, and factory fabricated items excluded. This section includes but is not limited to: lintels, louvers, stairs, railings and posts, grating, hatches, frames and covers, loose metal frames, nosings, edgings, ladders, vents, protective grilles and frames, and all other site or shop fabricated metal items not provided under Section 05120, STRUCTURAL STEEL, or otherwise excluded.

1.02 RELATED WORK:

- A. Section 03300, CAST-IN-PLACE CONCRETE
- B. Section 04200, MASONRY
- C. Section 05120, STRUCTURAL STEEL
- D. Section 06100, ROUGH CARPENTRY
- E. Section 09900, PAINTING

1.03 QUALITY ASSURANCE:

- A. The drawings show the character and extent of the work required, but do not attempt to show all methods, materials, and details of construction, fastening, etc. Supplementary parts customarily necessary to complete an item, though such parts are not definitely shown or specified, shall be included as part of the item.
- B. Details of construction of the various items shall be submitted on the shop drawings. High quality construction with a neat, finished, and workmanlike appearance will be required.

- C. The size and spacing of screws, connectors, anchors, and similar items, and the size and dimensions of metal items stated herein shall apply in general; specific sizes and spacing of fasteners and dimensions of metal items listed on the drawings shall take precedence.
- D. Items supplied hereunder which are required to be built into the concrete, masonry, etc., shall be delivered to the site at locations as required by the Owner or Engineer, and as required by the overall construction schedule.
- E. Manufacturers of other products comparable in quality and type to those specified will be acceptable if satisfactory data on past performance and other required information is furnished by the Contractor, and if approved by the Engineer.
- F. Color galvanized system shall be guaranteed by manufacturer for 20 years.
- G. Contractor shall submit an affidavit to Engineer that materials used are protected from or will not be subject to galvanic action.

1.04 REFERENCES:

- A. The following standards from a part of these specifications, and indicate the minimum standards required:

American Institute of Steel Construction (AISC)

AISC Specification for Structural Steel Buildings

American Society for Testing and Materials (ASTM)

ASTM A36	Structural Steel
ASTM A53	Pipe, Steel, Black and Hot-Dipped Zinc-Coated Welded and Seamless
ASTM A123	Zinc (Hot-Dip-Galvanized) Coatings on Iron and Steel Products
ASTM A153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A239	Test for Uniformity of Coating by the Preece Test (Copper Sulfate Dip) on Zinc-Coated (Galvanized) Iron or Steel Articles

ASTM A307	Carbon Steel Externally and Internally Threaded Standard Fasteners
ASTM A366	Steel, Carbon, Cold-Rolled Sheet, Commercial Quality
ASTM A525	Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, General Requirements
ASTM A569	Steel Carbon (0.15 Maximum Percent) Hot-Rolled Sheet and Strip, Commercial Quality
ASTM B221	Aluminum-Alloy Extruded Bars, Rods, Shapes and Tubes
ASTM B308	Aluminum-Alloy Standard Structural Shapes, Rolled or Extruded
ASTM C478	Precast Reinforced Concrete Manhole Sections
<u>American Welding Society (AWS)</u>	
AWS	D1.1 Structural Welding Code Steel

1.05 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

- A. Before fabricating or assembling any aluminum or stainless steel items, samples indicating full range of finish, color, and texture to be supplied shall be submitted to the ENGINEER for review.
- B. Shop drawings for all metalwork included in this section shall be submitted to the Engineer for review.
- C. The shop drawings shall be complete and checked, showing sizes, layout, method of assembly, fastenings, anchorage or connection with other work, finish, and coatings, etc. Shop drawings for aluminum work shall indicate alloys, temper and finish to be used.
- D. Samples of colors and finishes for items that are to be color galvanized shall be submitted to ENGINEER for selection, from manufacturer's full range. ENGINEER shall have discretion of selecting up to four colors for application to fabricated items.

PART 2 - PRODUCTS

2.1 PRODUCTS:

- A. Miscellaneous and ornamental items include the following. Requirements for materials, hot-dip galvanizing, and shop-applied primers are included with each item as applicable.

1. Handrails
2. Vehicular Pipe Gate
3. Metal railings
4. Service Cabinets

2.02 MATERIALS:

- A. Steel:

1. Materials, fabrication, and erection of miscellaneous steel sections shall conform to the applicable requirements of the AISC Specification.
2. Steel shapes, plates and bars shall conform to ASTM A36/A 36M.
3. Stainless Steel Sheet, Strip, Plate and Flat Bars: ASTM A666, Type 316L
4. Sheet steel shall be cold-rolled or hot-rolled carbon sheet steel conforming to ASTM A366 or ASTM A569 as appropriate.
5. Steel pipe shall conform to ASTM A53/A 36M.
6. Stainless steel shall be Type 304 unless otherwise indicated or specified.
7. Handrail shall be schedule 40 pipe.

2.03 FASTENERS:

- A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.

1. Metalwork shall be complete, with all bolts, anchors, plates, washers, clamps, screws, studs and other such devices for proper securing and anchoring. Where positions of anchorages can be predetermined, they shall be shop-installed on the item; otherwise the material or equipment to be fastened shall be expansion bolted, toggle bolted, screwed, or otherwise fastened as shown on the drawings or called for herein.

2. Bolts and nuts for general anchorage and for miscellaneous ferrous metal assemblies and fasteners shall be galvanized, unfinished bolts conforming to ASTM A307 unless otherwise noted on the drawings.
 3. The centerline of expansion shields shall not be closer than 3-inches to the edge of any concrete or masonry in which they are placed.
 4. Material for fasteners shall match or be galvanically compatible with the materials fastened. Washers, nuts and other accessories shall match the bolts.
 5. Where the specific type, material, size and spacing of fasteners has not been called for on the drawings or in specifications, the fasteners proposed by the Contractor shall be reviewed by the Engineer. If, in the opinion of the Engineer, they are not in accordance with good safety practices, the contractor shall revise and resubmit appropriate fasteners.
- B. Anchor Bolts: ASTM F 1554, Grade 36. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.
- C. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.
- D. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
1. Acceptable Manufacturers: Kwik-Bolt 3 by Hilti, Inc., TruBolt Wedge Anchor by ITW Red Head or Power-Stud by Powers Fasteners.
- 2.04 MISCELLANEOUS MATERIALS:
- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified alkyd primer complying with MPI#79. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds in steel, complying with SSPC-Paint 20.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- F. Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.05 STEEL RAILINGS, HANDRAILS AND GUARDRAILS:

- A. Steel railings, handrails and guardrails shall be in accordance with OSHA and State of Massachusetts standards and be capable of withstanding a load of 200 pounds applied at any point, in any direction on the top rail. Unless otherwise indicated on the drawings, pipe rail posts shall be 1-1/2-inch ID Schedule 40 stainless steel pipe conforming to ASTM A53.
- B. Bends in pipe shall be made with manufactured elbows. Rail ends which are not continuous with posts or bolted to the wall shall have self-return to solid walls, or shall have rounded end caps where there is no adjacent wall. Posts shall be approximately 5 feet on centers, or as noted on the drawings.
- C. Connections shall be welded, with welds ground smooth. Railings shall be fabricated in panels, which are as long as can be conveniently handled, to eliminate as much field welding as possible.
- D. Submit certification by a professional engineer licensed in the state where the project is located, stating load capacity.

2.06 FINISHES, GENERAL:

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

2.07 STEEL PRIMERS AND FINISHES:

- A. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Urethane Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 2. Interiors (SSPC Zone 1A): SSPC-SP 7, "Brush Off Blast Cleaning." 3. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be field welded, embedded in concrete or masonry, unless otherwise indicated. Extend priming of partially embedded members to a depth of 2-inches.
 3. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 4. Comply with SSPC-PA 2, "Measurement of Dry Coating Thickness with Magnetic Gages."
- B. Zinc-Rich Primer: Urethane zinc rich primer compatible with topcoat Specified in Section 09900 – PAINTING. Provide primer with a VOC content of 340 g/L (2.8 lb./gal.) or less per OTC and HAPS COMPLIANT STANDARDS PER 2007 standards when calculated according to 40 CFR 59, Subpart D (EPA Method 24). Provide Tnemec Series 394 Primerprime at 3.0 mils DFT or approved equal by DuPont or Carboline.
- C. Hot-Dip Galvanizing: For steel exposed to the elements, weather or corrosive environments and other steel indicated to be galvanized, provide coating for iron and steel fabrications applied by the hot-dip process. Comply with ASTM A 123 for fabricated products and ASTM A 153 for hardware. Provide thickness of galvanizing specified in referenced standards. The galvanizing bath shall contain high grade zinc and other earthly materials. Fill vent holes and grind smooth after galvanizing.
- D. Hot-Dip Galvanizing And Factory-Applied Primer for Steel: Provide hot-dip galvanizing and factory-applied prime coat, certified OTC/VOC compliant less than 2.8 lbs/gal. and conforming to EPA and Commonwealth of Massachusetts requirements. Apply primer within 12 hours after galvanizing at the galvanizer's plant in a controlled environment meeting applicable environmental regulations and as recommended by the primer coating manufacturer. Blast cleaning of the surface is unacceptable for surface preparation. Primer shall have a minimum two year coat window for application of finish coat. Coatings must meet or exceed the following performance criteria:

1. Fire proofing adhesion: ASTM E736
2. Adhesion: ASTM D 4541 5 mm crosshatch 1150 psi.
3. Humidity Resistance: ASTM D 4585, 5000 hours
4. Salt Spray (Fog): ASTM B 117, 10,000 hours

2.08 STAINLESS-STEEL FINISHES:

- A. Remove tool and die marks and stretch lines or blend into finish.
- B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- C. Bright, Directional Satin Finish: No. 4.
- D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.09 VEHICULAR PIPE GATE

- A. Steel pipe shall be Schedule 40 and the size as indicated on the Drawings.
- B. Steel pipe shall conform to ASTM A53.
- C. Steel shapes, plates and bars shall conform to ASTM A36.
- D. Posts, bar gate and diagonal brace diameters shall be as shown on the drawings.
- E. Galvanizing shall be done in accordance with ASTM A153

2.10 GALVANIZING:

- A. Hot-Dip Galvanizing:
 1. Provide a coating for iron and steel fabrication applied by the hot-dip process. The galvanizing bath shall contain 0.05-0.09% nickel. Immediately before galvanizing, the steel shall be immersed in a bath of zinc ammonium chloride. The use of the wet kettle process is prohibited. Comply with ASTM A-123 for fabricated products and ASTM A-153 for hardware. Provide thickness of galvanizing specified in referenced standards. Provide coating by Duncan galvanizing or approved equal.
- B. Factory-Applied Primer Over Hot-Dip Galvanizing:
 1. Provide a factory-applied polyamide epoxy coating primer, 2.0 mils dry film thickness minimum. Apply primer within 12 hours after galvanizing at

the galvanizer's plant in a controlled environment meeting applicable environmental regulations or mechanically abrade to create a uniform surface profile of 1.0 – 2.0 mils, and as recommended by coating manufacturer. Provide primer coating by Duncan Galvanizing, Tnemec Co. or approved equal.

- C. Factory – Or Field-Applied Architectural Finish Over Primer And Hot-Dip Galvanizing:
 - 1. Provide a factory- or field-applied polyurethane color coating, 2.5 mils dry film thickness minimum. Apply coating at the galvanizer's plant or coating shop, immediately after application of the prime coat, in a controlled environment meeting applicable regulations, and as recommended by the coating manufacturer. Provide finish coating by Duncan Galvanizing, Tnemec Co. or approved equal.
- D. Items noted as "color galvanized" shall have an architecturally compatible factory finish formulated to be applied over galvanized members, suitable for use in harsh environments, and applied by the galvanizer at the factory or coating shop.
- E. The Contractor shall be responsible for determining if any fabricated items are not suitable to be hot-dip galvanized and shall notify the Engineer in writing.
- F. Surfaces of metal to be galvanized shall be free from all dirt, grease, rust and moisture. Burrs and sharp projections shall be removed from edges, holes, etc., before galvanizing. Fabricated items shall be galvanized after fabrication.

2.11 WELDING OF STEEL:

Welding of steel shall be done in accordance with the AWS Code. Welds shall be continuous along entire line of contact, except where plug or tack welding is noted. Exposed welds shall be ground smooth.

2.12 FABRICATION AND ERECTION:

- A. Metalwork shall be complete, with all necessary bolts, nuts, washers, anchors, plates, fastenings, and other fittings. To the extent possible, holes for attachment of blocking, clip angles, etc. shall be shop punched. Where shop punching is impracticable, holes shall be field drilled. Burned holes will not be permitted.
- B. Material shall be straight, accurately fabricated with joints neatly framed, square, and well-riveted, bolted, or welded.

- C. Metalwork to receive hardware shall have all cutouts and attachments accurately made using the hardware itself or templates where necessary.
- D. Metalwork shall be accurately set and secured in position, with lines plumb and level and surfaces flush and square, or as otherwise required to conform to the structure as shown on the drawings.
- E. Wherever possible, all metalwork shall be built into the masonry work and shall have sufficient anchors, well- fastened. Anchors shall be welded to steelwork and shall be staggered where attached to structural shapes. Metalwork impracticable to set before masonry is built shall be anchored to it with approved expansion bolts set in solid masonry units or in concrete.
- F. Miscellaneous metalwork shall be plainly marked to indicate its location in the structure.

2.27 PAINTING:

- A. Ferrous metals of this section, except for galvanized or stainless steel shall be shop primed in accordance with the following:
 - 1. Submerged service components shall be sandblasted clean in accordance with SSPC-SP-10, Near White, immediately prior to priming.
 - 2. Non-submerged service components shall be sandblasted clean in accordance with SSPC-SP-6, Commercial Grade, immediately prior to priming.
 - 3. Shop primer, except as otherwise noted, shall be one spray applied coat with dry film thickness of 3.5 to 4.5 mils of Tnemec 66 Boston Gray Primer by Tnemec Co.; or Aquapun by PPG, Inc; or approved equal.
 - 4. Portions of ferrous metals to be embedded in concrete or masonry shall be given a heavy brush coat of alkali resistant bituminous paint.
 - 5. Scratches or abrasions in the shop coat and areas at field welds, bolts, nuts and other unpainted areas shall be touched up after erection with the paint specified for the shop coat. Cold galvanized paint shall be used for touch up of galvanized surfaces. Paint shall be one of the following: Sealube Co., ZRC; Galvicon Corp., Galvicon; Stanley Chemical Div., Zinc Shield; Duncan Galvanizing Corp., ZIRP; or an approved equal.
 - 6. Shop and field prime paint systems shall be compatible with finish coat.

END OF SECTION

SECTION 06100

ROUGH CARPENTRY

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This Section covers tools, equipment, labor, and materials necessary to perform rough carpentry work complete and miscellaneous carpentry items not specified elsewhere including fasteners and supports.
- B. Nails, screws, bolts, anchors, brackets, and other hardware for fastening and securing items provided under this section of the specification shall be furnished under this section.

1.02 RELATED WORK:

- A. Section 02252, SUPPORT OF EXCAVATION
- B. Section 03300, CAST-IN-PLACE CONCRETE
- C. Section 09900, PAINTING

1.03 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

Three sets of certificates of wood treatment upon delivery of treated wood product. Treated wood product shall bear appropriate American Wood Preservers Bureau (AWPB) quality mark.

1.04 DELIVERY:

Lumber, plywood, and other wood material shall be delivered to the job dry, and shall be protected from injury, dirt, dampness, and extreme changes of temperature and humidity at all times.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. LUMBER:

- 1. The grades of all materials under this section shall be defined by the rules of the recognized associations of lumber manufacturers producing the material specified, but the maximum defects and blemishes permissible in any specified grades shall not exceed the limitations of the American Lumber Standards.

2. Lumber shall bear the grade and trademark of the association under whose rules it is produced, and a mark of mill identification. Lumber shall be of sound stock, thoroughly seasoned, kiln dried to a moisture content not exceeding 15 percent.
3. Exposed surfaces of wood which are to be painted shall be free from defects or blemishes that will show after the second coat of paint is applied.
4. All planter box wood shall be Grade A or better Cedar, IPE, or Black Locust (Robinia).
7. Materials not specifically listed shall be of an accepted grade dictated by good practice.

B. WOOD PRESERVATION TREATMENT:

1. Wood shall be untreated.

PART 3 - EXECUTION

3.01 CONSTRUCTION:

- A. Work shall be erected plumb, true and square.
- B. Coordinate delivery and erection of prefabricated components. Field applied items shall be installed in accordance with good trade practices. Cutting and carpentry for other trades shall be performed. Cut ends of lumber previously treated with preservative specified shall be brush coated with the same material.
- C. Except as otherwise indicated on the design drawings, fasteners for roof nailers and for other wood members used as nailers or anchorage material shall be the equivalent of 1/2-inch diameter bolts at 2'-6" o.c. for 2-inch material, and 3/8-inch diameter bolts at 2'-0" o.c. for 1-inch material. Wood members in general shall be fastened to masonry with masonry nails, power-driven fasteners, or bolts in expansion shields, except where otherwise indicated.
- D. Minimum length of nails shall be twice the thickness of wood being fastened.
- E. Temporary wood planking, sized to provide safe walking areas and protection against rough usage in construction, shall be placed over site elements during construction operations. Where wheeling of building material is necessary, special provision shall be made to protect site elements.

END OF SECTION

SECTION 07920

JOINT PROTECTION

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This section covers the sealing of joints designated on the drawings or specified herein, including but not limited to, concrete to concrete, masonry to concrete, structural steel to concrete, structural steel to masonry, and any other metal surfaces butting to another metal, concrete or masonry.
- B. The above-mentioned joints shall be sealed even if not called out on the drawings.
- C. Seal beneath threshold and other items required to be set in caulking compound shall be by the trade installing the item.

1.02 RELATED WORK:

- A. Section 03150, WATERSTOPS
- B. Section 03300, CAST-IN-PLACE CONCRETE

1.03 REFERENCES:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

American Society for Testing and Materials (ASTM)

ASTM C920 Specification for Elastomeric Joint Sealant

ASTM C 1193 Standard Guide for Use of Joint Sealants

ASTM D1667 Specification for Flexible Cellular Materials – Vinyl Chloride
Polymers and Copolymers (Closed-cell Foam)

United States of America Standards Institute (USA)

USA 116.1 Standard Specification for Polysulfide-Base Sealing Compounds for
the Building Trade

- B. When reference is made to one of the above standards, the revisions in effect at the time of bid opening shall apply.

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

- A. Six sets of manufacturer's literature of the materials of this section shall be submitted to the Engineer for review.

1.05 DELIVERY, STORAGE, AND HANDLING:

- A. Materials shall be delivered to the site in the original, unopened, factory-sealed containers, bearing the manufacturer's label fully identifying the material and the producing company.
- B. Handle materials with care. Do not dump from trucks or delivery vehicles nor handle in any manner likely to cause damage.

1.06 QUALITY ASSURANCE:

- A. Materials shall not be applied in wet weather or to wet or damp surfaces. No work shall be performed when temperature is below 40 degrees Fahrenheit. Surfaces shall not be caulked until thirty days after completion of concrete, masonry work, or patching, whichever is later. At least three good drying days shall immediately precede application. Application shall in each case be in accordance with the instructions of the manufacturer of the material, except as modified herein.
- B. Surrounding areas which are not to be coated shall be completely protected from spray, spattering, or dripping, using drop cloths or other protective measures, as required. Spillage or dripping which occurs shall be immediately and completely removed, leaving no stain. Solvents or cleaning methods shall be those recommended by the manufacturer of the material being used.
- C. Furnish the service of a competent field representative of the approved manufacturer of the sealant. The field representative shall be present at the work site prior to any mixing of components to instruct on application and inspection of procedures and to inspect the finish or the prepared surfaces prior to application of the sealant. The representative shall make at least one additional visit to the site as the work progresses and shall report on each visit to the Contractor and the Engineer, advising as to whether the application is being performed in accordance with this specification and the printed instructions of the manufacturers.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

- A. Sealants and primers for use with sealants shall be as manufactured by J.B. Fred Kuhls, Brooklyn, New York; Minwax Co., Inc., New York, New York; Dewey and Almy Chemical Division of W.R. Grace & Co., Cambridge, Massachusetts; Sonneborn Building Products, New York, New York; or an approved equal product.

2.02 MATERIALS:

A. Sealants

- 1. Sealants shall be non-staining materials conforming to the requirements of United States of America Standards Institute "Standard Specification for Polysulfide-Base Sealing Compounds for the Building Trade", USA 116.1. Compound shall be Class A (self-leveling), or Class B (non-sag), as applicable in each case for the joint to be caulked. Color of sealant shall match as closely as possible the color of the surrounding materials, and when used adjacent to masonry work the compound shall match the color of the mortar in the masonry joints. Precise color shall in all cases be subject to the approval of the Engineer.

B. Joint Cleaner

- 1. Non-corrosive and non-staining type, recommended by sealant manufacturer and compatible with joint forming materials.

C. Primer

- 1. Primer shall be non-staining type as recommended by the manufacturer of the sealant.

D. Back-Up Material

- 1. Back-up material for sealer shall be a non-staining type oakum, treated to prevent rot, or shall be a non-staining, compressible, closed-cell joint filler of polyvinyl chloride, neoprene vinyl, or a similar inert and permanent back-up material approved in advance by the Engineer. Back-up materials containing oil or grease and materials which are not compatible with the primers and caulking compound shall not be used. Tremco Joint Backing and Dow Corning "Ethafom" are approved back-up materials.

E. Bond Breaker

1. Bond breaker tape shall be an adhesive-backed glazed butyl or polyethylene tape which will satisfactorily adhere to the premolded joint filler or concrete surface as required. The tape shall be the same width as the joint.
2. Bond breaker for concrete other than where tape is specifically called for shall be either bond breaker tape or a nonstaining type bond prevention coating such as Williams Tilt-up Compound by Williams Distributors, Inc. Silcoseal 77 by Nox-Crete Incorporated or equal.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Verify that substrate surfaces and joint openings are ready to receive work.
- B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION:

- A. Where recommended by the manufacturer of the sealant, primer shall be used before sealant is applied. Copper to be in contact with sealant shall be primed with five-pound cut shellac or as recommended by the sealant manufacturer, before sealant material is applied. Aluminum, stainless steel, and other materials shall have any protective film removed using a cloth dampened with Toluol, Xylol, or other suitable solvent.

3.03 APPLICATION:

- A. Sealant shall be mixed and applied in accordance with the manufacturer's printed directions. No materials shall be added to the compound.
- B. Joints and spaces to be caulked shall be clean, dust-free, and dry. Mortar droppings, construction debris, and other foreign matter shall be removed from the joint before it is caulked. Raking out excess mortar in masonry and similar joints which are to be caulked shall be performed by the trade responsible for installing the mortar.
- C. The joint or space to be sealed shall be packed tight with oakum or other approved filler materials, leaving a space approximately square in cross-section, and in no case deeper than half of its width, to receive the caulking compound. Filler materials shall be sufficiently wider than the joint in which they are used to provide adequate resistance when sealant material is being gunned into the joint.
- D. Sealant shall be applied with a gun, using a nozzle of proper size to fit the joint width, and shall be forced into the joints with sufficient pressure to expel all air and fill the joint solid. Superficial pointing of joints with a skin bead will not be accepted. Sealant shall be uniformly smooth and free from wrinkles, and shall have a slightly concave joint profile when dry. Intersections of beads shall form neat miters. Sealant at edges of the

joint shall be flush with the edges of the adjacent surfaces. Excess sealant material shall be removed. Improperly filled or finished joints shall be raked out and resealed.

- E. Sealant depth shall not exceed one-half of joint width.
- F. Particular care shall be taken not to soil adjacent surfaces. Spillage or excess material shall be removed immediately, leaving no stain. Masking tape shall be used as required to protect surrounding surfaces and prevent staining. Masking tape shall be removed immediately after tooling of the sealant. Adjacent surfaces soiled by operations under this section shall be cleaned to equal their condition before the start of the caulking work.
- G. Spaces left between walls and elements of roof shall be filled with back-up material inserts and then caulked on both sides.

END OF SECTION

SECTION 09900

PAINTING

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This Section covers field painting and coating of surfaces, complete. Shop painting of metal items is specified under the applicable item.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.
- C. A schedule listing the various types of surfaces to be painted and the types of paints to be applied is included herein.
- C. Surface preparation, including but not limited to scraping, sanding, parging proposed painted surfaces.
- D. Painting shall include, but not limited to, columns, fencing, cabinets, miscellaneous metals and touch up to new improvements.
- E. Unless otherwise indicated, the following items shall not be painted:
 - 1. Labels on equipment, such as Underwriters' Laboratories and Factory Mutual, equipment identification, performance rating, and name or nomenclature plates.
 - 2. Moving parts of operating units, exposed bolt threads, mechanical and electrical parts, such as valve and damper operators, linkages, sensing devices, motor and fan shafts.
 - 3. Electrical conduit unless mounted on painted or finished surfaces or exposed in a finished room.
 - 4. Structural steel not exposed to view, and other parts of buildings also not exposed to view.
 - 5. Stainless steel.
 - 6. Plumbing fixtures.
 - 7. Fiberglass and polyethylene storage tanks.
 - 8. Factory prefinished architectural components.

- * 9. Electrical panels and cabinets factory finish painted.

* Except for touch-up painting when required

1.02 RELATED WORK:

NOT APPLICABLE

1.03 SYSTEM DESCRIPTION:

- A. The term "paint" as used herein includes emulsions, enamels, paints, stains, varnishes, sealers, and other coatings, organic or inorganic, whether used as prime, intermediate, or finish coats.
- B. The Contractor shall do a complete painting job throughout the work in accordance with generally approved modern practices for work of high quality. Unless otherwise specified, all materials and surfaces customarily painted shall be given not less than one shop coat and two field coats or one prime coat and two finish coats, regardless of whether or not the surface to be painted is specifically mentioned.
- C. Paints containing lead shall not be used.
- D. To ensure a satisfactory painting job it is essential that the paints applied in the shop and in the field be mutually compatible. The Contractor shall determine what shop paints have been used and shall verify that field applied paints are compatible therewith.
- E. The colors of finish coatings shall be selected by the Engineer from color chips submitted by the Contractor for review. The color selection shall be in the form of a schedule indicating the colors to be used on the various surfaces. The colors used in the final work shall be in accordance with the color schedule and shall match the selected color chips.
- F. All coating systems used for potable water applications shall be previously approved by the National Sanitation Foundation (N.S.F.) in accordance with Standard 61. Evidence of such approval shall be an approval letter from N.S.F. listing the submitted materials.
- G. Paints submitted shall meet all Federal and State E.P.A. regulations pertaining to volatile organic compounds (VOC) compliance.

1.04 REFERENCES:

- A. The following standards form a part of these specifications, and indicate the minimum standards required:

American Society for Testing and Materials (ASTM)

ASTM F1869 Moisture Vapor Emission Rate Using Anhydrous Calcium Chloride

1.05 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL CONDITIONS, SUBMIT THE FOLLOWING:

- A. Manufacturer's literature of proposed paints shall be submitted to the Engineer for review.
- B. Painting schedule shall be submitted to the Engineer for review.
- C. Three (3) sets of color chips shall be submitted to the Engineer for selection of colors.

1.06 DELIVERY AND STORAGE:

- A. Paint shall be delivered to the site in the manufacturer's sealed containers. Each container shall bear the manufacturer's label, listing the brand name, type and color of paint, and instructions for thinning. Thinning shall be done only in accordance with directions of the manufacturer. Job mixing or job tinting may be done when approved by the Engineer and for preparing sample colors.
- B. Painting materials shall be stored and mixed in a single location designated by the Engineer for this purpose. The Contractor shall not use any plumbing fixture or pipe for mixing or for disposal of any refuse. He shall carry all necessary water to his mixing room and shall dispose of all waste outside of the building in a suitable receptacle. The Contractor will be held responsible for any damage done due to failure to observe these precautions.
- C. The paint storage area shall be kept clean at all times, and any damage thereto or to its surroundings shall be repaired. Any oily rags, waste, etc., shall be removed from the building every night, and every precaution shall be taken to avoid danger of fire.
- D. Heat must be provided in the storage area if paints are to be stored during winter months.

The temperature shall be maintained above 40 degrees F. at all times.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. PAINT SCHEDULE:

Except as otherwise indicated, all paint used shall be of the type listed in the schedule below, by Tnemec Company, Inc., or equivalent paints by Sherwin-Williams Company, International Paints, or other approved paint fully equal to paint manufactured by the above-named companies. No brand other than those named will be considered for approval unless the brand and type of paint proposed for each item in the following painting schedule are submitted in writing to the Engineer, along with sufficient data

supported by certified tests.

PAINT SCHEDULE

<u>Key</u>		<u>Tnemec</u>	<u>Note 1</u>
AGE	Acryli Gloss Enamel	1029 Enduratone	3.5
APE	Acrylic Polyurethane	73 Endura-Shield Enamel	3.0
ABF	Cementitious Block Filler	130 Envirofill	80-100 s.f./gal
CEE	Catalyzed Epoxy	L69F Epoxoline II	4.0
CEP	Catalyzed Epoxy Primer	L69F Epoxoline	3.0
EMC	Epoxy Modified Cement	218 Mortar-Clad	Fill/Surface
EP	Epoxy-Polyamide (thinned 30% #4 thinner)	FC 22 Pota-pox	25-30
EPW	Water-based Epoxy Primer	151 Elasto-Grip	1.0-1.5
HSE	High Solids Epoxy (Minimum 69%)	L69 Epoxy	6.0
MA	Modified Acrylic	115 Uni-bond	3.0
MAE	Modified Acrylic Elastomer	156 Envirocrete	6.0-8.0
MCU	Moisture Cured Urethane	Series 1 - Omnithane	2.5-3.0
MPE	Modified Polyamine Epoxy	Series 435 - Permaglaze	15-20 mils
NE	Novolac Epoxy	282 Tneme-Glaze	7.5
PEF	Polyamine Epoxy Finish	280 Tneme-Glaze	6.0-8.0
PEP	Polyamine Epoxy Primer	201 Epoxoprime	6.0-8.0
PVA	PVA Sealer	151 Elasto Grip	0.75-1.5
PWC	Potable Water Coating	Series FC 22 Pota Pox	25-30

- Notes
- 1: Minimum Dry Film Thickness/Coat (mils)
 - 2: Furnished by reputable manufacturer and acceptable to the Engineer.
 - 3: Shall be used as a tie-coat between incompatible paints @ 3.0-4.0 mils.
 - 4: This paint is suitable for temperatures up to 1200°F and must be final cured at 400°F for one hour.

- 5: Bleaching oil is a translucent gray paint stain with a chemical additive to enhance the natural bleaching tendencies of cedar shingles.

* Spot Prime

***For existing, painted masonry walls, use EPW primer, followed by two coats of MAE.

- ^ If galvanized metal is provided with a light top coat sealer, light brush blast surface preparation is required prior to first field coat

C. SPARE PAINT:

1. Furnish to the Owner one unopened gallon of each type and color of paint used on the work.
2. Furnish both components for each type and color of epoxy paints used on the work.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION:

- A. Before any surface is painted, it shall be cleaned carefully of all dust, dirt, grease, loose rust, mill scale, old weathered paint, efflorescence, etc. All necessary special preparatory treatment shall then be applied. Where required, imperfections and holes in surfaces to be painted shall be filled in an approved manner.
- B. Cleaning and painting shall be so programmed that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. Surfaces which have been cleaned, pretreated, or otherwise prepared for painting, shall be painted with the first field coat as soon as practicable after such preparation has been completed, but in any event prior to any deterioration of the prepared surface.
- D. Wood shall be sanded to a smooth and even surface and then dusted off. Before priming wood that is to be painted, shellac shall be applied to all knots, pitch and sapwood. After priming or stain coat has been applied, nail holes and cracks shall be thoroughly filled with plastic wood or putty. For natural finish work, putty shall be colored to be imperceptible in the finished work.
- E. Exposed nails and other ferrous metal or surfaces to be painted with water-thinned paint, and shall be spot primed with aluminum.
- F. Cracks and holes in masonry and concrete surfaces to be painted shall be filled with patching material recommended by the coatings manufacturer. Surfaces shall be clean and dry before painting. All efflorescence, grease, oil, etc., shall be removed before painting, and all loose, crumbling material shall be removed by vigorous wire brushing over entire surface, followed by removal of all dust. All high areas on masonry and

concrete surfaces such as mortar daubs, mortar ridges at joints, and ridges at form joints in concrete shall be removed.

- G. All holes in plaster shall be filled with repair plaster and all cracks shall be cut out and filled. No sandpaper shall be used on plastered surfaces. Prior to painting, surfaces shall be tested with a moisture detecting device. No sealer or paint shall be applied when the moisture content of the plaster exceeds 8 percent, as determined by the test. Testing shall be done in the presence of the Engineer's representative, and in as many locations as directed. Plaster shall be thoroughly dry-brushed before painting or sealing.
- H. All nonferrous metal surfaces to be painted shall be cleaned of all dirt, grease, oil and other foreign substances uniformly profiled per SSPC SP 7.
- I. All galvanized surfaces to be painted shall be brush blasted to create a uniform surface profile per SSPC SP7.
- J. Hardware accessories, machine surfaces, plates, lighting fixtures, and similar items in place prior to cleaning and painting, and not intended to be painted, shall be removed during painting operations and repositioned upon completion of each area or shall otherwise be protected.
- K. All PVC pipe to be painted shall be brush blasted per SSPC SP7 or shall be sanded to provide a uniform surface profile.

3.02 APPLICATION:

- A. Paint shall be used and applied as recommended by the manufacturer without being extended or modified, and with particular attention to the correct preparation and condition of surfaces to be painted.
- B. Paint shall be applied only within the temperature range recommended by the manufacturer. Painting of surfaces when they are exposed to the sun shall be avoided.
- C. Paint shall not be applied to wet or damp surfaces and shall not be applied in rain, snow, fog, or mist, or when the relative humidity exceeds 85 percent.
- D. No paint shall be applied when it is expected that the relative humidity will exceed 85 percent or that the air temperature will drop below 40°F within 18 hours after the application of paint. Dew or moisture condensation should be anticipated and if such conditions are prevalent, painting shall be delayed until midmorning to be certain that the surfaces are dry. Further, the days painting should be completed well in advance of the probable time of day when condensation will occur, in order to permit the film an appreciable drying time prior to the formation of moisture.
- E. All paint shall be applied under favorable conditions by skilled painters and shall be brushed out carefully to a smooth, even coating without run or sags. Enamel shall be

applied evenly and smoothly. Each coat of paint shall be allowed to dry thoroughly, not only on the surface but also throughout the thickness of the paint film before the next coat is applied. Finish surfaces shall be uniform in finish and color, and free from flash spots and brush marks. In all cases, the paint film produced shall be satisfactory in all respects to the Engineer.

- F. Exposed nails and other ferrous metal or surfaces to be painted with water-thinned paints shall be spot primed with aluminum paints.
- G. In order to provide contrast between successive coats, each coat shall be of such tint as will distinguish it from preceding coats.
- H. The Contractor shall not only protect his work at all times, but shall also protect all adjacent work and materials by the use of sufficient drop cloths during the progress of his work. Upon completion of the work, he shall clean up all paint, spots, oil, and stains from floors, glass, hardware, and similar finished items.
- I. Paint shall be applied so as to obtain coverage per gallon and the dry film thickness recommended by the manufacturer. Dry film thickness readings shall be taken to ensure that required thicknesses have been achieved. The Contractor shall record in a manner satisfactory to the Engineer, the quantities of paint used for successive coats on the various parts of the work.
- J. Spraying with adequate apparatus may be substituted for brush application of those paints and in those locations for which spraying is suitable.
- K. If paints are thinned for spraying, the film thickness after application shall be the same as though the unthinned paint were applied by brush. That is, the addition of a thinner shall not be used as a means of extending the coverage of the paint, but the area covered shall be no greater than the area that would have been covered with the same quantity of unthinned paint.
- L. Blast cleaned metal surfaces shall be coated immediately after cleaning, before any rusting or other deterioration or contamination of the surface occurs. Blast cleaned surfaces shall be coated not later than 8 hours after cleaning under ideal conditions or sooner if conditions are not ideal.
- M. The use of carbon dioxide or carbon monoxide emitting heaters is not permitted during the painting operation. Only indirect hot-air systems shall be permitted.

3.05 CLEANUP:

- A. The Contractor shall at all times keep the premises free from accumulation of waste material and rubbish caused by his employees or work. At the completion of the painting, he shall remove all of his tools, scaffolding, surplus materials, and all of his rubbish from

and about the buildings and shall leave his work "broom clean" unless more exactly specified.

- B. The Contractor shall also, upon completion, remove all paint where it has been spilled, splashed, or splattered on all surfaces, including floors, fixtures, equipment, furniture, glass, hardware, etc., leaving the work ready for inspection.

END OF SECTION

SECTION 13120

PRE-ENGINEERED GREENHOUSE STRUCTURE

PART 1 – GENERAL

1.01 SUMMARY

Contractor to furnish a prefabricated greenhouse structure. Structure to be field assembled per manufacturer's recommendations on a poured-in-place foundation pad constructed per plans and specifications.

1.02 QUALITY ASSURANCE

- A. ANSI/ASCE-7-02 "Building Code Requirement for Minimum Design Loads in Buildings and Other Structures".
- B. IBC 2006, 1996 BOCA
- C. Structure fabricator must have a minimum of 10 years experience manufacturing greenhouse structures.
- D. No alternate structure designs will be allowed unless pre-approved by the Owner's Representative 10 days prior to the bid date.

1.03 DESIGN REQUIREMENTS

A. Structure Dimensions:

Exterior – 30' x 48' x 14'-10"

Interior clearance – 9'-3"

B. Design Loads:

1. Seismic performance parameters: $S_S = 0.180g$, $S_1 = 0.066g$
2. Snow Load – 50 PSF

3. Wind Loading for Risk Category I – 114 MPH

1.04 SUBMITTALS

- A. Engineered drawings that are designed and sealed by a professional engineer, licensed to practice in the state where the project is located, shall be submitted for approval.
- B. Provide Life Safety Plan for approval by local code officials.

PART 2 – PRODUCTS

2.01 - MANUFACTURER

- A. Ovaltech III as manufactured by Harnois Industries , 1044 Principale Street, St-Thomas, Quebec, Canada, J0K 3L0 (450) 756-1041, <https://www.harnois.com/en/> or approved equal.
- B. Structure to be provided by manufacturer with all necessary openings as specified by contractor in conformance with manufacturer's structural requirements.

2.02 MATERIALS

- A. Steel:
 - a. Forty seven (47) internal steel gable arches set three feet on center. Cross-section of structural tube steel for arches shall be oval measuring 2" x 3 9/16"
 - b. Two (2) end wall steel frames
 - c. Two (2) 30' steel anchor plates for end walls
 - d. Two (2) steel gable end stiffeners
 - e. Ninety-four (94) steel anchors for steel gable arches
- B. Polycarbonate: Structure to be covered with PCSS double wall 8mm polycarbonate panels. Openings for service door frames and sliding door frames to be provided by manufacturer. Polycarbonate frames should not be modified in the field.
- C. Aluminum Sealing Tape: Tape shall be aluminum, 2 inch wide and 3.6 mils thick, with a synthetic adhesive.

2.03 ACCESSORIES

A. Doors:

- a. The structure shall be equipped with a single steel frame opening for 10'x12' double sliding doors with galvanized steel framing covered with triple polycarbonate. Locking mechanism shall be provided to allow for securing of sliding doors.
- b. The structure shall be equipped with two (2) 35-1/2" x 82" steel service doors with panic bar, door closer and wire glass. Seen from the outside hinges are on the right and the opening towards the outside. Door frame dimensions to be 36" x 82-1/4". Locking mechanism shall be provided for each door.

D. Ventilation fans: Two (2) HAF fans with speed control

- a. Fans: Power supply shall be 240V, 60Hz, maximum current requirement 0.9 A.
- b. Fans to provide 3 to 4 CFM per greenhouse floor sq. ft.
- c. Distance between fans should be 30 times fan diameter (18" diam. = 45 ft)
- d. Total fan capacity in cubic feet per minute (cfm) should equal one-fourth the greenhouse volume.
- e. Fan Controller: Shall allow for manual variable speed.

E. Roof vent and motor: Roof vent shall be a single 48' long steel framed ridge vent panel covered with a PCSS double wall 8mm polycarbonate panel located on the south side of the structure and driven by a motor gearboxes with a self-braking worm gear transmission. Motor gearbox shall have an integrated linear limit switch system with a maximum switching range equal to 97 revolutions of the drive shaft. Power requirements shall be 240V, 60Hz.

D. Motorized shutters: Four (4) shutters to be installed in openings provided by manufacturer, two in the front face of the structure and two in the rear face of the structure. Motorized shutter shall be made entirely of aluminum and shall include a "Multi product" actuator 120 vac/0.5 amp, 60hz., motor 110V. Each blade shall seal with a rubber seal. Shutter opening shall measure 36" x 36".

- F. Propane heater: Heater manufacturer shall calculate BTU's required to meet structure manufacturer's heating requirements.
- a. Heater: Heater shall have a stainless steel heat exchanger, minimum 80% thermal efficiency, power exhaustor able to rotate 180 degrees, 100% shut-off if unit does not light, an intermittent pilot-ignition system with continuous retry to keep the unit from locking and needing to be reset if the unit does not light on the first try, and a safety pressure switch to prevent flue gases from backing up in the structure. Heater shall have a vent pipe of sufficient diameter and length to exhaust fumes outside of structure. Heater power requirements shall be 115V, 60Hz.
 - b. Conversion Kit: If necessary, conversion kit shall be provided per heater manufacturer's recommendations.
 - c. Regulator: Regulator shall be provided per heater manufacturer's recommendations.
 - d. Hose: Hose material and thickness shall meet industry standards and be long enough to connect from propane source to heater.
 - e. Controls: Controller shall be provided by manufacturer of heater and shall provide sufficient heat to meet manufacturers recommendations
 - f. Installation: Heater to be installed per manufacturer's recommendations using hardware recommended by manufacturer at a height recommended by the structure manufacturer.
- G. Tables: Eighteen (18) 48"W x 96"L x 32"H galvanized steel table frames and mesh tops
- a. Frames: galvanized steel table frames with galvanized steel tube legs
 - b. Mesh: $\frac{3}{4}$ " #13 regular galvanized metal mesh
- H. Sink: Utility sink with hot and cold taps. Connect to water service supply.

2.04 FINISHES

- A. Seams: Seams between polycarbonate panels and between polycarbonate panels and door frames to be sealed with Aluminum Sealing Tape per manufacturer's recommendations.

PART 3 – EXECUTION

3.01 SITE PREPARATION REQUIREMENTS

- A. Poured-in-place concrete foundation to be constructed per drawings.
- B. Provide drainage for the poured-in-place concrete foundation as shown in drawings.

3.02 PRODUCT ASSEMBLY

- A. Structure shall be positioned on poured-in-place concrete foundation per layout plan and anchored per manufacturer's recommendations.
- B. Structure components to be fastened together using fasteners recommended by manufacturer at connection points specified by manufacturer.

END OF SECTION

SECTION 13280

REMOVAL OF UNIVERSAL AND HAZARDOUS WASTE FROM BUILDINGS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS:

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all sections within DIVISION 1-GENERAL REQUIREMENTS, which are hereby made part of this Section of the Specifications.
- B. Prior to removal and disposal, waste material will need to be properly characterized by the demolition contractor for approval by an applicable disposal facility.
- C. Equality of material, article, assembly or system other than those named or described in this Section shall be determined in accordance with applicable provisions of the GENERAL CONDITIONS.
- D. Examine all conditions as they exist at the project before submitting a bid for the work of this Section.
- E. All provisions of this Section relating to the health and safety of workers and the general public, as well as protection of the environment are minimum standards. The Contractor is responsible for determining whether any legal requirements or prudent conservative work practices require any additional and/or more stringent protective measures, and implementing such measures if deemed necessary. Nothing in this Section shall be deemed to relieve the Contractor from any liability with respect to any such legal requirements or requirement of prudent conservative practice.
- F. All work-site preparations and practices will be conducted in accordance with all Federal, **Massachusetts** and appropriate **City of Worcester** and other local regulations, standards and codes pertaining to worker health protection, protection of the public health and the environment, including current US Environmental Protection Agency (EPA), Department of Labor Occupational Safety and Health Administration (OSHA), US Department of Transportation (DOT), **Massachusetts Division of Occupational Safety (MA DOS)**, **Massachusetts Department of Environmental Protection (MA DEP)**, local and all other Federal, **Commonwealth of Massachusetts** and local regulations pertaining to removal, transportation and disposal.

1.02 SCOPE OF WORK – GENERAL:

- A. PCB- and/or di (2-ethylhexyl) phthalate (DEHP)-Containing Light Ballasts

1. Remove, package, transport and dispose/recycle all PCB- and DEHP-containing light ballasts as universal/hazardous waste.
2. Provide and secure all notifications and permits necessary for the transport and disposal of PCB- and DEHP-containing light ballasts as hazardous material.
3. Furnish all labor, materials, equipment, and services required for all work included in this Section.
4. Compliance with all applicable federal, state, and local regulations, as well as all requirements set forth in these Specifications and facility requirements.
5. Decontamination and clean up following removal activities in each designated work area.
6. Perform any other work or activities required by this Specification, applicable regulations, or as necessary to perform a complete job to the satisfaction of the Owner and Engineer.
7. Provide temporary electrical wiring and services as required for removal and disposal of PCB- and DEHP-containing light ballast.

B. Fluorescent Light Bulbs & Mercury-Containing Thermostats/Switches

1. Remove, package, transport and dispose of all mercury/lead-containing fluorescent lamp bulbs and thermostats/switches from Site buildings as hazardous waste. Contractor shall ensure that bulbs are handled carefully and not broken or damaged.
2. Provide and secure all notifications and permits necessary for the transport and disposal of mercury/lead-containing bulbs as hazardous material.
3. Furnish all labor, materials, equipment, and services required for all work included in this Section.
4. Comply with all applicable federal, state, and local regulations, as well as all requirements set forth in these Specifications and facility requirements.
5. Decontamination and clean up following removal activities in each designated work area.
6. Perform any other work or activities required by this Specification, applicable regulations, or as necessary to perform a complete job to the satisfaction of the Owner and Engineer.
7. Provide temporary electrical wiring and services as required for removal and disposal of mercury/lead-containing bulbs.

1.03 SCOPE OF WORK – DETAILED:

The Universal and Hazardous Wastes to be removed in accordance with this Section include fluorescent light bulbs, light ballasts and various paints. Additionally, PCBs were detected in paint samples collected from the former Little League concessions shack structure.

- A. PCB- and DEHP-Containing Light Ballasts Removal and Disposal: Suspect PCB- and DEHP-containing light ballasts are present throughout the facility based upon dismantling of representative fixtures to observe ballasts. The following work shall be included as the scope of work for removal, transport and disposal/recycling of PCB- and DEHP-containing light ballasts:
1. All hazardous material abatement work areas shall remain isolated from all other trades and remain inaccessible to the public. Contractor shall monitor access to these areas.
 2. Contractor shall remove and dispose of all PCB- and DEHP-containing light ballasts in the facility as PCB- and DEHP-containing waste in accordance with all applicable state and federal regulation. Removal and disposal of all light ballasts shall include proper packaging, transportation and disposal of waste. Contractor is required to provide and secure all notifications and permits necessary for the transportation and disposal of PCB- and DEHP-containing light ballasts as hazardous material. The disposal options may include recycling, Subtitle-C and disposal at a chemical or hazardous waste landfill, or incineration at an EPA-approved high temperature incinerator. Under no circumstances shall the Contractor be allowed to dispose of light ballasts (i.e. intact ballasts) at a municipal solid waste landfill. Contractor is advised that all leaking PCB-or DEHP-containing ballasts must be incinerated at an EPA-approved high temperature incinerator at its costs.
 3. If the Contractor elects to recycle PCB- and DEHP-containing light ballasts, the Contractor is required to provide certificates of recycling for specific light ballast components that can be reclaimed (i.e. metals including copper or steel) and hazardous waste manifests for the PCB- and DEHP-containing components of the light ballasts (i.e. capacitors and possibly asphalt potting material surrounding the capacitor).
 4. Contractor shall provide hazardous waste manifests documenting the proper disposal of all PCB- and DEHP-containing light ballasts in accordance with all applicable state and federal regulations.
 5. Contractor shall specify the method of disposal to the Owner and Engineer and provide any information and/or documentation requested by the aforementioned parties to prove that all PCB-containing light ballasts have been properly packaged, labeled, transported and disposed.

B. Fluorescent Light/Mercury-Containing Vapor Lamp Bulbs Removal and Disposal: The following work shall be included as the scope of work for removal of fluorescent light bulbs:

1. All hazardous materials abatement work areas shall remain isolated from all other trades and remain inaccessible to the public. Contractor shall monitor access to these areas.
2. Contractor shall remove all fluorescent light bulbs and/or mercury-containing vapor lamps, intact, prior to demolition activities, and to dispose of all light bulbs as mercury or lead waste in accordance with all applicable state and federal regulations. Removal and disposal of all light bulbs shall include proper packaging, transportation and disposal of waste. Contractor is required to provide and secure all notifications and permits necessary for the transportation and disposal of fluorescent light bulbs in accordance with all applicable state and federal regulations. The disposal options may include recycling or land disposal in accordance with all applicable state and federal regulations.
3. If the Contractor elects to recycle bulbs, the Contractor is required to provide certificates of recycling for specific bulb components that can be reclaimed (i.e., glass, aluminum, etc.) and hazardous waste manifests for the toxic substances present in the bulbs (i.e., mercury, lead).
4. Contractor shall provide manifests documenting the proper disposal of all bulbs in accordance with all applicable state and federal regulations.
5. Contractor will be required to specify the method of disposal to the Engineer and provide any information and/or documentation requested by the aforementioned parties to prove that all light bulbs have been properly packaged, labeled, transported and disposed.

1.04 RELATED WORK SPECIFIED ELSEWHERE:

A. **02051 ASBESTOS ABATEMENT**

B. **02112 REMOVAL OF UNDERGROUND NON-FRIABLE AC PIPE**

C. **13282 LEAD-BASED COATINGS REMOVAL**

D. **PCB-IMPACTED PAINT REMOVAL AND DISPOSAL**

The following work shall be included as the scope of work for disposal of PCB-impacted paints. The following PCB-containing paints were identified by Weston & Sampson during the initial hazardous building materials survey:

Field ID	Sample Description	Substrate	Analytical Result (mg/kg)	
			Total PCBs	Aroclor Detected
P-01	Dark Grey Paint	Cement	36	Aroclor-1254
P-02	Light Grey Paint	Cement	7.3	Aroclor-1254
P-03	Tan Paint	Plaster	5.9	Aroclor-1254
P-04	Turquoise Paint	Sheetrock	8.7	Aroclor-1254

1. All hazardous material abatement work areas shall remain isolated from all other trades and remain inaccessible to the public. Contractor shall monitor access to these areas.
2. Prior to removal and disposal, waste material will need to be properly characterized by the demolition contractor for approval by an applicable disposal facility.
3. The painted materials listed above contain greater than 2 parts per million (ppm) PCBs, and therefore, cannot be disposed of in Massachusetts and must be disposed at a facility that is permitted to accept PCBs in the concentrations present.
4. Contractor is required to provide and secure all notifications and permits necessary for the transportation and disposal of PCB painted materials.

E. The work of this section shall be performed as stated herein. In performing the work of this Section, the Contractor shall refer to other Divisions for additional procedures. The Contractor is responsible for the coordination of the work of this section with other related work.

F. Portions of the work herein require direct coordination with the work of the above noted Related Sections. The General Contractor shall coordinate this with the work of other trades on the site.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED

END OF SECTION

SECTION 13282

LEAD BASED COATINGS REMOVAL

PART 1 - GENERAL:

1.01 DESCRIPTION:

- A. This Section specifies renovation of structures involving lead paint.
- B. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Section in Division One through Sixteen of these Specifications.
- C. Examine all Drawings and all other Sections of the Specifications for requirements of related sections affecting the work of this Section. A lead determination at the site indicates that various components are considered to be lead containing.
- D. The work of this section shall be performed as stated herein. In performing the work of this section, the Contractor shall refer to other Sections for additional procedures. The Contractor is responsible for the coordination of the work of this section with related work. No delays in completion of the work may be claimed for lack of coordination.
- E. Contractor shall comply with all applicable local, state, and federal guidelines and regulations regarding all work involving the presence of lead-containing paint.
- F. The work of this section references work of the Contractor performing the renovations. Additionally, requirements of the General Contractor regarding coordination and related work are identified in this section and shall be considered the responsibility of the General Contractor.

1.02 DESCRIPTION OF WORK:

- A. The work of this section includes **lead-based coatings removal of the former Little League concession shack structure**. The procedures described herein apply to all renovation/demolition work where a worker may be occupationally exposed to lead as well as to the disposal of the demolition debris. The Contractor shall assume that any painted surface not tested under this specification shall be assumed to contain lead paint and it shall be the Contractor's responsibility to protect workers performing under this Contract. This may require additional testing by the Contractor to verify lead content.
- B. The Contractor shall assume full responsibility and liability for the compliance with all applicable Federal, State and local regulations pertaining to work practices, hauling and disposal of hazardous waste, protection of workers and visitors to the site, and persons occupying areas adjacent to the site. The Contractor shall hold the Owner, Engineer and

Engineer's Subconsultant (if any) harmless for failure to comply with any applicable work, hauling, disposal, safety, health or regulation on the part of itself, its workers or its subcontractors.

- C. The Contractor is required to ensure the protection of workers performing any related renovation work that will affect surfaces coated with lead containing paint as well as protecting the public and the environment from exposure to lead dust.

D. CODES AND STANDARDS:

1. All work shall conform to the standards set by applicable Federal, State and local laws, regulations, ordinances, and guidelines in such form in which they exist at the time of the work on the contract and as may be required by subsequent regulations.
2. In addition to any detailed requirements of the Specification, the Contractor shall at its own cost and expense comply with all laws, ordinances, rules and regulations of Federal, State, Regional and Local Authorities regarding handling and storing of lead waste material.
3. The following references are cited as applicable standard and regulations as amended:

a. Code of Federal Regulations (CFR) Publications:

29 CFR 1910	General Industry
29 CFR 1926.55	Gases, Vapors, Fumes, Dusts and Mists
29 CFR 1926.57	Ventilation
29 CFR 1926.62	Lead in Construction
29 CFR 1926.200	Signs, Signals and Barricades
29 CFR 1926.354	Welding, Cutting and Heating in Way of Preservative Coatings
29 CFR Subpart T	Demolition
40 CFR 50	National Primary and Secondary Ambient Air Quality Standards for Lead
40 CFR 61 Subpart A	General Provisions
40 CFR 61.152	Standard for Waste Manufacturing, Demolition, Renovation, Spraying, and Fabricating Operations.

- 40 CFR 241 Guidelines for the Land Disposal of Solid Wastes
- 40 CFR 257 Criteria for Classification of Solid Waste
- 40 CFR 261 and 262 Waste Disposal Facilities and Practices
- b. Massachusetts Regulations:
 - 454 CMR 23.00 Occupational Lead Exposure
- c. American National Standards Institute (ANSI) Publications:
 - 29.2-79 Fundamentals Governing the Design and Operation
of Local Exhaust Systems
 - 288.2-80 Practices for Respiratory Protection
- d. National Institute of Occupational Safety and Health (NIOSH) Publications:
 - Manual of Analytical Methods, 4th Ed.
- e. Underwriters Laboratories, Inc. (UL) Fire Resistance Directory Publications:
 - 586-77 (R 1982) Test Performance of High Efficiency Particulate, Air
Filter Units

- E. All regulations by the above and other governing agencies in their most current version are applicable throughout this project. Where there is a conflict between this Specification and the cited State, Federal, or local regulations, the more restrictive or stringent requirements shall prevail.

THIS SECTION REFERS TO MANY REQUIREMENTS FOUND IN THESE REFERENCES, BUT IN NO WAY IS IT INTENDED TO CITE OR REITERATE ALL PROVISIONS THEREIN OR ELSEWHERE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO KNOW, UNDERSTAND, AND ABIDE BY ALL SUCH REGULATIONS AND COMMON PRACTICES.

1.03 DEFINITIONS:

- A. The following definitions apply to the performance of the work of this project.
 - 1. Action Level: An airborne concentration of lead above 30 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) as a time weighted average (TWA) for more than 30 days per year.
 - 2. Area Monitoring: Sampling of lead concentrations within the work area and outside the work area which is representative of the airborne concentrations of lead.

3. Clean Room: An uncontaminated change room directly adjacent to the work area having facilities for storage of employees' personal clothing and uncontaminated work clothes, materials and equipment provided when the airborne exposure to lead is above the PEL.
4. Contractor: The Contractor who is performing work involving lead containing paint under this Section.
5. Decontamination Area: A contained area adjacent to or connected to the abatement work area and consisting of an equipment room, shower area, and clean room which is used for decontamination of workers, materials and equipment.
6. HEPA Filter Equipment: High efficiency particulate air (HEPA) filtered vacuuming or exhaust ventilation equipment with a UL 586 filter system. Filters shall be of 99.97 percent efficiency for retaining 0.3 micrometer diameter particles.
7. Lead-Containing Paint: Paint, varnish, or stain, which contains lead in excess of 0.0% lead by weight.
8. Lead Permissible Exposure Limit (PEL): 50 $\mu\text{g}/\text{m}^3$ of air, based upon an 8-hour time weighted average.
9. Sample Location: Area or place where an air or wipe sample is collected.
10. Time Weighted Average (TWA): The TWA is an 8-hour time weighted average for the test of the concentration of lead for worker exposure.
11. Wet Cleaning: The process of removing lead contamination from building surfaces, equipment and other objects by using cloths, mops, or other cleaning tools which have been dampened with water, and by afterwards disposing of these cleaning tools as lead contaminated wastes.
12. Work Area: A controlled-access work area, which has no plastic sheeting or other containment barriers, erected to separate the trades.

1.04 SUBMITTALS:

A. Notifications:

1. Provide in proper and timely fashion, all necessary notifications to relevant federal, state, and local authorities and obtain and comply with provisions of all permits or applications required by the work specified, as well as make all required submittals required under those auspices. Contractor shall indemnify Owner, Engineer and Consultant from, and pay for all claims resulting from failure to adhere to these provisions. Costs for all permits, applications, and the like are to be assumed by Contractor. Required notifications include but are not limited to the following:
 - a. Massachusetts Department of Environmental Protection, Form AQ06 - Construction/Demolition Notification.

B. Provide four (4) copies of the following Submittals at the Pre-Construction Conference:

1. Copies of all notifications, permits, applications, licenses and like documents required by Federal, State, or local regulations and this specification obtained or submitted in proper fashion,
2. Copies of written medical opinions for each employee who may be occupationally exposed to lead as required by 29 CFR 1926.62 (j)(3)(v),
3. Copies of supervisors' and workers' training certificates,
4. Record of successful respirator fit testing performed by a qualified individual within the previous 6 months for each employee to be used on this project with the employee's name and social security number with each record,
5. Employer's Lead Compliance Program as required by 29 CFR 1926.62, including proposed respiratory protection program and medical monitoring for all employees throughout all phases of the job, including make, model and NIOSH approval numbers of respirators to be used; worker orientation plan; written description of all proposed procedures, methods, or equipment to be utilized, including those that may differ from the Contract Specifications. In all instances, Contractor must comply with all applicable federal, state and local regulations.
6. Proposed number and type (i.e., hazardous waste or non-hazardous waste, open top, front loading, etc.) of dumpsters for waste, proposed location(s),
7. A list of all equipment to be used on site, by make and model,
8. Chain of Command of responsibility at work site including supervisors and competent person, their names, resumes and certificates of training and phone numbers,
9. List of total number of supervisors and workers intended to be assigned to the project, including name and lead awareness qualifications,

10. Material Safety Data Sheets on potentially hazardous materials to be used on the project,
11. Waste Disposal Plan which describes the waste stream and the disposal means (i.e. landfill, recycle, etc.) and includes the name, address, and ID number of the proposed hazardous waste hauler, waste transfer route, and proposed disposal reclamation or treatment facility,
12. Name and address of the proposed construction debris site,
13. Construction schedule including sequence of critical work.

No work on the project will be allowed to begin until the Pre-Construction Submittals as listed herein are accepted by Engineer. Any delay caused by the Contractor's refusal to submit this documentation in a timely fashion does not constitute a claim for extra compensation or a time extension.

C. Submit the following to the Engineer as a Post-Construction submittal package:

1. Copies of waste manifests and receipts acknowledging disposal of all lead waste material from the project, showing delivery date, quantity, and appropriate signature of landfill's authorized representative,
2. DEP approval for all waste reduction techniques, if utilized,
3. A notarized copy of the daily list of workers and site entry-exit logbook,
4. All personnel monitoring results,
5. All TCLP testing results.

1.05 GENERAL WORK PROCEDURES:

- A. Work shall be carried out in sequential phases. Inspection and approval of each phase by the Engineer shall be sought and gained before proceeding to the next phase and in accordance with the schedule approved. This shall include demolition requirements for work area clearance and work area release before other work. As a Contract requirement, any reasonable delay caused by this requirement will not constitute a basis for claim against the Engineer or Consultant. Contractor must coordinate the work of this section with the work of all other trades.
- B. At no time will Owner permit storage of debris generated from demolition activities to be stored inside buildings at the site, and any storage of materials will be subject to Owner's approval. Assure security of debris at all times.

1.06 SPECIAL CONSIDERATIONS:

A. Testing References:

1. Testing for lead paint has been performed on a representative number of painted components at **the former Little League concession shack structure** using EPA Method SW846-7000B with Atomic Absorption Spectrometry Analysis.
2. Testing results are found in Section 1.07.

B. The Contractors shall follow the requirements of this section regarding component removal, demolition, worker exposure and protection, work area cleaning, and waste disposal.

C. Work Affected – In general, the following activities are minimum requirements of this section and affect the demolition performed on the painted components:

1. No torch cutting, mechanical sanding, stripping, or abrasive methods of paint removal shall occur.
2. No demolition activities may occur which increase the workers' exposure above the Action Level of 30 $\mu\text{g}/\text{m}^3$. Contractor shall fully comply with the OSHA lead standard at 29 CFR 1926.62.
3. Workers shall be informed of the components to be renovated or demolished that have been identified as containing lead.
4. Worker protection, at a minimum, shall comply with the OSHA Lead Standard 29 CFR 1926.62. Worker Right to Know and Health and Safety Standards of 1926.62 shall also apply to the work of this section.
5. Separation of Trades: Unprotected, untrained workers or trades shall not perform any related work within the same vicinity as demolition-involving components identified with lead.
6. Clean-up Activities: The Contractor shall maintain work zones free of accumulated debris and paint chips.

1.07 REPORT OF FINDINGS:

- A. Seven of the eight following components were identified as containing lead in excess of 0.5% lead by weight:

Field ID	Sample Description	Substrate	Analytical Result (percent by weight)
L-1	Yellow Trim Paint	Wood	6.2
L-2	Green Wall Paint	Cement	4.7
L-3	Green Door Frame Paint	Wood	11
L-4	Dark Green Service Window Paint	Wood	8.7
L-5	Turquoise Interior Wall Paint	Sheetrock	3.0
L-6	Dark Grey Interior Floor Paint	Cement	0.53
L-7	Light Grey Interior Floor Paint	Cement	0.20
L-8	Tan Interior Ceiling Paint	Plaster	3.2

1.08 FEES, PERMITS & LICENSES:

- A. The Contractor shall pay all licensing fees, royalties, and other costs necessary for the use of any copyrighted or patented product, design, invention, or process in the performance of the work specified in this section. The Contractor shall be solely responsible for costs, damages, or losses resulting from any infringement of these patent rights or copyrights. The Contractor shall hold the Owner, Engineer and Engineer's Subconsultant (if any) harmless from any costs, damages, and losses resulting from any infringement of these patent rights or copyrights. If the Contract Documents requests the use of any product, design, invention, or process that requires a licensing, patent or royalty fee for use in the performance of the job, the Contractor shall be responsible for the fee or royalty fee and shall disclose the existence of such rights.
- B. Contractor shall be responsible for costs for all licensing requirements, where applicable and notification requirements and all other fees related to the Contractor's ability to perform the work in this Section.
- C. Secure all necessary permits for work under this Section, including hauling, removal, and disposal, fire, and materials usage, or any other permits required to perform the specified work.

1.09 CLEAN-UP:

- A. Maintain the work site in a neat and orderly manner at all times, so as not to interrupt or infringe upon the work of other trades.
- B. Comply with all requirements for release of work areas as described in the project specification.
- C. It is the prerogative of the Engineer to inspect whenever deemed necessary, the Contractor is responsible for meeting, and correcting any deficiencies discovered which do not meet the current applicable regulations and requirements of these specifications.

1.10 COORDINATION:

- A. At no time shall Contractor cause or allow to be caused conditions which may cause risk or hazard to the general public or conditions that might impair safe use of the facility. The use of the facility's electricity, water or like utilities by the Contractor shall be as specified in Division 1.

- B. Coordinate the work of this section with that of all other trades. Phasing and scheduling of this project will be subject to the approval of the Engineer. The work of this Section shall be scheduled and performed so as not to impede the progress of the project as a whole. Work shall not proceed in any area without the express consent of the Engineer. The Contractor shall be available within 24 hours notice for additional work if after acceptance of the work it is found that complete demolition was not achieved from the initial work effort as determined by the Engineer.
- C. The proposed schedule for the work in this Section shall show the time involved from start to finish of demolition operations, including preparation, removal, clean-up, Consultant's inspections and de-mobilization portions of the job.
- D. A final schedule shall then be prepared and coordinated with the Owner, Engineer and Engineer's Subconsultant (if any). The final scheduling shall be submitted in writing before the commencement of work.
- E. Complete activities in the phases of the agreed upon final schedule. The work must be completed in a continuous, uninterrupted operation.
- F. Unless specifically authorized by the Engineer, the work of this project shall be conducted according to the hours established in Division 1.
- G. Inspections: The Engineer may perform visual inspections during the work of this section, as described below. Contractor shall not proceed with work until Contractor has received Engineer's approval at the stages identified below:
 - 1. During: Before the commencement of a proposed alternative method other than specified.
 - 2. Post Inspection: At the completion of work and final clean-up, before clearance or removal of any critical barriers and decontamination unit from the work area.
 - 3. Waste Removal Inspection: Notify Engineer of impending removal of hazardous waste from the site.

1.11 AUTHORITY TO STOP WORK:

- A. The Engineer has the authority to stop the demolition work, at any time the Engineer determines that conditions are not within the specifications and applicable regulations. The stoppage of work shall continue until conditions have been corrected and corrective steps have been taken to the satisfaction of the Engineer. Standby time required to resolve violations shall be at the Contractor's expense, and shall not be cause for extending the completion date.

1.12 EMERGENCY PRECAUTIONS:

- A. The Contractor shall establish emergency and fire exits from the work area.
- B. When an injury occurs, the Contractor shall stop work until the injured person has been removed from the work area.

1.13 DISPOSAL OF WASTE MATERIAL:

A. General:

1. Contractor and transporting Contractor will be required to comply with the Resource Conservation and Recovery ACT (RCRA) and with all applicable state and local regulations.
2. Contractor shall be responsible for disposing of all waste determined by Toxicity Characteristic Leachate Procedure (TCLP) to be hazardous. If TCLP testing has not been performed, the Demolition Contractor shall be responsible for testing the waste.
3. Contractor and all sub-contractors shall comply with all EPA regulations.

PART 2 – PRODUCTS

2.01 GENERAL REQUIREMENTS:

- A. The Contractor shall deliver all materials and equipment to the site in the original containers bearing the name of the manufacturer, and details for proper storage and use.
- B. All materials or equipment delivered to the site shall be unloaded, temporarily stored, and transferred to the work area in a manner that shall not interfere with other trades working in the area.
- C. Unloading and temporary storage sites, and transfer routes, must be approved in advance by the owner.
- D. Damaged or deteriorated materials may not be used and must be promptly removed from the premises. Material that becomes contaminated shall be packaged and legally disposed in an approved, secure landfill.

2.02 MATERIALS:

- A. All materials and equipment proposed to be used on this project shall be subject to the acceptance of the Engineer. The list of required materials shall include, but not necessarily be limited to the following:
 1. Fire retardant polyethylene sheeting, minimum thickness of six (6)-mil.
 2. Plastic bags, minimum thickness of six (6)-mil.

3. Duct Tape, up to 3 inch width.
4. Lead Warning Signs, as required by the DLWD Regulations and OSHA Hazard Communication requirements.
5. Flexible duct for ventilation units (if required).
6. Spray adhesive, fire retardant.
7. Personal Protective Equipment, NIOSH approved respirators.
8. Ventilation units with HEPA filtration and exhaust fans.
9. HEPA vacuums.
10. Trisodium-Phosphate (TSP) and product data.
11. Cloth tarpaulin.

2.03 TOOLS AND EQUIPMENT:

- A. Transportation Equipment: Transportation equipment, as required, shall be suitable for loading, temporary storage, transporting, and unloading waste without exposure to persons or property. All over-the-road transportation equipment must carry the appropriate hazardous waste transport licenses and insurance.
- B. Vacuum Equipment: All vacuum equipment utilized in the work area shall utilize HEPA filtration systems.
- C. Water Sprayer: The water sprayer shall be an airless or other low-pressure sprayer for water application.
- D. Other Tools and Equipment: The Contractor shall provide other suitable tools including but not limited to: rounded edge shovels, rakes, brooms, and carts.
- E. The Contractor shall provide ground fault circuit interrupters (GFCI) to protect all electrical cord and connections.
- F. Approved lighting equipment for use in the work area.
- G. Scaffolding: Scaffolding, as required to accomplish specified work, shall meet all applicable Federal, State and local safety regulations and used in accordance with manufacturer's specifications.

PART 3 – EXECUTION

3.01 SCHEDULING:

- A. The Contractor shall coordinate all scheduling with the Engineer. A schedule of work shall be submitted to the Engineer before contract performance.

3.02 UTILITIES:

- A. Provide all necessary connections for temporary utilities in the workplace during work. Shut down and disconnect all electrical power to the work area so that there is no possibility of reactivation and electrical shock during the work. The temporary electrical power shall be in accordance with all OSHA requirements.

3.03 IDENTIFICATION OF HAZARDS:

- A. Prior to any work involving lead-containing items, the Contractor shall identify all work activities in which a worker may be occupationally exposed to lead.
- B. The Contractor shall initially determine if any worker may be exposed to lead above the action level.

3.04 BARRIERS AND ISOLATION AREAS:

- A. All lead in demolition work areas shall remain isolated from all other trades on the project and remain inaccessible to the public. Contractor shall monitor the access to the demolition work areas. The below listed items are required to control the generation of lead-containing dust during demolition activities. The Contractor is ultimately responsible for cleaning all generated dust and paint debris from demolition operations and must maintain work areas free from lead dust generated from demolition activities.
 - 1. Signs shall be posted at all approaches to the work area warning that work-involving lead is being conducted in the vicinity. Signs shall be in bold lettering not smaller than two inches tall.
 - 2. Barriers shall not be removed until the work areas are thoroughly cleaned and approved by the Consultant.

3.05 APPROVALS AND INSPECTIONS:

- A. All temporary facilities, work procedures, equipment, materials, services, and agreements must strictly adhere to and meet this Section along with EPA, OSHA, regulations and recommendations as well as federal, state, and local regulations. Where there exists overlap of these regulations, the most stringent one applies. All work performed by the Contractor is further subject to approval of the Engineer.

3.06 PERSONNEL SAMPLING – CONTRACTOR:

- A. Perform personnel air sampling during all demolition work to determine worker exposure limits. The results of such sampling shall be posted, provided to individual workers, and submitted to Engineer as described herein.
- B. Provide sampling to check personal exposure levels. Representative sampling shall be taken for the duration of the work shift or for eight hours, whichever is less. Personal samples need not be taken for repeated working conditions if working conditions remain unchanged, but must be taken every time there is a change in the removal operation, either in terms of the location or the type of work. Sampling will be used to determine eight-hour Time-Weighted-Averages (TWA). Personal sampling shall be as outlined in OSHA Standard 29 CFR 1926.62.
- C. Air sampling results shall be transmitted to the Engineer and individual workers available at the job site in written form no more than forty-eight (48) hours after the completion of a sampling cycle. The reporting document shall list each sample's result, sampling time and date, personnel monitored and their social security numbers (last four digits only), flow rate, sample duration, sample yield, cassette size, and analyst's name and company, and shall include an interpretation of the results. Air sample analysis results will be reported in micrograms/cubic meter ($\mu\text{g}/\text{m}^3$).
- D. The Contractor's testing lab shall be AIHA accredited for analysis of metals. Contractor shall submit for Engineer's review and acceptance the name and address of the laboratory, certification(s) of AIHA accreditation for metal analysis, listing of relevant experience in air lead analysis, and presentation of a documented Quality Assurance and Quality Control program.
- E. Air monitoring frequency will be established in accordance with the requirements set forth in 29 CFR 1926.62.

3.07 WORK PROCEDURES:

- A. The Contractor shall initiate, and continue, sufficient engineering and work practice controls, as described in the Contractor's Lead Compliance Program, to reduce and maintain worker exposures to lead at or below the Action Level.
- B. The following work practices are specifically required by these specifications:
 - 1. All persons except those directly involved in the work shall be excluded from the work area. Physical barriers shall be used, where necessary, to limit access to the work area for the duration of the demolition operations. Warning signs may be posted in accordance with applicable regulations.

2. Provide hand-washing facilities and assure that all workers thoroughly wash their hands and face upon exiting the work area. Workers shall pay careful attention to cleanse the hands and face when decontaminating. Provide hygiene facilities, including shower, as required based on initial assessment and continued monitoring.
 3. Thoroughly wet the buildings or areas to be demolished and mist the air to reduce the potential for creating airborne lead and dust.
 4. All equipment used by the workers inside the work area shall be either left in the work area or thoroughly decontaminated before being removed from the area. Extra work clothing (in addition to the disposable suits supplied by the Contractor) shall be left in the clean area until the completion of work in that area. The clean area shall be cleaned of all visible debris and disposable materials daily.
 5. Under no circumstances shall workers or supervisory personnel eat, drink, smoke, chew gum, or chew tobacco in the work area; to do so shall be grounds for the Engineer to stop all demolition operations. Only in the case of life threatening emergency shall workers or supervisory personnel be allowed to remove their protective respirators while in the work area. In this situation, respirators are to be removed for as short a duration as possible.
 6. No torch cutting, mechanical sanding, stripping, or abrasive methods of paint removal shall occur.
 7. No demolition activities may occur which increase the workers exposure above the Action Level of $30 \mu\text{g}/\text{m}^3$. Contractor shall fully comply with the OSHA lead standard 29 CFR 1926.62.
- C. Workers shall be informed of the components to be renovated that are identified as containing lead.
- D. Separation of Trades: Unprotected, untrained workers or trades shall not perform any related work within the same areas as demolition involving components identified as containing lead. Other trades may not enter these areas until clean-up procedures are completed.
- 3.08 STORAGE OF WASTE:
- A. Use of waste containers on site shall be controlled under the following requirements:
1. Location of waste containers on site shall be subject to Owner's approval.
 2. The waste containers lined shall be lined with two layers of six-mil polyethylene sheeting, be solid, enclosed containers, locked and sealed at all times. This requirement applies to waste classified as hazardous based on TCLP testing.

3. Contractor shall comply with all federal, state, and local regulations and ordinances regarding lead waste storage.

END OF SECTION

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SECTION 15408

PLUMBING

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This section of the specification covers the complete interior and exterior plumbing work, including but not limited to the following:

Pipe and fittings
Valves
Insulation, pipe and equipment
Miscellaneous fittings
Plumbing fixtures
Backflow preventers
Hose bibs
Yard Hydrants
Water lines
Water Meter

- B. The following are not included under this section of the specification:

Process piping
Excavation, pumping of excavations, and backfilling
Cutting and patching, except as noted
Concrete and masonry work
Field painting
Electric wiring, except as noted

1.02 RELATED WORK:

- A. Section 02300, EARTHWORK
B. Section 02240, DEWATERING
C. Section 03300, CAST-IN-PLACE CONCRETE
E. Section 09900, PAINTING
F. Division 16, ELECTRICAL

1.03 SYSTEM DESCRIPTION:

- A. The Contractor shall furnish and install all plumbing fixtures and water and drainage piping as herein specified and as indicated on the drawings. The Contractor shall make the connection to the water mains and shall extend the drain piping as indicated on the drawings.

- B. All materials and workmanship shall be suitable for the respective positions in the work and the type of service encountered. All equipment shall be constructed to operate safely without water hammer or undue wear.
- C. The drawings show the general arrangement, direction, and sizes of pipes; it is not intended to show every offset, valve, and fitting, or every structural difficulty that may be encountered, but the piping and appurtenances shall be installed to suit, and to avoid interference with the installation, operation and maintenance of fixtures, equipment, or other piping. All measurements shall be verified at the job site.

1.04 QUALITY ASSURANCE:

- A. The Contractor, at his own expense, shall do all work required by and in accordance with applicable State and local plumbing codes; shall arrange for all permits, inspections, and tests required by those codes; and shall do everything necessary to provide complete systems which will be ready for use without further expense to the Owner.
- B. Work and materials shall conform to applicable codes, utility company standards, and the rules and regulations of authorities having jurisdiction.
- C. Should work or material called for in the specification or on the drawings not conform to the requirements of the previous paragraphs, above, the Contractor shall so notify the Engineer when submitting his proposal. Failing to do this, the Contractor shall comply with these requirements at his own expense.

1.05 REFERENCES:

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

American Society for Testing and Materials (ASTM)

ASTM	A53	Specification for Welded and Seamless Steel Pipe
ASTM	A120	Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Ordinance Uses
ASTM	A72	Specification for Welded Wrought Iron Pipe
ASTM	A74	Specification for Hub and Spigot Cast Iron Soil Pipe and Fittings
ASTM	A167	Specification for Stainless and Heat-Resisting Chromium - Nickel Steel Plate, Sheet and Strip
ASTM	B62	Specification for Composition Bronze Ounce Metal Castings
ASTM	B88	Specification for Seamless Copper Water Tube
ASTM	C564	Standard Specifications for Rubber Gaskets for Cast Iron soil Pipe and

Fittings

ASTM	D3034	Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.
ASTM	D3212	Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

American National Standards Institute (ANSI)

ANSI	B16.3	Malleable-Iron Screwed Fittings 150 and 300 lb.
ANSI	B16.12	Cast Iron Screwed Drainage Fittings
ANSI	B16.26	Cast Bronze Fittings for Flared Copper Tubes
ANSI	B16.18	Cast Bronze Solder-Joint Pressure Fittings
ANSI	B16.22	Wrought Copper and Bronze Solder-Joint Pressure Fittings

American Water Works Associations (AWWA)

AWWA	C651	Standard for Disinfecting Water Mains
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1.06 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

- A. Shop drawings shall consist of manufacturer's scale drawings, cuts, or catalogs, including descriptive literature and complete characteristics, code requirements, and motor drive. Shop drawings shall be identified by name and number of equipment, as indicated on contract drawings or in the specification. Catalog data submitted without proper identification of model number or type will not be accepted or acted upon by the Engineer. Information on shop drawings which applies to models or systems which are not to be provided hereunder and which does not specifically apply to the item submitted shall be deleted.

- B. Shop drawings of the following equipment and materials shall be submitted for review:

Plumbing fixtures
Valves (all types)
Non-lead solder
Backflow Preventers

1.07 SEQUENCING/SCHEDULING:

- A. Contractor shall cooperate with Contractors for other work to avoid interference of plumbing

work with that of other trades.

- B. Pertinent contract and shop drawings of other trades shall be consulted as required for proper coordination of work.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. PIPE AND FITTINGS:

Note: ~~Engineer shall verify client preference for use of copper tubing or polyethylene pipe and delete the paragraph pertaining to the piping that will not be used.~~

Note: Engineer shall verify client preference for flared or compression fittings. Contractor shall refer to city of Worcester Standards for all service piping and fitting standards as superseding the below specifications.

1. All pipe and fittings shall conform to the listed ASTM and ANSI Specifications as applicable, unless otherwise indicated.
2. Underground water piping shall be Type K, annealed, copper water tubing with flared joints.
3. Soil, drain and waste piping 2-1/2-inches and smaller shall be composed of standard-weight, galvanized-steel pipe with screwed, galvanized, cast iron drainage fittings.
4. Except as hereinafter specified, drainage piping, which includes soil, waste, and vent piping, 3-inches and larger, shall be composed of Class XH (extra-heavy), cast iron, soil pipe with Class XH, cast iron, soil-pipe fittings. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute or receive prior approval of the Engineer. Joints for hub and spigot pipe shall be installed with compression gaskets conforming to the requirements of ASTM Standard C564 or shall be installed with lead and oakum.
5. Vent piping 2-1/2-inches and smaller shall be composed of standard-weight, galvanized-steel pipe with screwed galvanized malleable iron fittings.
6. PVC vent piping shall be furnished in accordance with ASTM D3034 and ASTM D3212.

B. VALVES:

1. Except where flanged valves are specified or required to suit flanged connections, the valves described below shall have screwed ends where used with pipe. Where used with copper tubing, they shall have solder-joint ends or, at the Contractor's option, may have screwed ends for which solder joint adapters for copper tubing shall be provided. In addition to the requirements hereinafter specified, all valves

shall be equal in quality and performance to those made by Crane Co., New York, N.Y., Jenkins Bros., New York, N.Y., Kennedy Valve Mfg. Co., Elmira, N.Y.; Lukenheimer Co., Cincinnati, Ohio; William Powell Co., Cincinnati, Ohio; or Walworth Co., New York, N.Y. Insofar as possible, all valves shall be the product of one manufacturer.

2. Gate valves 2-1/2-inches and smaller shall be 150 lb. bronze valves with screwed or solder-joint ends, as hereinbefore specified, and body material shall conform to Standard Specification for Composition Bronze or Ounce Metal Castings, ASTM B62. Valves shall have union bonnet, rising stem, inside screw, and solid wedge gate. Stems shall be made of wrought silicon bronze. If the manufacturer does not furnish this stem material in the class specified, the valves shall be furnished in the next higher class in which the stem material is available.
3. Globe, angle and check valves 2-1/2-inches and smaller shall be 150 lb. bronze valves with screwed or solder-joints ends as hereinbefore specified, and body material shall conform to Standard Specification for Composition Bronze or Ounce Metal Castings, ASTM B62. Valves shall have union bonnet, plug disk globe, renewable or regrindable seat, swing check. Stems shall be made of wrought silicon bronze. If the manufacturer does not furnish this stem material in the class specified, the valves shall be furnished in the next higher class in which the stem material is available.
4. Globe or angle valves may be used for stop valves one inch and smaller, subject to the approval of the Engineer.
5. Strainers shall be placed ahead of each control valve and elsewhere as specified or indicated on the drawings. Strainers shall be screwed or flanged as specified for valves. Bodies shall be of the T, S, or Y type designed for not less than 125 lb. working pressure. Screens shall be bronze, Monel or stainless steel. The size of the perforation shall be 1/32-inch for strainers 3/4-inch to 2-inches, inclusive, and 1/16-inch for strainers over 2-1/2-inches in size.
6. The free area of each screen shall be not less than three times the area of the strainer inlet pipe. Unless the strainer design is devoid of air pockets, a 1/4 inch air vent cock shall be provided.
7. Manufacturers of other products comparable in quality and type to those specified will be acceptable, if, said products are offered by the Contractor with satisfactory data on past performance and other information required, and if approved by the Engineer.
8. Pressure-reducing valves 4 inches and smaller shall be self-contained, bronze body, single-port valves with spring-loaded diaphragm. The valve shall be equal to the pressure-reducing valves manufactured by Fisher Governor Co., Marshalltown, Iowa; Worthington Controls Co., Div., Norwood, Mass.; or Watts Regulator Co., Lawrence, Mass.

C. DRAINS:

1. Drains shall have cast iron bodies and shall be of the types listed below.
2. For convenience of listing, the various drains are identified by Josam Mfg. Co., Michigan City, Ind.; Wade Mfg. Div., Franklin Park, Ill., and Jay R. Smith Mfg. Co., Piscataway, Pa., catalog numbers, unless otherwise noted. Approved equal products of other manufacturers will be acceptable.

D. CLEANOUTS AND TRAPS:

1. Cleanouts and traps (except those furnished with fixtures) shall be class XH cast iron soil pipe fittings. Cleanout ferrules shall have an iron body suitable for standard hub ends of soil pipe or soil-pipe fittings. The ferrule shall be fitted with a threaded solid cast-brass plug. Cleanout plugs in floors and in ground shall be kept just below the finished floor level and covered with an adjustable cast iron head with a heavy-duty scoriated tractor cover. All plumbing fixtures shall be trapped.

E. BACKFLOW PREVENTERS:

Backflow preventers shall be Watts No. 909S reduced pressure principle backflow preventer or approved equal and shall be listed by **the Massachusetts Department of Environmental Protection** as approved backflow prevention devices. Each unit shall be a complete assembly including shut-off valves before and after the device and shall include a strainer, test cocks and pressure differential relief valve. Furnish test kit No. TK-9A and spare parts for each backflow preventer. This Contractor shall obtain and pay for the required permits.

F. MISCELLANEOUS FITTINGS:

1. Items listed in this subsection shall be equal to Josam, Zurn or Beacon. Manufacturers of other products comparable in quality and type to those specified will be acceptable if, said products are offered by the Contractor with satisfactory data on past performance and other information required, and if approved by the Engineer.
2. Shock absorbers shall have stainless steel castings and air charged bellows; 1-inch NPT male end connections; Zurn Shoktrols Model 300.
3. Wall cleanouts for drainage lines shall be cast iron countersunk plugs with cast iron ferrule; polished nickel-bronze round access cover with securing screw; Josam Y-130-BB. Threaded plug size shall suit arrangement drawings, access cover shall be 7-3/4-inch diameter for all sizes of plugs.
4. Floor cleanouts for drainage lines shall be cast iron with seriated cut-off sections, bronze internal plug same size as ferrule, and heavy-duty cover with the letters "C.O." cast in, vandal proof screws: Josam 8000.

5. Relief valves shall be combination temperature and pressure relief valves; capacity to suit heating element size; Watts 40L.
6. Gages shall be furnished and installed with the specified equipment as indicated on the drawings or specified, and shall be complete with all shutoff cocks and extensions necessary to clear insulation and maintain visibility.
7. Gages shall have a black case and shall be 4-1/2-inches nominal diameter with phosphor bronze Bourdon tubes (beryllium copper bellows), 1/4-inch NPT male connection, stainless steel rack and pinion movement, microadjustment for calibration, white dials and black figures, threaded ring case. Gages shall have a guaranteed accuracy of at least one percent of scale range.
8. T-branch cleanouts shall be cast iron, sized to fit the line in which they are installed, with line size rough brass raised head plug with polished brass round access cover. Countersunk screw between cover and raised plugs shall be of length to suit final installation; Josam Y-1510.
9. Wall hydrant shall be cast brass non freezing with 3/4-inch NPT outlet, T handle polished face bronze wall casing, renewable nylon seat, brass operating parts and 3/4-inch male NPT inlet connection with integral vacuum breaker, Smith Series 5509.
10. Ground cleanouts shall be cast iron with seriated cut-off sections, with all brass adjustable head, heavy-duty cover with letters "C.O" cast in, and screwed cleanout plug; Josam Y-620.
11. Yard hydrants shall be Model S4H Sanitary Yard Hydrant, as manufactured by Woodford, 2121 Waynoka Rd., Colorado Springs CO 80915. Phone 800-621-6032 | Fax 800-765-4115 email: sales@woodfordmfg.com or approved equal.

I. WATER METER:

Water meter shall be of type approved by the water system owner providing service to this project and furnished and installed in accordance with water system owner requirements.

L. QUICK COUPLING VALVES

- A. The valve body shall be of cast brass construction with a Working pressure of 125 psi. The valve seat disc plunger body shall be spring loaded so that the valve is normally closed under all conditions when the key is not inserted.
- B. The top of the valve body receiving the key shall be equipped with a single slot and smooth face to allow the key to open and close the valve slowly with a one-half turn. The quick coupling valve shall be equipped with a locking vinyl cover.
- 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.
- D. Quick coupling valves shall be installed on one (1") inch prefabricated PVC triple

elbow swing joint with 315 psi pressure rating. Swing joint shall be a minimum twelve (12") inches in length. Installation shall be as per detail.

E. Keys shall be single lug with one (1") inch male thread and three-quarter (3/4") inch female thread at the top.

F. Quick coupling valves shall be as manufactured by Hunter Industries model HQ-44RC, or approved equal.

G. Quick coupling Valve Boxes shall be TurfCool TCITQCV Quick Connect Valve Box by Sportsturf Specialties or approved equivalent.

2.02 SHOP PAINTING:

A. Before exposure to the weather, and after thorough cleaning to remove all mill scale (by sandblasting or pickling), rust, dirt, grease, and other foreign matter, the plumbing equipment, exterior casings, jackets, motors, and similar parts customarily finished at the shop shall be given coats of paint filler and enamel, or other approved treatment customary with the manufacturer.

B. Ferrous surfaces, including flange faces, obviously not to be painted, shall be given a shop coat of grease or other suitable rust-resistant coating.

C. Field painting is specified under Section 09900 PAINTING.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. PIPE AND FITTINGS:

1. All piping shall be installed in a neat, workmanlike manner, and the various lines shall be parallel to building walls wherever possible. Piping shall be installed to accurate lines and grades, and shall be supported by hangers of the type and spacing hereinafter specified. Where temporary supports are used, they shall be sufficiently rigid to prevent shifting or distortion of the pipe. Suitable provision shall be made for expansion where necessary.

2. All piping shall pitch toward low points, and provision shall be made for draining these low points. Sanitary and roof drainage piping shall be pitched 1/4-inch per foot wherever possible, but under no circumstances less than 1/8-inch per foot.

3. Cleanouts shall be installed in soil and waste piping at ends of branches, in traps and stacks, at points where direction of flow changes, and at convenient points in long runs of pipe. End cleanouts for pipe buried under floor slabs shall be brought up to just below the floor level and a flush access cover provided.

4. Before installation, uncoated steel pipe shall be placed on an end and hammered to remove scale.

5. Before assembly, all dirt and chips shall be removed from inside the pipe and fittings

and from the threads.

6. After being cut to final lengths, the ends of steel pipe and copper tubing shall be reamed to remove burrs.
7. Threads of all screwed joints shall be clean-cut and of long taper. Screwed joints shall be made up with an approved pipe joint compound applied to the male threads only.
8. All pipe connected to recessed drainage fitting shall be screwed against the shoulder of the fittings.
9. Pipe-joint compound, for pipe carrying flammable or toxic gas, must bear the approval of the Underwriter's Laboratories or Factory Mutual Engineering Division.
10. Isolation valves shall be provided in all branches, subbranches, and equipment connections, whether or not indicated on the drawings.
11. Joints, which are required to be backed off, shall be entirely disjointed, the threads of both the pipe and fittings wiped clean, new joint compound applied and the connection reassembled.
12. No close nipples will be allowed.
13. Solder joints for copper tubing shall be prepared by cleaning the ends of the tubing and the inner surfaces of the fittings with steel wool until they are bright. The cleaned surface shall be given a thin coating of approved non-lead soldering flux, and the tubing end inserted into the fittings as far as possible. Heating and finishing of the joint shall be done in accordance with the recommendations of the manufacturer of the fittings, using solid string or wire solder with no more than 0.2 percent lead. Solder shall be 95 percent tin and 5 percent antimony, or other approved composition. The use of cored solder will not be permitted.
14. Flared joints for copper tubing shall be cut and burred (as above) after which the sleeve nut shall be slipped on the tubing and the end flared with a flaring tool. Care shall be taken in flaring not to crack or split the flared portion, but if inspection reveals such damage, the flare shall be cut off and a new flare made. The flared end shall be squarely seated on the fitting and the nut tightened.
15. Where ferrous pipes join nonferrous pipes carrying liquid either underground or elsewhere, such as at electric water heaters, dielectric bushings or unions shall be used to make the joint.
16. A sufficient number of unions shall be used to allow for the dismantling of all water pipe, valves, and equipment. Unions shall be 250 WSP and shall be made of brass or bronze for joining nonferrous pipe and malleable iron or steel with brass or bronze seats for joining ferrous pipe. In vent piping, Tucker connections shall be used instead of unions.

17. Joints in soil pipe shall be made with picked oakum, packed tightly into the space between the hub and the pipe, and molten lead at least one inch in depth. Each joint shall be made in one pouring and caulked to ensure tightness.
18. Joints between soil pipe and steel pipe shall be made with malleable-iron Manhoff fittings.
19. Where exposed or encased in concrete, the pipe and fittings shall be uncoated, but buried pipe or pipe in concealed or inaccessible locations, shall be coated with bituminous varnish.
20. The type of service of piping, whether exposed or concealed in pipe chases or above ceilings, shall be properly identified by means of labels. Labels shall be adhered to piping at not more than 25 feet o.c. Labeling on branch lines shall begin at take-off from main line. Piping systems to be identified include the following:

Hot water,
Sanitary vent, Cold water
Sanitary drains
Domestic water, Protected water*

*All high pressure and low pressure lines downstream of the backflow preventer are classified as "protected water" lines.

B. VALVES:

1. At the completion of the installation, the Contractor shall tag all valves with 1-1/2-inches square brass or aluminum numbered tags. Tags shall be attached to valve bonnets with metal hooks as manufactured by National Tags and Label Company, or approved equal.

Note to Specifier: Edit the following paragraph to indicate the location you want the valve chart when other than in a treatment facility, i.e., pump station or other building.

2. The Contractor shall provide and hang in the operations office a typewritten, framed and glass covered valve chart indicating the number and location of the valves and the area served.

C. CABINETS

D. INSULATION:

1. Insulation shall be Johns Manville Micro-Lok glass fiber 3-1/2 pcf density, one inch thick, with a factory-applied white vapor barrier jacket. Butted end joints shall be wrapped with a 4-inch wide strap of vapor barrier jacketing, sealed with a vapor barrier lap cement. Longitudinal joints of the jacket shall also be sealed with vapor

barrier cement. If staples are used to aid fastening, they shall be brushed over with the vapor barrier lap cement. Each 3-foot section of pipe insulation shall be secured by means of 2 aluminum bands. Fittings shall be insulated with glass fiber blanket insulation, wrapping firmly and compressed to a thickness equal to the adjoining pipe insulation, held in place by spiral winding of twine. The fitting insulation shall be sealed with a wrapping of open-mesh cloth or glass fabric tape, coated with white vapor barrier lap cement. Valves and flanges 3-inches and larger shall be insulated as described for fittings. Valve insulation shall extend up to bonnets.

2. Insulation shall be applied carefully, by mechanics skilled in the trade.
3. Cold water valve shall be covered to the underside of the stuffing box gland.
4. Insulation shall be dry when applied, and shall be maintained dry until acceptance of the work by the Owner. Insulation shall be applied over clean, dry pipe, after the piping system has been tested and accepted by the Engineer.
5. Insulation shall not be applied over chrome piping.
6. Insulation shall be installed on all water piping above ground, on above-ground roof drainage piping run at any angle from 0° to 45° from horizontal, inclusive, and on the vertical riser to roof drain box from the horizontal run of piping.

E. SLEEVES AND FLASHING:

1. Pipes shall be enclosed in schedule 40 steel pipe sleeves where they pass through floors or masonry or concrete walls or partitions. Sleeves shall be one size larger than the pipe or insulated line passing through. Sleeves shall finish flush with finished faces of walls and partitions, and shall extend at least one inch above finished floor. In lieu of installing sleeves in cast floors, neat cored holes may be made. Cored openings shall have tight-fitting heavy gage sheet metal sleeves, adequately anchored, and caulked to provide as watertight an installation as the cast-in-place sleeves. Sheet metal sleeves shall also extend one inch above the finished floor.
2. Uninsulated exposed lines which pass through floors, ceilings, walls, or partitions shall have chrome escutcheon cover plates; insulated lines shall not have escutcheon cover plates. Escutcheon plates at floors shall cover the one-inch pipe sleeve extension above the finished floor.
3. Insulated piping shall be carried through the sleeve with no reduction in insulation thickness.
4. Where pipes pass through exterior walls, space between pipe and sleeve (surface of insulation and sleeve for insulated lines) shall be filled with a suitable non-combustible insulation and the exterior face fully sealed against the weather.
5. Counterflashing at ductwork and piping which pass through the roof shall be made

with Type 304 stainless steel, conforming to Standard Specification for Corrosion-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip, ASTM A167.

6. Counterflashing shall be formed to fit over base flashing with a slight clearance, to permit differential movement without damage. Counterflashing shall be fabricated to make a tight fit with the vent or other item being flashed, and shall be banded, bolted, and caulked as required to make a completely watertight flashing installation. Counterflashing shall lap over base flashing not less than 4-inches.
7. Straps for counterflashing shall be 1-inch x 0.037-inch temper-rolled stainless steel. All other stainless steel shall be temper-rolled, not less than 0.018-inches thick. All metal accessories shall be stainless steel.
8. Counterflashing shall conform to details on the architectural drawings. Base flashing is excluded from this section of the specification.

F. MISCELLANEOUS:

1. Wood plugs shall be inserted in weepholes of drains installed over floor membranes. Plugs shall be removed by the Contractor who installs concrete or mortar over the floor membrane.
2. In addition to those indicated on the drawings, fittings shall be installed in accordance with the following:
 - a. Shock absorbers on water supply lines to each battery of plumbing fixtures, up-stream of each solenoid or quick-closing valve on water lines.
 - b. Vacuum breaker valve for hot water heater.
 - c. Relief valve not provided as an accessory item for a packaged hot water heater shall be provided at each hot water tank, and shall have capacity equal to the heating BTU output of the coil.

3.02 QUALITY ASSURANCE:

- A. Upon completion of installation, all pipelines shall be tested by the Contractor in the presence of the Engineer or the plumbing or building inspector, and in accordance with the requirements of local or applicable plumbing or building code.
- B. Piping located underground shall be tested before being backfilled. Piping to be insulated or painted shall be tested before the insulation or paint is applied. Portions of piping that will be concealed before completion shall be tested separately in the same manner as described below for the entire pipeline.
- C. All materials, equipment, tools and labor for testing shall be furnished by the Contractor.
- D. Piping which carries water or liquid under pressure shall be filled with water and subjected

to a pressure of 125 psig. or 1-1/2 times the normal working pressure, whichever is greater, for a period of two hours or longer as may be necessary to examine the piping for leaks.

- E. Soil, vent, waste, and roof or other drain piping shall be tested by filling with water to the top of the highest vent stack above the roof, with all outlets plugged. The piping shall hold this water for a period of 30 minutes without showing a drop greater than 4-inches in the water level.
- F. Should leaks be found, faulty joints shall be repaired, even to the extent of disassembling and remaking the joint. Caulking of threads or the use of chemical compounds to correct leaks will not be permitted. The Contractor shall replace defective pipe or fittings, and the tests shall be repeated until test requirements are met to the satisfaction of the Engineer.

3.03 ADJUSTING AND CLEANING:

- A. Apparatus shall be thoroughly lubricated and cleaned before being placed in final operation. Finished surfaces shall be restored if damaged, and the entire installation shall be delivered in an approved condition.
- B. Items with porcelain-enameled surfaces, and others for which no satisfactory field repair is possible, shall be replaced if damaged before final acceptance of the installation.
- C. Labels shall be removed. Plumbing fixtures shall be washed clean. Floor drains and receptors shall be clean, free of debris, and shall be sealed with water. Liquid piping systems shall be thoroughly flushed.

3.04 DISINFECTION:

- A. The Contractor shall disinfect water piping before it is placed in service.
- B. The Contractor shall furnish all equipment and materials necessary to do the work of disinfecting, and shall perform the work in accordance with the procedure outlined in the Standard for Disinfecting Water Mains, AWWA C651.
- C. The dosage shall be such as to produce a chlorine residual of not less than 10 ppm after a contact period of not less than 24 hours. After treatment, the piping shall be flushed with clean water until the residual chlorine content does not exceed 0.2 ppm.
- D. During the disinfection period, care shall be exercised to prevent contamination of water in the street main.

3.05 TAPPED CONNECTIONS:

- A. Tapped connections in pipe and fittings shall be made in such a manner as to provide a watertight joint with adequate strength against pullout. The maximum size or taps in pipe or fittings without bosses shall not exceed that listed in the appropriate table of Appendix to ANSI A21.51, based on 3 full threads for ductile iron.

- B. Where the size of the connection for the pipe in question, exceeds that given above, a boss shall be provided on the pipe barrel, the tap shall be made in the flat part of the intersection of the run and branch of a tee or cross, or the connection shall be made by means of a tapped tee, branch fitting and tapped plug or reducing flange, or tapping tee and tapping valve, all as indicated or approved.
- C. All drilling and tapping of ductile iron pipe shall be done normal to the longitudinal axis of the pipe; fittings shall be drilled and tapped similarly, as appropriate. Drilling and tapping shall be done only by skilled mechanics. Tools shall be adapted to the work and in good condition so as to produce good, clean-cut threads of the correct size, pitch, and taper.

3.06 RECORD DRAWINGS:

- A. As the work progresses, legibly record (red line) all field changes on a set of project contract drawings. Prior to Substantial Completion of the project, submit the red lined prints to the Engineer for use in preparation of the record drawings.

3.07 OPERATION & MAINTENANCE MANUAL:

- A. Upon completion of all work, and before final inspection and acceptance of the installation by the Engineer, four (4) copies of a complete instruction manual, bound in booklet form and suitably indexed, shall be submitted to the Engineer for approval. The manual shall be fully typewritten or printed; material written in longhand shall not appear in the manual. The manual shall contain the following:
 - 1. Brief description of each system covering basic operating characteristics.
 - 2. List of all equipment, with manufacturer's name and model number of each item.
 - 3. Manufacturer's literature describing each item of equipment.
 - 4. Parts list for each major item of equipment.
 - 5. Detailed step-by-step instructions for starting and shutdown of system.
 - 6. Detailed maintenance instructions for systems.

END OF SECTION

SECTION 16010

ELECTRICAL WORK - GENERAL PROVISIONS

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. The work covered by this section of the specifications consists of furnishing all labor, equipment, appliances, materials and incidentals in connection with the installation of the complete electrical systems as herein specified and as shown on the drawings.
- B. It is not the intent that the drawings shall show every junction box, conduit, wire, fitting, device, accessory, etc., but the Contractor shall be required to furnish without additional expense all transportation, labor and materials necessary to complete the electrical systems in accordance with the best practice of the trade.
- C. Unless otherwise specified, materials of the same classifications, used for the same purpose shall be the product of the same manufacturer.
- D. The work shall include furnishing and installing the following items:
 - 1. Underground Secondary Services
 - 2. Grounding System
 - 3. Panelboards
 - 4. Raceways
 - 5. Feeder and Branch Circuit Conductors
 - 6. Solderless Lugs and Connectors
 - 7. Conduit and wire for equipment and controls furnished under other divisions of the specifications, when shown on the electrical plans, with the exception of the instrumentation low voltage signal wiring.
- E. Electric Service and Metering

The power company serving this project is Eversource.

- 1. Secondary conduit and wiring will be by the Contractor.

2. Metering will be by the Contractor per the electric company's requirements.
3. Arrangements shall be made with the power company for obtaining service. All cost for overhead line extensions and work required for these services including metering cost shall be obtained from the power company. The Contractor shall include in his bid and shall pay this money to the power company. All work involving the service and metering shall be as approved by the power company.

F. Interpretation of Drawings

1. The Drawings are diagrammatic only and are not intended to show exact locations of outlets and conduit runs. Handholes shall be located in the field by owner's representative.
2. All three-phase circuits shall be run in separate conduits unless otherwise shown on the Drawings.
3. The Contractor shall verify with the Engineer the exact locations and mounting heights of lighting fixtures, switches and receptacles prior to installation.
4. Any work installed contrary to Contract Documents, or without approval by the Engineer, shall be changed or replaced as required by the Engineer and no extra compensation will be allowed the Contractor for making these changes.
5. The locations of equipment, fixtures, and similar devices shown on the Drawings are approximate only. Exact locations shall be as approved by the Engineer during construction. The Contractor shall obtain in the field all information relevant to the placing of electrical work and in case of any interference with other work, shall proceed as required by the Engineer and shall furnish all labor and materials necessary to complete the work in an approved manner.
6. Surface mounted panel boxes, junction boxes, conduit, etc., shall be supported by spacers to provide a clearance between wall and equipment.
7. The number of conductors shown on the Drawings are not necessarily the correct number required. As many conductors as are required in each case shall be installed.
8. Unless otherwise specified, all conduits, wires, and cables and the support systems for the conduits and cables that are required to make the electrical

connections to equipment shall be furnished and installed. All connections to equipment shall be made as shown, specified, and required and in accordance with the approved shop and setting drawings.

9. The Contractor shall verify, in the field, all measurements necessary for his work and shall assume responsibility for their accuracy.

1.02 LOCAL CONDITIONS:

- A. Before submitting proposals, the Contractor is expected to inspect the site and survey the conditions to be encountered in the performance of the work. Failure to familiarize himself with the conditions shall not relieve the Contractor's responsibility for full completion of the work in accordance with the provisions of the Contract.

1.03 PERMITS AND INSPECTION:

- A. Permits, fees and notices shall be in accordance with the General Conditions.
- B. All work shall meet or exceed the latest requirements of all national, state, county, municipal and other authorities exercising jurisdiction over electrical construction at this project.
- C. All required permit and inspection certificates shall be obtained, paid for, and given to the Owner at the completion of the work.

1.04 CODES AND STANDARDS:

- A. Unless indicated or specified otherwise, materials and workmanship shall conform with the latest editions of the following codes, standards and specifications.
 1. Massachusetts Electrical Code
 2. National Bureau of Standards Handbook H-30 National Electrical Safety Code
 3. State and Local Codes, and all other authorities having jurisdiction
 4. Underwriter's Laboratories, Inc. (UL)
 5. American National Standards Institute, Inc.
 6. Institute of Electrical and Electronic Engineers (IEEE)
 7. National Electrical Manufacturers Association (NEMA)

8. National Board of Fire Underwriters
9. International Municipal Signal Association (IMSA)
10. Insulated Power Cable Engineers Associated Specifications
11. American Society for Testing Materials Specifications

1.05 REVIEW OF MATERIALS:

- A. Material and Equipment Schedules. As soon as practicable and within thirty days after the date of notice to proceed and before commencement of installation of any materials or equipment, the Contractor shall submit to the Engineer six (6) complete Brochures for approval of materials, fixtures, and equipment to be incorporated in the work. The list shall include manufacturer's name, catalog numbers, cuts, diagrams, drawings, and such other descriptive data as may be required. No consideration will be given to a partial submittal from time to time. Approval of materials will be based on manufacturer's published ratings. Any materials, fixtures and equipment listed that are not in accordance with the specification requirements will be rejected.
- B. Substitutions: Substitution of material or equipment shall be in accordance with the General Conditions.
- C. Shop Drawings. Shop drawings shall be submitted to the Engineer for review in accordance with the Division 1. Shop drawings shall be submitted for, but not limited to the following:
 1. Panelboards
 2. Wire and Cable
 3. Hangers and Supports
 4. Raceways
 5. Cabinets
- D. Submit the following information with all equipment shop drawings.
 1. Manufacturer's certified scale drawings, cuts, or catalogs, including installation details and manufacturer's name.
 2. Manufacturer's specifications, including certified performance characteristics and capacity ratings.

3. Electrical wiring diagrams and controls, where applicable.
 4. Certificate of compliance with Code, where applicable.
 5. Detail of all conduit stub-up with conduit size and dimensions from columns or walls.
- E. Equipment shop drawings and wiring diagrams must be prepared specifically for this installation. Standard factory wiring diagrams with a revision marked in ink for this installation will be accepted.
- F. All control and wiring diagrams shall be complete with the following description:
1. Sequence of operation
 2. Sequence of interlocking
 3. Operation of alarms
 4. Legend
 5. Wiring Numbers
- G. All equipment shop drawings shall be properly identified and indicate the Article number of the specifications or the Drawing number which applies to the submitted item.
- H. Shop drawings for the items listed above shall be submitted for approval in accordance with the preceding paragraphs. The Engineer, however, reserves the right to require submittal of shop drawings on any other material or equipment to be installed under this Section not specifically listed above.

1.06 MINOR DEVIATIONS:

- A. The work as shown on the drawings is diagrammatic and is intended to show the work included and the arrangement of the various systems.
- B. It is not intended that the accompanying plans and specifications cover every detail of the required installation. Furnish and install equipment, materials and labor as shown or specified, as are usually furnished, or as are needed to make a complete and satisfactory operating installation, whether mentioned or not, omitting only those items which are specifically excluded.
- C. Locations and mounting heights of equipment and/or devices as shown are approximately correct. The Engineer reserves the right to relocate any equipment or device prior to actual installation at no extra cost to the Owner.

- D. No deviation from layout shall be made without written approval from the Engineer.

1.07 TEMPORARY LIGHT AND POWER:

- A. The Contractor shall provide temporary light and power and pay all energy charges as described in Division 1.

1.08 ELECTRICAL REFERENCE SYMBOLS:

- A. Symbols shown on the drawings shall approximate location of fixtures, outlet boxes, and conduit runs, and other equipment, unless otherwise detailed. The exact location shall be governed by structural conditions and obstructions. This is not to be construed to permit redesigning systems. Locate and install all boxes and equipment where they will be readily accessible.

1.09 PHASE IDENTIFICATION:

- A. The entire system of wiring shall be phased by color code as follows:
 - 1. Wires No. 6 AWG and smaller shall have a continuous colored outer covering.
 - 2. Wires larger than No. 6 AWG shall be identified at all points of termination by gummed tape, plastic tape, etc., applied to the wire.
 - 3. Bus bars in panelboards shall be properly identified by color as herein specified.
 - 4. Code colors for 120/208 volt systems shall be:
 - a. Phase A - Black
 - b. Phase B – Red
 - c. Phase C - Blue
 - 5. Neutral wires shall be white or grey.
 - 6. Equipment ground wires shall be green.
 - 7. The same colors shall be used for the same phases throughout the entire project.

1.10 PROTECTION AND CLEANING OF EQUIPMENT:

- A. All electrical equipment, upon receipt, shall be adequately stored and protected from damage.
- B. After installation, all electrical equipment shall be protected to prevent damage during the construction period. Openings in conduits and boxes shall be closed to prevent entrance of foreign materials.
- C. The interior of boxes and cabinets shall be left clean. Exposed surfaces shall be cleaned and plate surfaces polished.

1.11 OPERATION AND MAINTENANCE MANUALS:

- A. The Contractor shall furnish the Owner with three (3) copies of complete operating and maintenance manuals. Manuals shall include all equipment, maintenance instruction, parts list, warranties, schematic diagrams of control systems, and lubrication charts.
- B. Manuals shall contain only that information which specifically applies to this project, and all unrelated material shall be deleted. During the instruction period, herein specified, this manual shall be used and explained. Each copy of manual shall be clearly indexed and include a directory of all subcontractors and maintenance contractors, indicate the area of their responsibility, and list the name and telephone numbers of the responsible member of each organization. This material shall have a clear plastic protective shield over each sheet of data.
- C. Each manual shall be bound in an expandable plastic covered hard bound binder. Binders shall be three post type. The manual's front cover and side cover shall be stamped "Operation and Maintenance Manual -- Electrical Systems" along with the project title.

1.12 OPERATING AND MAINTENANCE INSTRUCTIONS:

- A. A competent Engineer shall be provided by the Contractor to instruct operating personnel in the operation and maintenance of equipment and systems.

1.13 SPARE PARTS DATA:

- A. The Contractor shall furnish a complete list of recommended spare parts and supplies for the equipment furnished with current unit prices and source of supply.

1.14 TESTS:

- A. The Electrical Subcontractor shall perform all tests at the completion of the work and the results furnished to the Owner and Engineer in writing. Tests shall

include, but not be limited to: all systems test free of shorts or grounds, proper neutral connections, ground system resistance, secondary voltages at main distribution panel, power panels and lighting panels.

- B. Upon completion of all work, the Electrical Subcontractor shall furnish, in duplicate, certificates of inspections from all inspectors and authorities having jurisdiction, notarized letters from the manufacturers stating that authorized Factory Engineers or agents have inspected and tested the installation of their respective systems and found same to be in satisfactory operating condition.
- C. Furnish all labor, material, instruments, supplies and services and bear all costs for the accomplishment of the tests.

1.15 GUARANTEE:

- A. The Contractor shall guarantee equipment and performance of the installation and equipment in accordance with the GENERAL CONDITIONS.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. The materials used in all systems shall be new, unused and as hereinafter specified. All materials where not specified shall be of the very best of their respective kinds. Samples of materials or manufacturer's specification shall be submitted for approval as required by the Engineer.
- B. Materials and equipment used shall be U.L. listed wherever such approved materials and equipment is available.
- C. Electrical equipment shall at all times during construction be adequately protected against mechanical injury or damage by water. If any apparatus has been damaged, such damage shall be repaired by the Contractor at his cost and expense. If any apparatus has been subject to possible damage by water, it shall be thoroughly dried out and put through such special tests as required by the Engineer, at the cost and expense of the Contractor, or shall be replaced by the Contractor at his own expense.

PART 3 EXECUTION

3.01 INSTALLATION

- A. All work shall be executed in full accordance with the National Electrical Code and local rulings. Should any work be performed contrary to said rulings,

ordinances and regulations, this Contractor shall bear full responsibility for such violations and assume all costs arising therefrom.

- B. Load Balance. Check the load balance on the phases of the various systems and reconnect where necessary as approved by the Engineer to provide equal division of the loads between the phases of the various systems.
- C. Before starting the work, confer with all other trades relative to the location of pipes, and apparatus or fixtures to be installed by them and select locations for the work which will avoid possible conflicts with the work of other trades involved. All differences or conflicting conditions concerning the work shall be called to the attention of the Engineer for adjustment before starting work. For such work performed or materials installed in violation of the above clause the work shall be readjusted to the complete satisfaction of the Engineer at the sole expense of the Electrical Subcontractor.

D. Cleanup

- 1. This Contractor shall cooperate with other workmen and with the General Contractor in the daily removal of debris from the work site.
- 2. This Contractor shall leave "broom clean" all areas where he has interrupted or completed his work.
- 3. He shall cooperate with the General Contractor in good housekeeping procedures.
- 4. At the completion of his work, prior to the final inspection, this Contractor shall clean all devices, plates, fixtures, glassware, switches, cabinets, exposed conduits, fittings, etc. and shall have the premises in a thoroughly clean condition.

END OF SECTION

SECTION 16123
CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Qualification Data: For testing agency.
- C. Field Quality-Control Test Reports: From a qualified testing and inspecting agency engaged by Contractor.

1.04 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the International Electrical Testing Association and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 CONDUCTORS AND CABLES

- A. Manufacturers:
 - 1. Alcan Aluminum Corporation; Alcan Cable Div.
 - 2. American Insulated Wire Corp.; a Leviton Company.
 - 3. General Cable Corporation.
 - 4. Senator Wire & Cable Company.
 - 5. Southwire Company.
- B. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.
- C. Conductor Material: Copper, except feeders No. 4 AWG and larger may be aluminum complying with NEMA WC 5 or 7; solid conductor for No. 10 AWG and smaller, stranded for No. 8 AWG and larger.
- D. Conductor Insulation Types: Type THHN-THWN XHHW UF complying with NEMA WC 5 or 7.
- E. Multiconductor Cable: Nonmetallic-sheathed cable, Type NM and Type USE with ground wire.

2.03 CONNECTORS AND SPLICES

- A. Manufacturers:
 - 1. AFC Cable Systems, Inc.
 - 2. AMP Incorporated/Tyco International.
 - 3. Hubbell/Anderson.
 - 4. O-Z/Gedney; EGS Electrical Group LLC.
 - 5. 3M Company; Electrical Products Division.

- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.01 CONDUCTOR AND INSULATION APPLICATIONS

- A. Service Entrance: Type XHHW, single conductors in raceway.
- B. Exposed Feeders: Type THHN-THWN, single conductors in raceway
- C. Exposed Branch Circuit: Type THHN-THWN, single conductors in raceway.
- D. Underground Feeders and Branch Circuits: Type UF multiconductor cable.

3.02 INSTALLATION

- A. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- B. Use pulling means; including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
- C. Support cables according to Division 16 Section "Basic Electrical Materials and Methods."
- D. Identify and color-code conductors and cables according to Division 16 Section Basic Electrical Materials and Methods.

3.03 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

3.04 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified testing agency to perform the following field quality-control testing:
- B. Testing: Engage a qualified testing agency to perform the following field quality-control testing:
- C. Testing: Perform the following field quality-control testing:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
 - 2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.
- D. Test Reports: Prepare a written report to record the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

END OF SECTION

SECTION 16130
RACEWAYS AND BOXES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Related Sections include the following:
 - 1. Division 2 Section "Underground Ducts and Utility Structures" for exterior ductbanks, manholes, and underground utility construction.
 - 2. Division 16 Section "Basic Electrical Materials and Methods" for supports, anchors, and identification products.
 - 3. Division 16 Section "Seismic Controls for Electrical Work" for seismic restraints and bracing of raceways, boxes, enclosures, and cabinets.
 - 4. Division 16 Section "Wiring Devices" for devices installed in boxes.

1.03 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. FMC: Flexible metal conduit.
- D. IMC: Intermediate metal conduit.
- E. LFMC: Liquidtight flexible metal conduit.
- F. LFNC: Liquidtight flexible nonmetallic conduit.
- G. RNC: Rigid nonmetallic conduit.

1.04 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: Show fabrication and installation details of components for raceways, fittings, boxes, enclosures, and cabinets.
- C. Shop Drawings: Signed and sealed by a qualified professional engineer.
 - 1. Design Calculations: Calculate requirements for selecting seismic restraints.
 - 2. Detail assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
- D. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:
 - 1. Ceiling suspension assembly members.
 - 2. Method of attaching hangers to building structure.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- E. Manufacturer Seismic Qualification Certification: Submit certification that enclosures, cabinets, accessories, and components will withstand seismic forces defined in Division 16 Section "Seismic Controls for Electrical Work." Include the following:
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.05 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 METAL CONDUIT AND TUBING

- A. Manufacturer[s]:
 - 1. AFC Cable Systems, Inc.
 - 2. Alflec Inc.
 - 3. Anamet Electrical, Inc.; Anaconda Metal Hose.
 - 4. Electri-Flex Co.
 - 5. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
 - 6. LTV Steel Tubular Products Company.
 - 7. Manhattan/CDT/Cole-Flex.
 - 8. O-Z Gedney; Unit of General Signal.
 - 9. Wheatland Tube Co.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. Aluminum Rigid Conduit: ANSI C80.5.
- D. IMC: ANSI C80.6.
- E. Plastic-Coated Steel Conduit and Fittings: NEMA RN 1.

- F. Plastic-Coated IMC and Fittings: NEMA RN 1.
- G. EMT and Fittings: ANSI C80.3.
 - 1. Fittings: Compression type.
- H. FMC: Zinc-coated steel.
- I. LFMC: Flexible steel conduit with PVC jacket.
- J. Fittings: NEMA FB 1; compatible with conduit and tubing materials.

2.03 NONMETALLIC CONDUIT AND TUBING

- A. Manufacturer[s]:
 - 1. American International.
 - 2. Anamet Electrical, Inc.; Anaconda Metal Hose.
 - 3. Arnco Corp.
 - 4. Cantex Inc.
 - 5. Certainteed Corp.; Pipe & Plastics Group.
 - 6. Condux International.
 - 7. ElecSYS, Inc.
 - 8. Electri-Flex Co.
 - 9. Lamson & Sessions; Carlon Electrical Products.
 - 10. Manhattan/CDT/Cole-Flex.
 - 11. RACO; Division of Hubbell, Inc.
 - 12. Spiraldut, Inc./AFC Cable Systems, Inc.
 - 13. Thomas & Betts Corporation.
- B. ENT: NEMA TC 13.
- C. RNC: NEMA TC 2, Schedule 40 and Schedule 80 PVC.
- D. ENT and RNC Fittings: NEMA TC 3; match to conduit or tubing type and material.
- E. LFNC: UL 1660.

2.04 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating.
 - 1. Manufacturer[s]:
 - a. Airey-Thompson Sentinel Lighting; Wiremold Company (The).
 - b. Thomas & Betts Corporation.

- c. Walker Systems, Inc.; Wiremold Company (The).
 - d. Wiremold Company (The); Electrical Sales Division.
- B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC compound with matte texture and manufacturer's standard color.
 - 1. Manufacturer[s]:
 - a. Butler Manufacturing Co.; Walker Division.
 - b. Enduro Composite Systems.
 - c. Hubbell, Inc.; Wiring Device Division.
 - d. Lamson & Sessions; Carlon Electrical Products.
 - e. Panduit Corp.
 - f. Walker Systems, Inc.; Wiremold Company (The).
 - g. Wiremold Company (The); Electrical Sales Division.
- C. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceways.

2.05 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturer[s]:
 - 1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
 - 2. Emerson/General Signal; Appleton Electric Company.
 - 3. Erickson Electrical Equipment Co.
 - 4. Hoffman.
 - 5. Hubbell, Inc.; Killark Electric Manufacturing Co.
 - 6. O-Z/Gedney; Unit of General Signal.
 - 7. RACO; Division of Hubbell, Inc.
 - 8. Robroy Industries, Inc.; Enclosure Division.
 - 9. Scott Fetzer Co.; Adalet-PLM Division.
 - 10. Spring City Electrical Manufacturing Co.
 - 11. Thomas & Betts Corporation.
 - 12. Walker Systems, Inc.; Wiremold Company (The).
 - 13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
- B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.
- D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
- E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- F. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

- G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.
- H. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

2.06 FACTORY FINISHES

- A. Finish: For raceway, enclosure, or cabinet components, provide manufacturer's standard prime-coat finish ready for field painting.
- B. Finish: For raceway, enclosure, or cabinet components, provide manufacturer's standard paint applied to factory-assembled surface raceways, enclosures, and cabinets before shipping.

PART 3 - EXECUTION

3.01 RACEWAY APPLICATION

- A. Outdoors:
 - 1. Underground, Single Run: RNC.
 - 2. Underground, Grouped: RNC.
 - 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 - 4. Boxes and Enclosures: NEMA 250, Type 4.
- B. Minimum Raceway Size: 1/2-inch trade size.
- C. Raceway Fittings: Compatible with raceways and suitable for use and location.
 - 1. Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
 - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.

- D. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- E. Do not install aluminum conduits embedded in or in contact with concrete.

3.02 INSTALLATION

- A. Complete raceway installation before starting conductor installation.
- B. Support raceways as specified in Division 16 Section "Basic Electrical Materials and Methods."
- C. Install temporary closures to prevent foreign matter from entering raceways.
- D. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.
- E. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.
- F. Join raceways with fittings designed and approved for that purpose and make joints tight.
 - 1. Use insulating bushings to protect conductors.
- G. Tighten set screws of threadless fittings with suitable tools.
- H. Terminations:
 - 1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
 - 2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
- I. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- J. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 2. Where otherwise required by NFPA 70.
- K. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.
- L. Flexible Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.
- M. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals.
- N. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.03 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.04 CLEANING

- A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

END OF SECTION

SECTION 16442

PANELBOARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes load centers and panelboards, overcurrent protective devices, and associated auxiliary equipment rated 600 V and less for the following types:
 - 1. Lighting and appliance branch-circuit panelboards.

1.03 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. RFI: Radio-frequency interference.
- D. RMS: Root mean square.
- E. SPDT: Single pole, double throw.
- F. TVSS: Transient voltage surge suppressor.

1.04 SUBMITTALS

- A. Product Data: For each type of panelboard, overcurrent protective device, TVSS device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details for types other than NEMA 250, Type 1.

- b. Bus configuration, current, and voltage ratings.
 - c. Short-circuit current rating of panelboards and overcurrent protective devices.
 - d. UL listing for series rating of installed devices.
 - e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
- 2. Wiring Diagrams: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.
- C. Manufacturer Seismic Qualification Certification: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 16 Section "Seismic Controls for Electrical Work." Include the following:
 - 1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. The term "withstand" means "the unit will remain in place without separation of internal and external parts during a seismic event."
 - 3. The term "withstand" means "the unit will remain in place without separation of internal and external parts during a seismic event and the unit will be fully operational after the event."
 - 4. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 5. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Qualification Data: Submit data for testing agencies indicating that they comply with qualifications specified in "Quality Assurance" Article.
- E. Field Test Reports: Submit written test reports and include the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- F. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
- G. Maintenance Data: For panelboards and components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Division 1 Section "Contract Closeout," include the following:
 - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - 2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Testing agency that is a member company of the InterNational Electrical Testing Association and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NEMA PB 1.
- D. Comply with NFPA 70.

1.06 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

1.07 EXTRA MATERIALS

- A. Keys: Six spares of each type of panelboard cabinet lock.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
 - a. Eaton Corp.; Cutler-Hammer Products.
 - b. General Electric Co.; Electrical Distribution & Control Div.

- c. Siemens Energy & Automation, Inc.
- d. Square D Co.

2. TVSS Panelboards:

- a. Current Technology, Inc.
- b. Liebert Corporation.

2.02 FABRICATION AND FEATURES

- A. Enclosures: Surface mounted cabinets. NEMA PB 1, Type 1, to meet environmental conditions at installed location.
 - 1. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
- B. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
- C. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
- D. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
- E. Directory Card: With transparent protective cover, mounted inside metal frame, inside panelboard door.
- F. Bus: Hard-drawn copper, 98 percent conductivity.
- G. Main and Neutral Lugs: Compression type suitable for use with conductor material.
- H. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
- I. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.
- J. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.
- K. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
- L. Gutter Barrier: Arrange to isolate individual panel sections.
- M. Feed-through Lugs: Compression type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

2.03 PANELBOARD SHORT-CIRCUIT RATING

- A. UL label indicating series-connected rating with integral or remote upstream devices. Include size and type of upstream device allowable, branch devices allowable, and UL series-connected short-circuit rating.
- B. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.04 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- B. Doors: Front mounted with concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.05 OVERCURRENT PROTECTIVE DEVICES

- C. Molded-Case Circuit-Breaker Features and Accessories. Standard frame sizes, trip ratings, and number of poles.
 - 1. Lugs: Mechanical or Compression style, suitable for number, size, trip ratings, and material of conductors.
 - 2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
 - 3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - 4. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at [55] [75] percent of rated voltage.

2.06 ACCESSORY COMPONENTS ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Portable Test Set: To test functions of solid-state trip devices without removal from panelboard.
- C. Fungus Proofing: Permanent fungicidal treatment for panelboard interior, including overcurrent protective devices and other components.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Mounting Heights: Top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.
- C. Circuit Directory: Create a directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- D. Install filler plates in unused spaces.
- E. Wiring in Panelboard Gutters: Arrange conductors into groups and bundle and wrap with wire ties after completing load balancing.

3.02 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section Basic Electrical Materials and Methods.
- B. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.03 CONNECTIONS

- A. Install equipment grounding connections for panelboards with ground continuity to main electrical ground bus.
- B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.04 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.

- B. Testing Agency: Owner will engage a qualified independent testing agency to perform specified testing.
- C. Testing Agency: Engage a qualified independent testing agency to perform specified testing.
- D. Testing: After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
 - 1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- E. Balancing Loads: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes as follows:
 - 1. Measure as directed during period of normal system loading.
 - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data-processing, computing, transmitting, and receiving equipment.
 - 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
 - 4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.
- F. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove panel fronts so joints and connections are accessible to portable scanner.
 - 1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
 - 2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - 3. Record of Infrared Scanning: Prepare a certified report that identifies panelboards checked and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
 - 4.

3.05 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges.

3.06 CLEANING

- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION

SECTION 16461

DRY-TYPE TRANSFORMERS (600 V AND LESS)

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 100 kVA:

1.03 SUBMITTALS

- A. Product Data Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.
- B. Shop Drawings: Wiring and connection diagrams.
- C. Source quality-control test reports.
- D. Output Settings Reports: Record of tap adjustments specified in Part 3.

1.04 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with IEEE C 57.12.91.
- C. Energy-Efficient Transformers Rated 15 kVA and Larger: Certified as meeting NEMA TP 1, Class 1 efficiency levels when tested according to NEMA TP 2.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during

which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.06 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.
- B. Coordinate installation of wall-mounting and structure-hanging supports.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Acme Electric Corporation; Power Distribution Products Division.
 - 2. Challenger Electrical Equipment Corp.; a division of Eaton Corp.
 - 3. Cutler-Hammer.
 - 4. Federal Pacific Transformer Company; Division of Electro-Mechanical Corp.
 - 5. GE Electrical Distribution & Control.
 - 6. MagneTek.
 - 7. Siemens Energy & Automation, Inc.
 - 8. Sola/Hevi-Duty Electric.
 - 9. Square D/Groupe Schneider NA.

2.02 MATERIALS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Cores: Grain-oriented, non-aging silicon steel.
- C. Coils: Continuous windings without splices, except for taps.
 - 1. Internal Coil Connections: Brazed or pressure type.
 - 2. Coil Material: Copper.

2.03 SOURCE QUALITY CONTROL

- A. Test and inspect transformers according to IEEE C57.12.91.
- B. Factory Sound-Level Tests: Conduct sound-level tests on equipment for this Project.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
- C. Examine walls and floors for suitable mounting conditions where transformers will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.
- B. Install floor-mounting transformers level on concrete bases. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit and 4 inches high.
 - 1. Anchor transformers to concrete bases according to manufacturer's written instructions.

3.03 CONNECTIONS

- A. Connect wiring according to Division 16 Section "Conductors and Cables."
- B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.04 ADJUSTING

- A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 5 percent. Submit recording and tap settings as test results.
- B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

END OF SECTION