

Contract Documents and Technical Specifications for

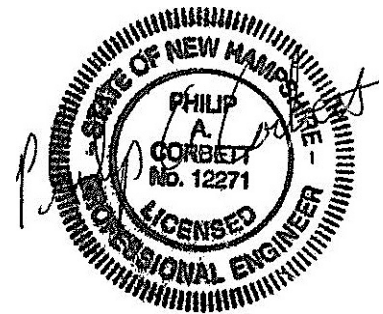


City of Portsmouth, NH

MULTI-PURPOSE RECREATION FIELDS & REGIONAL STORMWATER TREATMENT SYSTEM PROJECT

April 2020

**Prepared for:
City of Portsmouth, NH
1 Junkins Avenue
Portsmouth, NH 03801
Bid #37-20**



Karen Conard, City Manager

Prepared By:



**35 Bow Street
Portsmouth, NH 03801
(603) 431-6196**



**427 Main Street, Suite 400
Worcester, MA
(978) 977-0110**

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SPECIAL CONDITIONS

The SPECIAL CONDITIONS summarize selected project requirements for the Contractor's easy reference. It is not intended to provide all requirements. Refer to Technical Specifications and Drawings for details.

1. CONSTRUCTION INTENT

This City funded project involves the construction of separate Base Bid and Add Alternates.

Work as described below:

Base Bid: The Base Bid includes mobilization and general conditions; the site preparation and erosion control; earthwork preparation for two recreational fields; the synthetic turf and field drainage for Field 1; foundations for four sport lights; underground electrical infrastructure (conduit and handholes) for six sport lighting posts; recreational site fencing, ball netting around Field 1; site amenities; landscaping; gravel and paved parking areas; site access road improvements for the access off Community Campus Drive; a water main connection from Community Campus Drive to the site; porous pavement walkway around the outside perimeter of the recreation fields; site drainage and stormwater management; and two regional stormwater management ponds, including control of water.

Add Alternate A – Field 2 Synthetic Turf: Includes Field 2 synthetic turf, foundations for two sport lighting posts and fixtures; additional perimeter fence, ball netting, additional porous pavement path, field drainage, and additional landscaping.

Add Alternate B – Sport Field Lighting: Includes Sport Field Lighting Posts and Fixtures, typ. of six locations; and electrical service infrastructure from Community Campus Road, including conduit, manholes and transformer pad.

Add Alternate C – Snow Storage Gravel Area: Includes snow storage area gravel and upgrades to transfer station access road.

Add Alternate D – Sewer Force Main Pipe: Includes an HDPE sewer force main pipe connection from Community Campus Drive to the Rec Fields site.

Add Alternates E & F – Alternative Infills: Includes alternative infills systems for the synthetic turf field.

Add Alternates G – Scoreboard & Footings: Includes scoreboards and footings.

The Owner may choose to add any combination of Add-Alternate to the Base Bid for the purpose of awarding the contract as may be in the best interest of the Owner.

2. CONTRACT TIME

Since time is of the essence, work must be intermediately complete within **150** calendar days and substantially completed within **300** calendar days (inclusive of 150 days for intermediate completion) of the start date of the Notice to Proceed. Final Completion must be achieved within **30** days of substantial completion. Work included in the Intermediate Completion must be done in 2020. The CONTRACTOR should note that liquidated damages in the amount of \$1,000/day will be levied for every calendar day in excess of the specified contract time.

The Work shall be completed Monday through Friday during daylight hours (7 AM to 5 PM) unless specifically noted otherwise. No work shall be allowed on Holidays or the day after Thanksgiving. Requests to perform nighttime or weekend operations must be approved by the City at least 2 weeks prior to the anticipated construction operations. Additional costs associated with nighttime or weekend operations will be at the Contractor's expense.

Intermediate Completion must be completed in within **150** calendar days of the Notice to Proceed and in 2020 and shall include all work under Schedule 5 – Regional Stormwater Treatment Systems in the Bid Form.

If contractor is delayed in the performance or progress of the work by fire, flood, epidemic, abnormal weather conditions, acts of God, acts or failures to act of utility owners not under the control of the owner, or other causes not the fault of and beyond control of owner and contractor, then contractor shall be entitled to an equitable adjustment in contract times, if such adjustment is essential to contractors ability to complete the work within the contract times. Such an adjustment shall be the contractor's sole and exclusive remedy for the delays.

3. SUBSTANTIAL COMPLETION

Prior to the issuance of a Certificate of Substantial Completion all Work must be complete and tested except final wearing course paving, pavement striping, and minor site cleanup.

4. HIERARCHY OF DOCUMENTS

1. Plans will govern Technical Specifications;
2. Technical Specifications and Plans will govern Supplementary Conditions and General Conditions;
3. Supplementary Conditions shall govern General Conditions;
4. Special Conditions will govern Technical Specifications, Plans, Supplementary Conditions, and Modified General Conditions;
5. The Agreement supersedes all other Contract Documents.

5. SEQUENCING OF WORK

The CONTRACTOR shall be prepared to commence work no later than the date on the Notice to Proceed. If required, a designated **winter shutdown** will be established that will not be included as Contract Time during which the Contractor will not complete significant field work but remain responsible for all other provisions of the Contract. Any work required to meet this sequencing, including winter demobilization and spring mobilization is incidental to the contract.

The active construction in 2020 is anticipated to run between June and December. After the 2020 winter shutdown, the contract time (construction) will restart by April 15, 2021, unless previously approved by the OWNER.

Prior to the start of any work, the Contractor shall submit for approval a proposed work schedule. Schedule updates or alterations should be presented at regular progress meetings.

6. TRAFFIC CONTROL

A Traffic Control Plan (TCP) shall be submitted to the Engineer for review and will require approval by the City of Portsmouth prior to construction. Road detours (except for local traffic) are anticipated. Construction warning signs must conform to MUTCD standards, as applicable. A flagging permit will be required from the City of Portsmouth DPW.

The Trenches will be backfilled (plates may be used with prior approval from the Owner) and roads shall be re-opened to provide safe vehicular and pedestrian traffic at the end of each working day. The Plan shall also include the anticipated number of flaggers to be used for a given work area. Police details shall only be used at major intersections or as required by the Portsmouth Police Department.

7. CONSTRUCTION LAYOUT

Work is to be generally constructed as shown on the drawings. The Contractor will be responsible for all construction layouts. A list of horizontal control points (and coordinates) and TBM's will be provided by the Engineer and confirmed by the Contractor, for reference throughout the project. The Engineer and/or Owner's Representative, together with the Project Superintendent will review utility corridors, giving consideration to dig-safe markings and Contractor's work plan. The Contractor will advise the Engineer, in advance, of potential conflicts concerning execution of his work. It will be the responsibility of the Contractor to protect and maintain TBM's, layout and control points provided by the Engineer. The Engineer will provide an electronic copy of plans and coordinates to the Contractor upon request to facilitate the Contractor's layout, providing the Contractor executes a release concerning the information transmitted.

8. COORDINATION OF WORK WITH OTHER SUBCONTRACTORS

The Contractor is to fully coordinate the work of all subcontractors having a direct contract with the Contractor for performance of work associated with this Contract, including without limitation, surveyors, material suppliers, and equipment suppliers.

The Contractor must coordinate schedules, delivery dates, staging area, trades and all other work according to these Specifications and the Construction Schedule.

9. COORDINATION WITH OTHER PROJECTS

The Owner reserves the right at any time to Contract for and perform other or additional work on or near the Work covered by the Contract.

When separate Contracts are let within the limits of any one project or on adjacent projects, each Contractor shall conduct the Work without interfering or hindering the progress or

completion of the work by other Contractors. Contractors working on the same project or adjacent projects shall cooperate with each other in a manner to serve the best interest of the City. In case of any unavoidable interference, the Engineer will determine priorities.

Each Contractor involved shall assume all liability, financial or otherwise, in connection with the Contract and shall protect and save harmless the Owner from damages or claims that may arise because of inconvenience, delays, or loss experienced because of the presence and operations of other Contractors working within the limits of the same project.

The Contractor shall arrange the Work and place and dispose of materials being used without interfering with operations of the other Contractors within the limits of the same project or on adjacent projects. The Work shall be coordinated with the work and sequence of other Contractors.

10. CONFLICTS AND COORDINATION WITH EXISTING UTILITIES

It will be the Contractor's responsibility to coordinate with the utility companies for identification and re-location, if necessary, of any utilities that are interfering or conflicting with the work shown on the drawings. Loss of production or crew downtime relating to utility work by others will not be considered for additional payment.

11. OTHER BURIED UTILITIES AND SERVICE PIPES

The Contractor is expected to coordinate utility markings through Dig Safe, Unitil and the City of Portsmouth Water and Sewer Department before proceeding with this project. Utility Markings for sewer and water are based on information on file and should be considered approximate. Repairs to damaged utilities either shown on the plans, or through markings on the ground, will not be measured for payment. Direct conflicts with utilities resulting in the need for relocation of utilities will be measured for payment, utilizing contract unit items, as deemed appropriate by the Engineer. Additional compensation beyond unit items for loss of production, delays or downtime will not be considered.

Company: **Eversource**
Contact: Nick Kosko
Phone: (603) 332-4227 (x-5555334)
Mobile: (603) 345-0387
Email: nickolai.kosko@eversource.com

Company: **Consolidated Communications**
Contact: Joe Considine
Phone: (603) 427-5525
Mobile: (603) 703-9424
Email: jconsidine@fairpoint.com

Company: **City of Portsmouth**
Address: 680 Peverly Hill Road
Portsmouth, NH 03801
Contact: Peter Rice, P.E..
Director of Public Works
Phone: 603-766-1416
Email: price@cityofportsmouth.com

Company: **Unitil**
Address: 325 West Road
Portsmouth, NH 03801
Contact: Phil Johnson
Phone: 603-294-5191
Mobile: 603-944-2454
Email: pjohnson@unitil.com

12. MEETINGS

Project Meetings (Also, see Section 01200):

It is anticipated that regular scheduled meetings will be held with Owner's Representatives, Contractor, sub-contractors and regulatory at a minimum frequency of twice monthly, unless weekly meetings are considered necessary by the Contractor, Owner or Engineer.

Coordination Meetings (Also, see Section 01200)

Informal weekly meetings are anticipated between the Contractor's Superintendent, Owner, and Resident Project Representative to review progress/schedule, sequence and other day to day issues.

13. TEMPORARY EROSION CONTROL

The Contractor's attention is directed to the provisions of Sections 02540 and 02402 of the Specifications. The Contractor shall exercise caution to minimize the intrusion of any spillage, sediment, turbidity, or pollution into the waterways or adjacent properties around the project area, as this watershed drains to waters of the state. Sediment and erosion controls shall be operational prior to commencing trench de-watering operations.

A copy of the Storm Water Pollution Prevention Plan (SWPPP) will be required and must be kept on site at all times. The Contractor will be responsible for filing the NOI and maintaining the SWPPP onsite at all times. The NOI must be submitted to the EPA at least 14 days prior to the start of construction. The SWPPP must be in place prior to submittal of the NOI.

The SWPPP may be amended as necessary to provide continued erosion and sediment control throughout the project. Appropriate measures shall be implemented to prevent sedimentation migration resulting from the Contractor's construction operations.

14. CONSTRUCTION DEWATERING (Also, refer to Section 02402)

This project requires excavations below normal surface water and groundwater elevations. The Contractor is responsible for all costs associated with dewatering the construction site. Dewatering is subsidiary to the Contractor's work and will not be measured for payment. The Contractor shall comply with the Environmental Protection Agency's (EPA) National Pollutant Discharge Elimination System (NPDES) General Permit for Construction Dewatering before proceeding with the work.

This NPDES general permit covers construction dewatering discharges defined as pumped, or drained, discharges of groundwater and/or storm water from excavations, or other points of accumulation, associated with a construction activity.

Appropriate sediment and erosion controls shall be operational prior to commencing trench dewatering operations. Construction dewatering is incidental. See specification Sections 02402 and 02650 for additional information.

15. GEOTECHNICAL INFORMATION (refer to Appendix A)

To assist the Contractor in preparing a bid, borings logs, groundwater readings, and a geotechnical report are included in Appendix A of the Specifications. Fluctuations in groundwater may exist.

16. DUST CONTROL (refer to Section 01562)

Water and/or Calcium Chloride are required on unpaved surfaces to control dust. The City will enforce a strict dust control policy for this project as described in the above referenced section.

17. STAGING AREA

The Contractor is required to locate and secure all staging and material storage areas. All staging areas to be secured by the Contractor must be approved in advance by the City. Contractor shall provide a Hold Harmless Release to the City prior to start of use of the staging area. At the completion of work, the Contractor shall receive a release from the property owners of the staging area(s) and a copy of each release shall be provided to the City prior to final acceptance of the project.

Private property shall not be used for storage purposes without written permission of the property owner. If requested, copies of such written permission shall be furnished to the Owner and Engineer.

With City approval, the Contractor may use the side of the roadway for staging of pipe and structures (CB's and manholes) providing the following conditions are met (unless approved otherwise by the City).

- A. Structures are placed no sooner than one (1) week preceding installation.
- B. Sidewalks and driveways are unimpeded and a minimum of 20 feet of roadway is maintained as a smooth traveling surface for vehicular traffic.
- C. The Contractor will relocate structures upon notification by the City, if deemed necessary to maintain public relations and/or public safety.

18. PRECONSTRUCTION VIDEO

Preconstruction digital photographs or video of the entire construction site including all areas within the scope of work and access roads leading to construction areas, shall be completed or recorded and provided by the Contractor to the Owner two weeks prior to start of work. Photographs shall be provided as electronic photo digital images. The video shall be supplied in standard digital format (DVD) as approved by Engineer. Three copies of the digital photo log or video shall be prepared and provided one each to the Owner, Engineer and Contractor.

19. SAMPLES AND TESTING

The Contractor shall plan his operations to allow adequate time for laboratory tests and to permit taking of field density tests during compaction. No materials will be placed without review by the Engineer. All material testing will be paid for by the Contractor, except as noted.

20. PAVEMENT MARKINGS

Temporary pavement markings, to match the existing pavement markings, are subsidiary. Permanent pavement markings are to be reviewed with the Owner's Representative prior to placement. Markings not approved shall be removed at the Contractor's own expense, if requested by the Owner.

21. SALVAGE OF MATERIALS (Refer to Section 01611)

All items selected by the City for salvage shall be delivered to a location specified by the City. The City has the right to salvage additional materials as requested. Contractor is to coordinate delivery of materials within the City.

22. VIBRATION MONITORING

Vibration Monitoring in addition to the vibration monitoring for blasting, required by state and local ordinances, will be provided by the Contractor upon request, if deemed necessary to monitor vibration resulting from the Contractor's equipment, compaction efforts or operations. Vibration monitoring for blasting operations is provided at the Contractor's own expense.

23. PROTECTION OF TREES

The Contractor will endeavor to prevent damage to all trees that are designated to remain. Tree limbs that impede normal construction operations shall be trimmed, with approval from the Engineer. Trees to be removed are shown on the drawings. Additional limb or tree removal is subject to Owner approval. A penalty will be assessed to the Contractor for damage to trees designated to remain as follows:

- Limbs damaged following trimming (Paragraph 29): \$100/limb (in addition limbs will require further trimming by Contractor as directed)
- Tree bark or surface scarring: \$10/sq. in. of impact area (\$100 MIN. and \$1000 MAX.)

In addition, Contractor shall remove trees that were designated to remain but are, in the opinion of the Owner, significantly altered, cosmetically impaired, or terminally damaged.

24. NORTHERN LONG-EARED BAT PROTECTION

The U.S. Fish and Wildlife Service has listed the northern long-eared bat as threatened under the Endangered Species Act (ESA) and the following requirements exist to protect the bat and its habitat. To ensure compliance under the ESA, the Contractor must comply with tree cutting provisions:

Tree Cutting and Clearing Restriction

Tree cutting/ clearing of trees greater than 3-inches DBH is prohibited from June 1 through July 31 of each year. The Contractor shall ensure tree removal is limited to that specified in project plans. Prior to tree removal the Contractor shall demarcate the clearing limits in the field (e.g. with bright orange flagging/fencing or another marking method) to ensure all tree cutting staff know and work within the tree clearing limits.

25. INVASIVE SPECIES

Bidders are alerted to the existence of several invasive plant species including phragmites (*Phragmites australis*), reed canary grass (*Phalaris arundinacea*), autumn olive (*Elaeagnus umbellata*), multiflora rose (*Rosa multiflora*), oriental bittersweet (*Celastrus orbiculatus*), and glossy buckthorn (*Frangula alnus*) have been observed on Site. The Contractor shall implement practices to control the spread of invasive plants within the work limits of the project. Invasive plants that are excavated for construction will be managed in accordance with “Best Management Practices for the Control of Invasive and Noxious Plant Species,” dated 2018, prepared by the New Hampshire Department of Transportation. The contractor will be required to develop a site-specific Invasive Species Management Plan.

26. CERTIFIED FIELD BUILDERS

The General Contractor shall retain the services or employ a Certified Field Builder as certified by the American Sports Builders Association (ASBA) who will be present at the site regularly throughout the project to supervise and inspect all phases of the field construction, including subgrade verification of the synthetic turf field. The Certified Field Building must have a minimum of five years’ experience with the installation of athletic facilities of similar size and type. The identity of the certified builders and documentation of their credentials will be provided as part of this bid submittal.

27. PIKE INDUSTRIES ACCESS AGREEMENT

The City is finalizing the agreement with Pike Industries for access on their property for construction of the earthen berm and cleaning the existing pond culvert. The draft agreement is in Appendix D. The contractor shall comply with the conditions of this agreement.

28. QUANTITIES OF ESTIMATE: SCHEDULE 5 – REGIONAL STORMWATER TREATMENT SYSTEMS

The City specifically reserves the ability to reduce the sizes of the Regional Stormwater BMP Facilities, or eliminate one of the BMPs, depending on total bid costs and the project budget, in the sole judgement of the City. The Contractor shall maintain their unit prices for items under Schedule 5, regardless of the percentage that quantities are decreased for Schedule 5 pay items as described above. For Schedule 5 pay items only, this Special Condition supersedes Article 36 in the General Conditions.

29. COVID-19 SAFETY PROTOCOLS

The Contractor shall implement safety procedures in compliance with governmental orders and CDC guidance relative to COVID-19, as applicable during the term of the Contract. Representatives of Contractor and Owner shall, during the preconstruction meeting, which shall be held virtually if still required, discuss compliance with any effective orders and guidance and coordination. The Contractor shall instruct employees, subcontractors, vendors, of the required health and safety practices required for operation at the construction site.

END OF SECTION

Section A
BID DOCUMENTS

ADVERTISEMENT FOR BIDS
INFORMATION FOR BIDDERS
BID PROPOSAL
BID BOND

ADVERTISEMENT FOR BIDS**Multi-purpose Recreation Fields & Regional Stormwater Treatment Project**

Sealed BIDS for the construction of: **Multi-purpose Recreation Fields & Regional Stormwater Treatment Project Bid #37-20** will be accepted by the City of Portsmouth Public Works Department, 680 Peverly Hill Road, Portsmouth, NH 03801 until **2:00 PM, May 19, 2020**, and then publicly opened and read aloud. As a result of the ongoing Coronavirus (COVID-19) outbreak, the City of Portsmouth is taking precautionary measures to help prevent the spread of the virus. The City will conduct a public Bid Opening **but ask that only one representative attend from each firm submitting a Bid**. No one will be admitted into the building until 10 minutes before the bid opening. **The general public is discouraged from attending**. Bid results will be posted on the City's purchasing webpage under the project heading as usual (<https://www.cityofportsmouth.com/finance/purchasing-bids-and-proposals>).

The project includes earthwork preparation and installing of a new synthetic turf multi-purpose recreational fields including gravel parking, paved areas, site amenities, stormwater improvements (including large regional stormwater BMP systems), utility connections, sport field lighting, gravel access road improvements, fencing & safety netting, landscaping, and other ancillary tasks.

There will be a **non-mandatory pre-bid meeting** on **May 7, 2020 at 10 AM**. The pre-bid meeting will be held in the at the Public Works Department, 680 Peverly Hill Road in Portsmouth, NH. If required because of ongoing Coronavirus (COVID-19) requirements, the meeting will be held virtually.

1. Completion time for the project will be calculated as **150** calendar days to intermediate completion and substantially completed within **300** calendar days (inclusive of 150 days for intermediate completion) of the start date of the Notice to Proceed. Final Completion must be achieved within **30** days of substantial completion. **Intermediate Completion** must be completed within **150** calendar days of the Notice to Proceed **and in 2020**, and it includes all work under **Schedule 5 – Regional Stormwater Treatment Systems** in the Bid Form.

It is anticipated that a Notice to Proceed will be issued on or before **July 1, 2020**.

2. The General Contractor shall retain the services or employ a Certified Field Builder as certified by the American Sports Builders Association (ASBA) who will be present at the site regularly throughout the project to supervise and inspect all phases of the field construction, including subgrade verification of the synthetic turf field.. The Certified Field Building must have a minimum of five years' experience with the installation of athletic facilities of similar size and type. The identity of the certified builders and documentation of their credentials will be provided as part of this bid submittal.
3. All electrical work on this project, including conduit, will be installed under the supervision of a New Hampshire Licensed Electrician. An electrical permit is required prior to any project work being completed.
4. Liquidated damages for this project will be in accordance with the following schedule:
\$1,000.00 for each day of delay from the date established for Substantial Completion.
\$500.00 for each calendar day of delay from the date established for Contract Completion.
5. Each General Bid shall be accompanied by a bid security in the amount of 5% of the Total Bid Price.

6. The successful bidder must furnish 100% Performance and Payment Bonds and will be required to execute the Contract Agreement within 10 days following notification of the acceptance of his bid.
7. No Bidder may withdraw a Bid within 60 days after the actual date of opening thereof.
8. The owner reserves the right to reject any and all bids, to accept any bid, to waive any informality on bids received, and to omit any item or items as it may deem to be in the best interest of the Owner.
9. All questions regarding bid documents, plans, and specifications for this project should be emailed to Philip Corbett, Project Manager, at pcorbett@cmaengineers.com. Questions will be accepted until **7:30 AM EST on Thursday, May 14, 2020**.
10. Specifications can be obtained from the City's website at <http://www.cityofportsmouth.com/finance/purchasing.htm>.
11. Bidders may contact the Purchasing Coordinator at (603) 610-7227 or by email purchasing@cityofportsmouth.com with any procedural questions.
12. Addenda to this bid document, if any, including written answers to questions, will be posted by close of business on **Friday, May 15, 2020** on the City of Portsmouth website at <http://www.cityofportsmouth.com/finance/purchasing.htm>, under the project heading.

INFORMATION FOR BIDDERS

BIDS will be received by
(herein called the "OWNER"), at

City of Portsmouth, New Hampshire
**City of Portsmouth, Public Works Department,
680 Peverly Hill Road, Portsmouth, New Hampshire 03801**

until **2:00 PM on May 19, 2020** and then at said office publicly opened and read aloud.
Each BID must be submitted in a sealed envelope, addressed to:

City of Portsmouth at **Public Works Department
680 Peverly Hill Road
Portsmouth, New Hampshire 03801**

Each sealed envelope containing a BID must be plainly marked on the outside as BID
for **Multi-purpose Recreation Fields & Regional Stormwater Treatment Project Bid #37-20** and
the envelope should bear on the outside the BIDDER's name, address, and license number if applicable
and the name of the project for which the BID is submitted. If forwarded by mail, the sealed envelope
containing the BID must be enclosed in another envelope addressed to the OWNER at **City of
Portsmouth Public Works Department, 680 Peverly Hill Road, Portsmouth, NH 03801**

As a result of the ongoing Coronavirus (COVID-19) outbreak, the City of Portsmouth is taking
precautionary measures to help prevent the spread of the virus. The City will conduct a public Bid
Opening **but ask that only one representative attend from each firm submitting a Bid**. No one will
be admitted into the building until **10 minutes** before the bid opening. **The general public is
discouraged from attending**. Bid results will be posted on the City's purchasing webpage under the
project heading as usual (<https://www.cityofportsmouth.com/finance/purchasing-bids-and-proposals>).

The Bid Opening will be held at the City of Portsmouth Department of Public Works facility located at
680 Peverly Hill Road, Portsmouth, NH 03801, in the training room located on the first floor of the
building. Please note the following requirements regarding the Bid Opening:

- No one will be admitted into the building until 10 minutes before the bid opening.
- Please use the main entrance located on the northwest side of the building. Staff will be on hand to direct you to the training room.
- Each Bidder is asked to send only one representative to the Bid Opening.
- Please be aware of and adhere to the current CDC guidelines for social distancing and sanitation while on Public Works property. The training room chairs and tables will be set up to provide adequate distance between all meeting attendees.

All BIDS must be made on the required BID form. All blank spaces for BID prices must be filled in, in ink or typewritten, and the BID form must be fully completed and executed when submitted. Only one copy of the BID form is required.

Addenda to this bid document, if any, including written answers to questions, will be posted by Friday, May 15, 2020 on the City of Portsmouth website at <http://www.cityofportsmouth.com/finance/purchasing.htm> under the project heading. Addenda and updates will NOT be sent directly to firms. Contractors submitting a bid should check the web site

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daily for addenda and updates after the release date. Firms should print out, sign and return addenda with the proposal. Failure to do so may result in disqualification.

The OWNER may waive any informalities or minor defects or reject any and all BIDS. Any BID may be withdrawn prior to the above scheduled time for the opening of BIDS or authorized postponement thereof. Any BID received after the time and date specified shall not be considered. No BIDDER may withdraw a BID within 60 days after the actual date of the opening thereof. Should there be reasons why the contract cannot be awarded within the specified period, the time may be extended by mutual agreement between the OWNER and the BIDDER.

The OWNER reserves the right to reject any and all bids, to accept any bid, to waive any informality on bids received, and to omit any item or items as it may deem to be in the best interest of the Owner.

BIDDERS must satisfy themselves of the accuracy of the estimated quantities in the BID Schedule by examination of the site and a review of the drawings and specifications including ADDENDA. After BIDS have been submitted, the BIDDER shall not assert that there was a misunderstanding concerning the quantities of WORK or of the nature of the WORK to be done.

The OWNER shall provide to BIDDERS prior to BIDDING, all information which is pertinent to, and delineates and describes, the land owned and rights-of-way acquired or to be acquired.

The CONTRACT DOCUMENTS contain the provisions required for the construction of the PROJECT. Information obtained from an officer, agent, or employee of the OWNER or any other person shall not affect the risks or obligations assumed by the CONTRACTOR or relieve him from fulfilling any of the conditions of the contract.

Each BID must be accompanied by a BID bond payable to the OWNER for five **(5%)** percent of the total amount of the BID. As soon as the BID prices have been compared, the OWNER will upon request, return the BONDS of all except the three lowest responsible BIDDERS. When the Agreement is executed, the bonds of the two remaining unsuccessful BIDDERS will be returned. The BID BOND of the successful BIDDER will upon request, be retained until the payment BOND and performance BOND have been executed and approved, after which it will be returned. A certified check may be used in lieu of a BID BOND.

A performance BOND and a payment BOND, each in the amount of 100 percent of the CONTRACT PRICE, in a form and with a corporate surety approved by the OWNER, will be required for the faithful performance of the contract.

Attorneys-in-fact who sign BID BONDS or payment BONDS and performance BONDS must file with each BOND a certified and effective dated copy of their power of attorney.

The party to whom the contract is awarded will be required to execute the Agreement and obtain the performance BOND and payment BOND and proof of insurance within ten calendar days from the date when NOTICE OF AWARD is delivered to the BIDDER. The NOTICE OF AWARD shall be accompanied by the necessary Agreement and BOND forms. In case of failure of the BIDDER to

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execute the Agreement, the OWNER may at his option consider the BIDDER in default, in which case the BID BOND accompanying the proposal shall become the property of the OWNER.

The OWNER within ten (10) days of receipt of acceptable performance BOND, payment BOND, proof of insurance and Agreement signed by the party to whom the Agreement was awarded shall sign the Agreement and return to such party an executed duplicate of the Agreement. Should the OWNER not execute the Agreement within such period, the BIDDER may by WRITTEN NOTICE withdraw his signed Agreement. Such notice of withdrawal shall be effective upon receipt of the notice by the OWNER.

The NOTICE TO PROCEED shall be issued within ten (10) days of the execution of the Agreement by the OWNER. Should there be reasons why the NOTICE TO PROCEED cannot be issued within such period, the time may be extended by mutual agreement between the OWNER and CONTRACTOR. If the NOTICE TO PROCEED has not been issued within the ten (10) day period or within the period mutually agreed upon, the CONTRACTOR may terminate the Agreement without further liability on the part of either party.

The OWNER may make such investigations as deemed necessary to determine the ability of the BIDDER to perform the WORK, and the BIDDER shall furnish to the OWNER all such information and data for this purpose as the OWNER may request. The OWNER reserves the right to reject any BID if the evidence submitted by, or investigation of, such BIDDER fails to satisfy the OWNER that such BIDDER is properly qualified to carry out the obligations of the Agreement and to complete the WORK contemplated therein.

A conditional or qualified BID will not be accepted.

Award will be made to the lowest responsive and responsible BIDDER. A Responsible bidder is one who can satisfy the Qualifications set forth herein.

Only one Contract will be awarded for all the work called for in the plans and specifications. **The OWNER may choose to add any combination of Add-Alternates to the Base Bid for the purpose of awarding a contract as may be in the best interest of the OWNER.** The basis of the award will be the total of items as enumerated on the Bid Form.

All applicable laws, ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the PROJECT shall apply to the contract throughout.

Each BIDDER is responsible for inspecting the site and for reading and being thoroughly familiar with the CONTRACT DOCUMENTS. The failure or omission of any BIDDER to do any of the foregoing shall in no way relieve any BIDDER from any obligation in respect to its BID.

The low BIDDER shall supply the names and addresses of major material SUPPLIERS and SUBCONTRACTORS when requested to do so by the OWNER.

NON-MANDATORY PRE BID MEETING pre-bid meeting for all prospective bidders will be held at the:

Portsmouth Public Work Department
680 Peverly Hill Road
Portsmouth, New Hampshire
at **10:00 AM**, (local time) on **May 7, 2020**

If required because of ongoing Coronavirus (COVID-19) requirements, the meeting will be held virtually.

MANUFACTURERS EXPERIENCE

Wherever it may be written that an equipment manufacturer must have a specified period of experience with his product, equipment which does not meet the specified experience period can be considered if the equipment supplier or manufacturer is willing to provide a bond or cash deposit for the duration of the specified time period which will guarantee replacement of that equipment in the event of failure.

NON-DISCRIMINATION IN EMPLOYMENT

Contracts for work under this proposal will obligate the contractors and sub-contractors not to discriminate in employment practices

SAFETY AND HEALTH REGULATIONS

This project is subject to all of the Safety and Health Regulations (CFR 29 Part 1926 and all subsequent amendments) as promulgated by the U.S. Department of Labor on June 24, 1974. Contractors are urged to become familiar with the requirements of these regulations.

COPIES OF THE CONTRACT

There shall be at least three executed copies of the Contract to be distributed as follows: one copy each to the Owner, Contractor, and Engineer.

NON-RESIDENT CONTRACTORS

The successful bidder, if a corporation established under laws other than the State of New Hampshire, shall file, at the time of the execution of the contract, with the Owner, notice of the name of its resident attorney, appointed as required by the laws of the State of New Hampshire.

The successful bidder, if not a resident of New Hampshire, and not a corporation, shall file, at the time of execution of the contract, with the Owner a written appointment of a resident of the state of New Hampshire, having an office or place of business therein, to be his true and lawful attorney upon whom all lawful processes in any actions or proceedings against him may be served; and in such writing, which shall set forth said attorney's place of residence, shall agree that any lawful process against him which is served on said attorney shall be of the same legal force and validity as if served on him and-that the authority shall continue in force so long as any liability remains outstanding against him in New Hampshire. The power of attorney shall be filed in the office of the Secretary of State if required, and copies certified by the Secretary shall be sufficient evidence thereof. Such appointment shall continue in force until revoked by an instrument in writing, designating in a like manner some other person upon

whom such processes may be served, which instrument shall be filed in the manner provided herein for the original appointment.

A Non-resident Contractor shall be deemed to be:

- a) A person who is not a resident of the State of New Hampshire.
- b) Any partnership that has no member thereof resident of the State of New Hampshire.
- c) Any corporation established under laws other than those of the State of New Hampshire.

BIDDER DISQUALIFICATION

Any or all of the following reasons may be deemed by Owner in its sole discretion as being sufficient for the disqualification of a bidder and the rejection of his proposal:

- a) More than one proposal for the same work from an individual, firm, or corporation under the same or different name;
- b) Evidence of collusion among bidders;
- c) Failure to submit all required information requested in the bid specifications;
- d) If the Contractor is not listed with the New Hampshire Department of Transportation as a pre-qualified contractor under the classification of Site Work;
- e) Lack of competency or of adequate machinery, plant or other equipment, as revealed by the statement of bidders qualification or otherwise;
- f) Uncompleted work which, in the judgment of the owner, might hinder or prevent the prompt completion of additional work if awarded;
- g) Failure to pay, or satisfactorily settle, all bills due for labor and materials on former contracts;
- h) Default or unsatisfactory performance on previous contracts; or
- i) Such disqualification would be in the best interests of the Owner.

NON-CONFORMING BIDS

Proposals will be considered nonconforming and may be rejected in the Owner's sole discretion for any of the following reasons:

- a) If the proposal is on a form other than that furnished by the Owner, or if the form is altered or any portion thereof is detached.
- b) If there are unauthorized additions, conditional or altered bids, or irregularities of any kind which may tend to make the proposal or any portion thereof incomplete, indefinite or ambiguous as to its meaning.
- c) If the bidder adds any provisions reserving the right to accept or reject an award, or to enter into a contract pursuant to an award.
- d) Failure to identify the ASBA certified builder and provide documentation of their credentials.
- e) If the proposal does not contain a unit price for each pay item listed except in the case of authorized alter pay items.

WITHDRAWAL OF BIDS

Prior to the date and time for the opening of Bids, a Bid may be withdrawn by an appropriate document duly executed in the same manner that a Bid must be executed and delivered to the place where Bids are to be submitted. Upon receipt of such notice, the unopened Bid will be returned to the Bidder.

BID

Proposal of _____ (hereinafter called "BIDDER"), organized and existing under the laws of the State of _____ doing business as _____
(Corporation, Partnership, Individual)

To the City of Portsmouth, NH (hereinafter called "OWNER").

In compliance with your Advertisement for Bids, BIDDER hereby proposes to perform all WORK for the construction of **Multi-purpose Recreation Fields & Regional Stormwater Treatment Project** in strict accordance with the CONTRACT DOCUMENTS, within the time set forth therein, and at the prices stated below.

By submission of this BID, each BIDDER certifies, and in the case of a joint BID each party thereto certifies as to his own organization, that this BID has been arrived at independently, without consultation, communication, or agreement as to any matter relating to the BID with any other BIDDER or with any competitor.

BIDDER hereby agrees to commence WORK under this contract on or before a date to be specified in the NOTICE TO PROCEED and to complete the PROJECT within:

150 Calendar Days to **Intermediate Completion (Regional Stormwater Facilities)**

300 Calendar Days to **Substantial Completion**

Liquidated damages for this project will be in accordance with the following schedule:

- a. **\$1,000.00** for each day of delay from the date established for **Substantial Completion**.
- b. **\$500.00** for each calendar day of delay from the date established for **Final Completion**.

BIDDER acknowledges receipt of the following ADDENDUM:

The Bidder is requested to state below what works of a similar character to that included in the proposed contract he has done to give references that will enable the Owner to judge his experience, skill, and business standing.

A-3.2

All questions must be answered and the data given must be clear and comprehensive. This statement must be notarized. If necessary, add separate sheets.

1. Name of Bidder.
2. Permanent Main Office address.
3. When organized?
4. Where incorporated?
5. Is bidder registered with the Secretary of the State to do business in New Hampshire?
6. How many years have you engaged in the contracting business under your present firm name? Also state names and dates of previous firm names, if any.
7. Current Contracts on hand. (Schedule these, showing gross amount of each contract and the anticipated completion date.)
8. List your major equipment available for this contract.
9. Identify the Project Superintendent and foreman for this contract.
10. ASBA Certified Field Builder Qualifications.
11. List any subcontractors whom you would expect to use for the following (unless this work is to be done by your own organization):
 - a. Materials Testing _____
 - b. Sewer Testing _____
 - c. Paving _____
 - d. Other Work _____
 - e. Curbing _____
 - f. Sidewalk _____

Respectfully submitted:

A-3.3

_____ Signature	_____ Address
_____ Title	_____ Date

Being duly sworn, deposes and says that he is
_____ of _____
(Name of Organization)

and that the answers to the foregoing questions and all statements contained therein are true and correct.

Sworn to before me this _____ day of _____, 20 _____

Notary Public

My commission expires _____

(Seal - If BID is by Corporation)

ATTEST: _____

BIDDER agrees to perform all the work described in the CONTRACT DOCUMENTS for the following unit prices or lump sum:

- NOTE:
- 1.) BIDS shall include sales tax and all other applicable taxes and fees.
 - 2.) Prices written in words shall govern and unit prices shall govern over extended totals when discrepancies occur.

Multi-purpose Recreational Fields and Regional Stormwater Treatment System

BIDDER: _____

PROJECT: Multi-purpose Recreational Fields and Regional Stormwater Treatment System

OWNER: City of Portsmouth, NH

PRICES WRITTEN IN WORDS SHALL GOVERN AND UNIT PRICES SHALL GOVERN OVER EXTENDED TOTALS WHEN DISCREPANCIES OCCUR.
ALL prices shall be typewritten or written by hand in black ink.

The OWNER may choose to add any combination of Add Alternates to the Base Bid for the purpose of awarding the contract as may be in the best interest of the OWNER.

BASE BID					
Bid Item No.	Item Description	Units	Estimated Quantity	Unit Price in Figures (Dollars and Cents)	Extended Total in Figures (Dollars and Cents)
Schedule 1 - Common Items					
1.00	Mobilization, Project Management, and Demobilization (Max 8% of Total Base Bid): _____ Dollars and _____ Cents per	LS	1		
1.01	Stormwater Pollution Prevention Plan (SWPPP) & Monitoring: _____ Dollars and _____ Cents per	LS	1		
1.02	Implement & Maintain Approved Dust & Erosion Controls: _____ Dollars and _____ Cents per	LS	1		
1.03	Maintenance of Traffic: _____ Dollars and _____ Cents per	LS	1		
1.04	Site Preparation - Rec Fields: _____ Dollars and _____ Cents per	LS	1		
1.05	Exploratory Excavations: _____ Dollars and _____ Cents per	CY	100		
1.06	Turf Establishment, Cleanup & Restoration: _____ Dollars and _____ Cents per	LS	1		
Schedule 2 - Recreational Fields Earthwork, Drainage & Site Improvements					
2.00	Earthwork for Recreational Fields, Earthen Berm & Parking Lot _____ Dollars and _____ Cents per	LS	1		
2.01	Ledge Removal and Disposal (\$50 min/CY) _____ Dollars and _____ Cents per	CY	800		
2.02	Stockpiled Re-handle & Material Compaction: _____ Dollars and _____ Cents per	LS	1		
2.03	Gravel Parking Lot & Emergency Access Drive (General Gravel Section): _____ Dollars and _____ Cents per	SY	2,100		
2.04	Gravel Access Road (Access Drive Section): _____ Dollars and _____ Cents per	SY	2,200		

<i>Bid Item No.</i>	<i>Item Description</i>	<i>Units</i>	<i>Estimated Quantity</i>	<i>Unit Price in Figures (Dollars and Cents)</i>	<i>Extended Total in Figures (Dollars and Cents)</i>
2.05	DPW Access Road (Access Drive Section): _____ Dollars and _____ Cents per	SY	2,100		
2.06	Grass-Lined Swale: _____ Dollars and _____ Cents per	LF	1,260		
2.07	BMP-1 Subsurface Stormwater Chamber, Stone & Fabric: _____ Dollars and _____ Cents per	LS	1		
2.08	BMP-2 Subsurface Gravel Wetlands Construction: _____ Dollars and _____ Cents per	SF	22,200		
2.09	Wetland Soil: _____ Dollars and _____ Cents per	CY	140		
2.10	3/4" Washed Stone (AASHTO #5 Stone): _____ Dollars and _____ Cents per	Ton	570		
2.11	3/8" Pea Gravel (AASHTO #8 Stone): _____ Dollars and _____ Cents per	Ton	72		
2.12	Stone Fill, Class C (NHDOT Item 585.3): _____ Dollars and _____ Cents per	Ton	265		
2.13	Outlet Control Structure (Subsurface Chambers POCS-1): _____ Dollars and _____ Cents per	EA	1		
2.14	Outlet Control Structure (BMP-2 - POCS-2): _____ Dollars and _____ Cents per	EA	1		
2.15	8" Perf. Underdrain: _____ Dollars and _____ Cents per	LF	56		
2.16	12" Perf. Underdrain: _____ Dollars and _____ Cents per	LF	635		
2.17	15" Perf. Underdrain: _____ Dollars and _____ Cents per	LF	125		
2.18	Not Used				
2.19	12" CPE Plastic Pipe (Smooth Interior): _____ Dollars and _____ Cents per	LF	5		
2.20	15" CPE Plastic Pipe (Smooth Interior): _____ Dollars and _____ Cents per	LF	220		
2.21	18" CPE Plastic Pipe (Smooth Interior): _____ Dollars and _____ Cents per	LF	60		
2.22	24" CPE Plastic Pipe (Smooth Interior): _____ Dollars and _____ Cents per	LF	30		
2.23	15" Reinforced Concrete Pipe (Class V): _____ Dollars and _____ Cents per	LF	55		
2.24	18" Reinforced Concrete Pipe (Class V): _____ Dollars and _____ Cents per	LF	295		

<i>Bid Item No.</i>	<i>Item Description</i>	<i>Units</i>	<i>Estimated Quantity</i>	<i>Unit Price in Figures (Dollars and Cents)</i>	<i>Extended Total in Figures (Dollars and Cents)</i>
2.25	24" Reinforced Concrete Pipe (Class V): _____ Dollars and _____ Cents per	LF	50		
2.26	Catch Basins: _____ Dollars and _____ Cents per	EA	5		
2.27	Drainage Manhole (4' Diameter): _____ Dollars and _____ Cents per	EA	8		
2.28	2" - 6" Washed Stone (Forebay Floor and Forebay Weir): _____ Dollars and _____ Cents per	Ton	80		
2.29	Headwall: _____ Dollars and _____ Cents per	CY	16		
2.30	Not Used				
2.31	Not Used				
2.32	Porous Media Infiltration Bed: _____ Dollars and _____ Cents per	SY	1,690		
2.33	Porous Pavement: _____ Dollars and _____ Cents per	Ton	350		
2.34	General Hot Bituminous Pavement: _____ Dollars and _____ Cents per	SY	930		
2.35	Pavement Marking: _____ Dollars and _____ Cents per	LF	250		
2.36	Pavement Symbols: _____ Dollars and _____ Cents per	SF	14		
2.37	Bituminous Sidewalk: _____ Dollars and _____ Cents per	SY	110		
2.38	Stone Dust Walk: _____ Dollars and _____ Cents per	SY	465		
2.39	Wood Guardrail: _____ Dollars and _____ Cents per	LF	260		
2.40	6' Chain Link Fence: _____ Dollars and _____ Cents per	LF	850		
2.41	Security Gate: _____ Dollars and _____ Cents per	EA	2		
2.42	Traffic Signs: _____ Dollars and _____ Cents per	EA	15		
2.43	Bollard: _____ Dollars and _____ Cents per	EA	6		
2.44	Removable Bollard: _____ Dollars and _____ Cents per	EA	3		

<i>Bid Item No.</i>	<i>Item Description</i>	<i>Units</i>	<i>Estimated Quantity</i>	<i>Unit Price in Figures (Dollars and Cents)</i>	<i>Extended Total in Figures (Dollars and Cents)</i>
2.45	Tree Planting (2.5-3" Caliper): _____ Dollars and _____ Cents per	EA	60		
2.46	Landscaping: _____ Dollars and _____ Cents per	LS	1		
2.47	Solar Powered Lights for Parking Lot: _____ Dollars and _____ Cents per	EA	3		
Schedule 3 - Utilities					
3.00	8" Water Main: _____ Dollars and _____ Cents per	LF	1,120		
3.01	Water Main Connection (SS Tapping Sleeve w/ 8" Valve): _____ Dollars and _____ Cents per	EA	1		
3.02	Fire Hydrant: _____ Dollars and _____ Cents per	EA	1		
3.03	Water Service Connection and Valve Box: _____ Dollars and _____ Cents per	EA	1		
3.04	1-1/2" Water Service Pipe: _____ Dollars and _____ Cents per	LF	260		
3.05	Water Meter Pit: _____ Dollars and _____ Cents per	EA	1		
3.06	Water Spigot: _____ Dollars and _____ Cents per	EA	2		
3.07	8" Gate Valve and Valve Box: _____ Dollars and _____ Cents per	EA	1		
3.08	Water Fountain: _____ Dollars and _____ Cents per	EA	1		
Schedule 4 - Recreational Field Synthetic Turf & Site Amenities					
4.00	Field 1 Synthetic Turf Field: _____ Dollars and _____ Cents per	LS	1		
4.01	Ball Netting System: _____ Dollars and _____ Cents per	LF	920		
4.02	4' BVCL Fence: _____ Dollars and _____ Cents per	LF	1,230		
4.03	4' BVCL Single Swing Gate: _____ Dollars and _____ Cents per	EA	2		
4.04	4' BVCL 10' Wide Double Swing Gate: _____ Dollars and _____ Cents per	EA	2		
4.05	Goal Posts: _____ Dollars and _____ Cents per	EA	2		
4.06	Soccer Goals: _____ Dollars and _____ Cents per	EA	4		

Bid Item No.	Item Description	Units	Estimated Quantity	Unit Price in Figures (Dollars and Cents)	Extended Total in Figures (Dollars and Cents)
4.07	Portable Toilets (2) in Shelter on Concrete Pad: _____ Dollars and _____ Cents per	EA	2		
4.08	Mobile Bleachers: _____ Dollars and _____ Cents per	EA	1		
4.09	Storage Shed on Concrete Pad: _____ Dollars and _____ Cents per	EA	1		
4.10	Bike Rack: _____ Dollars and _____ Cents per	EA	3		
4.11	Sport Light Foundations: _____ Dollars and _____ Cents per	EA	4		
4.12	Sport Light Conduits & Handholes for Future Service: _____ Dollars and _____ Cents per	LS	1		
Schedule 5 - Regional Stormwater Treatment Systems					
5.00A	Site Preparation - BMP_R1: _____ Dollars and _____ Cents per	LS	1		
5.00B	Site Preparation - BMP R2&R3: _____ Dollars and _____ Cents per	LS	1		
5.01	Ledge Removal and Disposal (\$50 min/CY) _____ Dollars and _____ Cents per	CY	500		
5.02	BMP-R1 Subsurface Gravel Wetlands Construction: _____ Dollars and _____ Cents per	SF	47,000		
5.03	BMP-R2&R3 Bioretention Basin w/ Internal Storage Reservoir: _____ Dollars and _____ Cents per	SF	39,000		
5.04A	Wetland Soil: _____ Dollars and _____ Cents per	CY	580		
5.04B	Bioretention Soil Mix: _____ Dollars and _____ Cents per	CY	580		
5.05	3/4" Washed Stone (AASHTO #5 Stone): _____ Dollars and _____ Cents per	Ton	2,450		
5.06	3/8" Pea Gravel (AASHTO #8 Stone): _____ Dollars and _____ Cents per	Ton	545		
5.07A	Stone Fill, Class B (NHDOT Item 585.2): _____ Dollars and _____ Cents per	Ton	750		
5.07B	Stone Fill, Class C (NHDOT Item 585.3): _____ Dollars and _____ Cents per	Ton	915		
5.08	Outlet Control Structure (BMP-R1 - POCS-3): _____ Dollars and _____ Cents per	EA	1		
5.09	Outlet Control Structure (BMP-R2&R3 - POCS-4): _____ Dollars and _____ Cents per	EA	1		

<i>Bid Item No.</i>	<i>Item Description</i>	<i>Units</i>	<i>Estimated Quantity</i>	<i>Unit Price in Figures (Dollars and Cents)</i>	<i>Extended Total in Figures (Dollars and Cents)</i>
5.10	Outlet Control Structure (BMP-R2&R3 - POCS-5): _____ Dollars and _____ Cents per	EA	1		
5.11	Outlet Control Structure (BMP-R2&R3 - POCS-6): _____ Dollars and _____ Cents per	EA	1		
5.12	Headwall: _____ Dollars and _____ Cents per	CY	10		
5.13	Culvert Cleaning and Inlet Clearing: _____ Dollars and _____ Cents per	LS	1		
5.14	Riprap, Class VII: _____ Dollars and _____ Cents per	Ton	140		
5.15	Drainage Manhole (5' Diameter): _____ Dollars and _____ Cents per	EA	2		
5.16	2" - 6" Washed Stone (Forebay Floor and Forebay Weir): _____ Dollars and _____ Cents per	Ton	215		
Base Bid Total (Items #1.00-5.16):					

Bid Item No.	Item Description	Units	Estimated Quantity	Unit Price in Figures (Dollars and Cents)	Extended Total in Figures (Dollars and Cents)
Bid Alternate A - Synthetic Field 2 Turf					
Bid Item No.	Item Description	Units	Estimated Quantity	Unit Price in Figures (Dollars and Cents)	Extended Total in Figures (Dollars and Cents)
A1	Field 2 Synthetic Turf Field: _____ Dollars and _____ Cents per	LS	1		
A2	Ball Netting System: _____ Dollars and _____ Cents per	LF	500		
A3	4' BVCL Fence: _____ Dollars and _____ Cents per	LF	900		
A4	Porous Media Infiltration Bed: _____ Dollars and _____ Cents per	SY	290		
A5	Porous Pavement: _____ Dollars and _____ Cents per	TON	60		
A6	Mobile Bleachers: _____ Dollars and _____ Cents per	EA	1		
A7	Tree Planting (2.5-3" Caliper): _____ Dollars and _____ Cents per	EA	6		
A8	Sport Light Foundations: _____ Dollars and _____ Cents per	EA	2		
A9	Sport Light Conduits & Handholes for Future Service: _____ Dollars and _____ Cents per	LS	1		
A10	Gravel Parking Lot (General Gravel Section): _____ Dollars and _____ Cents per	SY	2,000		
A11	Solar Powered Lights for Parking Lot: _____ Dollars and _____ Cents per	EA	3		
Bid Alternate A Total (Items #A1-A11):					
Bid Alternate B - Sport Field Lighting					
Bid Item No.	Item Description	Units	Estimated Quantity	Unit Price in Figures (Dollars and Cents)	Extended Total in Figures (Dollars and Cents)
B1	Sport Field Lighting Poles and Fixtures: _____ Dollars and _____ Cents per	EA	6		
B2	Electrical Service Conduit: _____ Dollars and _____ Cents per	LF	1,300		
B3	Electrical Cabinet and Transformer: _____ Dollars and _____ Cents per	LS	1		
B4	Utility Connection (Eversource): _____ Dollars and _____ Cents per	Allow	1	\$40,000	Forty Thousand Dollars and No Cents
Bid Alternate B Total (Items #B1-B4):					

Bid Item No.	Item Description	Units	Estimated Quantity	Unit Price in Figures (Dollars and Cents)	Extended Total in Figures (Dollars and Cents)
Bid Alternate C - Snow Storage Gravel Area & Public Works Access Road Improvements					
Bid Item No.	Item Description	Units	Estimated Quantity	Unit Price in Figures (Dollars and Cents)	Extended Total in Figures (Dollars and Cents)
C1	Heavy Duty Gravel: _____ Dollars and _____ Cents per	SY	3,800		
C2	DPW Access Drive: _____ Dollars and _____ Cents per	SY	2,300		
Bid Alternate B Total (Items #C1-C2):					
Bid Alternate D - Sewer Forcemain					
Bid Item No.	Item Description	Units	Estimated Quantity	Unit Price in Figures (Dollars and Cents)	Extended Total in Figures (Dollars and Cents)
D1	Sewer forcemain: _____ Dollars and _____ Cents per	LF	1,060		
Bid Alternate D Total:					
Bid Alternate E - Alternative Infill - Envirofill with Shock Pad					
Bid Item No.	Item Description	Units	Estimated Quantity	Unit Price in Figures (Dollars and Cents)	Extended Total in Figures (Dollars and Cents)
E1	Alternative Infill - Envirofill with Shock Pad: _____ Dollars and _____ Cents per	LS	1		
Bid Alternate E Total					
Bid Alternate F - Alternative Infill - Safeshell with Shock Pad					
Bid Item No.	Item Description	Units	Estimated Quantity	Unit Price in Figures (Dollars and Cents)	Extended Total in Figures (Dollars and Cents)
F1	Alternative Infill - Safeshell with Shock Pad: _____ Dollars and _____ Cents per	LS	1		
Bid Alternate F Total:					
Bid Alternate G - Scoreboard & Footings					
Bid Item No.	Item Description	Units	Estimated Quantity	Unit Price in Figures (Dollars and Cents)	Extended Total in Figures (Dollars and Cents)
G1	Scoreboard & Footings: _____ Dollars and _____ Cents per	EA	2		
Bid Alternate G Total:					

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned,
as Principal, and _____ as Surety,
are Hereby held and firmly bound unto City of Portsmouth, New Hampshire as OWNER in the
penal sum of **5% of Multi-purpose Recreation Fields & Regional Stormwater Treatment Project**
for the payment of which, well and truly to be made, we hereby jointly and severally bind
ourselves, successors and assigns.

Signed, this _____ day of _____, 2020.

The Condition of the above obligation is such that whereas the Principal has submitted to
_____ a certain BID,
attached hereto and hereby made a part hereof to enter into a contract in writing, for the

NOW, THEREFORE,

- (a) If said BID shall be rejected, or
- (b) If said BID shall be accepted and the Principal shall execute and deliver a contract
in the Form of Contract attached hereto (Properly completed in accordance with
said BID) and shall furnish a BOND for his faithful performance of said contract,
and for the payment of all persons performing labor or furnishing materials in
connection therewith, and shall in all other respects perform the agreement
created by the acceptance of said BID, then this obligation shall be void,
otherwise, the same shall remain in force and effect; it being expressly understood
and agreed that the liability of the Surety for any and all claims hereunder shall, in
no event, exceed the penal amount of this obligation as herein
stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety
and its BOND shall be in no way impaired or affected by any extension of the time within which
the OWNER may accept such BID; and said Surety does hereby waive notice of any such
extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

_____(L.S.)
Principal

By: _____

Surety

By: _____

IMPORTANT - Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state of New Hampshire.

Section B
CONTRACT DOCUMENTS

NOTICE OF AWARD
AGREEMENT
PAYMENT BOND
PERFORMANCE BOND
NOTICE TO PROCEED
CONTRACTOR'S AFFIDAVIT
CONTRACTOR'S FINAL RELEASE & LIEN WAIVER
CERTIFICATE OF SUBSTANTIAL COMPLETION
CHANGE ORDER
CERTIFICATE OF FINAL COMPLETION

B-1.1

NOTICE OF AWARD

Dated _____, 2020

TO: _____
(BIDDER)

ADDRESS: _____

OWNER'S PROJECT NO: _____

PROJECT: **Multi-purpose Recreation Fields & Regional Stormwater Treatment Project**

OWNER'S CONTRACT NO: _____

CONTRACT FOR: **Multi-purpose Recreation Fields & Regional Stormwater Treatment Project**

(Insert name of contract as it appears in the Bid Documents)

You are notified that your Bid dated _____ for the above Contract has been considered. You are the apparent successful bidder and have been awarded a contract for:

Earthwork preparation and installing of a new synthetic turf multi-purpose recreational fields including gravel parking, paved areas, site amenities, stormwater improvements (including large regional stormwater BMP systems), utility connections, sport field lighting, gravel access road improvements, fencing & safety netting, landscaping, and other ancillary tasks.

(Indicate total Work, alternates or sections of Work awarded)

The Contract Price of your contract is _____ Dollars (\$ _____).

6 copies of each of the proposed Contract Documents (except Drawings) accompany this Notice of Award. The same number of sets of the Drawings will be delivered separately or otherwise made available to you immediately.

You must comply with the following conditions precedent within ten days of receiving this Notice of Award.

1. You must deliver to the OWNER all of the fully executed counterparts of the Agreement including all the Contract Documents. This includes the sets of Drawings. Each of the Contract Documents must bear your signature on the cover page.

2. You must deliver with the executed Agreement the Contract Security (Bonds) as specified in the Information for Bidders and General Conditions and proof of insurance.

B-1.2

3. (List other conditions precedent).

Failure to comply with these conditions within the time specified will entitle **OWNER** to consider your bid abandoned, to annul this Notice of Award and to declare your Bid Security forfeited.

Within ten days after receipt of acceptable performance BOND, payment BOND, proof of insurance and agreement signed by the party to whom the Agreement was awarded, the **OWNER** will return to you one fully signed counterpart of the Agreement with the Contract Documents attached.

City of Portsmouth
(OWNER)

By _____
(AUTHORIZED SIGNATURE)

Judie Belanger
Finance Director
(TITLE)

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE OF AWARD is hereby acknowledged

By _____

The _____ day of _____, 20 _____

By _____

Title _____

Copy to ENGINEER
(Use Certified Mail, Return Receipt Requested)

B-2.1
AGREEMENT

THIS AGREEMENT, made this _____ day of _____, 2020 by
and between City of Portsmouth, New Hampshire, hereinafter called "**OWNER**"
(Name of Owner)
and _____ doing business as (an individual,) or (a
partnership,) or (a corporation) hereinafter called "**CONTRACTOR**".

WITNESSETH: That for and in consideration of the payments and agreements hereinafter
mentioned:

1. The **CONTRACTOR** will commence and complete the construction of

Multi-purpose Recreation Fields & Regional Stormwater Treatment Project

(Project)

2. The **CONTRACTOR** will furnish all of the material, supplies, tools, equipment, labor and
other services necessary for the construction and completion of the **PROJECT** described herein.

3. The **CONTRACTOR** will commence the work required by the **CONTRACT DOCUMENTS**
within 10 calendar days after the date of the **NOTICE TO PROCEED unless the period
for completion is extended otherwise by the CONTRACT DOCUMENTS.** Completion time for
the project will be calculated as calendar days from the date specified in the **NOTICE TO
PROCEED** as follows:

150 Calendar Days to **Intermediate Completion (Regional Stormwater Facilities)**

300 Calendar Days to **Substantial Completion**

Liquidated damages for this project will be in accordance with the following schedule:

- a. **\$1,000.00** for each day of delay from the date established for **Substantial Completion.**
- b. **\$500.00** for each calendar day of delay from the date established for **Final Completion.**

4. The **CONTRACTOR** agrees to perform all of the **WORK** described in the **CONTRACT
DOCUMENTS** and comply with the terms therein for the sum of _____ or as shown in the
BID schedule.

5. The term "**CONTRACT DOCUMENTS**" means and includes the following:

- (A) ADVERTISEMENT FOR BIDS
- (B) INFORMATION FOR BIDDERS
- (C) BID
- (D) BID BOND
- (E) AGREEMENT
- (F) GENERAL CONDITIONS
- (G) SUPPLEMENTAL GENERAL CONDITIONS
- (H) SPECIAL CONDITIONS
- (I) PAYMENT BOND
- (J) PERFORMANCE BOND
- (K) NOTICE OF AWARD
- (L) NOTICE TO PROCEED
- (M) CONTRACTORS AFFIDAVIT
- (N) CONTRACTORS RELEASE
- (O) CERTIFICATE OF SUBSTANTIAL COMPLETION
- (P) CHANGE ORDER(S)
- (Q) DRAWINGS prepared by: CMA Engineers, Inc.

Multi-purpose Recreation Fields & Regional Stormwater Treatment Project

numbered 1 through 44 , and dated April 2020

- (R) TECHNICAL SPECIFICATIONS prepared or issued by: CMA Engineers, Inc.
Included in Contract and Specifications for **Multi-purpose Recreation Fields & Regional Stormwater Treatment Project**

_____, and dated April 2020

- (S) ADDENDA:

No. _____ , dated _____ , 20 ____

No. _____ , dated _____ , 20 ____

No. _____ , dated _____ , 20 ____

B-2.3

6. The **OWNER** will pay to the **CONTRACTOR** in the manner and at such times as set forth in the General Conditions such amounts as required by the **CONTRACT DOCUMENTS**.

7. This Agreement shall be binding upon all parties hereto and their respective heirs, executors, administrators, successors, and assigns.

IN WITNESS WHEREOF, the parties hereto have executed, or caused to be executed by their duly authorized officials, this Agreement in 6 copies, each of which shall be deemed an original on the date first above written.

OWNER: City of Portsmouth, New Hampshire

By: _____
Karen Conard
Name: City Manager
(Please type)

(SEAL)
ATTEST: _____
Name: _____
Title: _____

CONTRACTOR: _____

By: _____
Name: _____
Address: _____

(SEAL)
ATTEST: _____
Name: _____
Title: _____

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS: that

(Name of Contractor)

(Address of Contractor)

a _____, hereinafter called Principal,
(Corporation, Partnership or Individual)

and _____
(Name of Surety)

(Address of Surety)

hereinafter called Surety, are held and firmly bound unto

City of Portsmouth, New Hampshire

(Name of Owner)

1 Junkins Avenue, Portsmouth, NH 03801

Address of Owner)

hereinafter called **OWNER** and unto all persons, firms, and corporations who or which may furnish labor, or who furnish materials to perform as described under the contract and to their successors and assigns, in the total aggregate penal sum of _____ Dollars, (\$ _____) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the **OWNER**, dated the _____ day of _____ 20____, a copy of which is hereto attached and made a part hereof for the construction of:

NOW, THEREFORE, if the Principal shall promptly make payment to all persons, firms, and corporations furnishing materials for or performing labor in the prosecution of the **WORK** provided for in such contract, and any authorized extension or modification thereof, including all amounts due for materials, lubricants, oil, gasoline, coal and coke, repairs on machinery, equipment and tools, consumed or used in connection with the construction of such **WORK**, and for all labor cost incurred in such **WORK** including that be a subcontractor, and to any mechanic or material lienholder whether it acquires its lien by operation of State or Federal Law; then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, that beneficiaries or claimants hereunder shall be limited to the subcontractors, and persons, firms, and corporations having a direct contract with the PRINCIPAL or its SUBCONTRACTORS.

PROVIDED FURTHER, that the said Surety for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to the **WORK** to be performed thereunder or the **SPECIFICATIONS** accompanying the same shall in any way affect its obligation on this **BOND**, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the **WORK** or to the **SPECIFICATIONS**.

PROVIDED, FURTHER that no suit or action shall be commenced hereunder by any claimant: (a) Unless claimant, other than one having a direct contract with the PRINCIPAL shall have given written notice to any two of the following: The PRINCIPAL, the OWNER, or the SURETY above named within ninety (90) days after such claimant did or performed the last of the work or labor, or furnished the last of the materials for which said claim is made, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were furnished, or for whom the work or labor was done or performed. Such notice shall be served by mailing the same by registered mail or certified mail, postage prepaid, in an envelope addressed to the PRINCIPAL, OWNER, or SURETY, at any place where an office is regularly maintained for the transaction business, or served in any manner in which legal process may be served in the state in which the aforesaid project is located, save that such service need not be made by a public officer. (b) After the expiration of one (1) year following the date on which PRINCIPAL ceased work on said CONTRACT, it being understood, however, that if any limitation embodied in the BOND is prohibited by any law controlling the construction hereof, such limitation shall be deemed to be amended so as to be equal to the minimum period of limitation permitted by such law.

PROVIDED, FURTHER, that it is expressly agreed that this BOND shall be deemed amended automatically and immediately, without formal and separate amendments hereto, upon amendment to the Contract not increasing the contract price more than 20 percent, so as to bind the PRINCIPAL and the SURETY to the full and faithful performance of the Contract as so amended. The term "Amendment", wherever used in this BOND and whether referring to this BOND, the contract or the loan Documents shall include any alteration, addition, extension or modification of any character whatsoever.

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

B-3.3

IN WITNESS WHEREOF, this instrument is executed in _____ counterparts, each one of
(number)
which shall be deemed an original, this _____ day of _____, 20 ____ .

ATTEST:

By: _____
(Principal) Secretary
(SEAL)

Principal
BY _____

(Address)

By: _____
Witness as to Principal

(Address)

(Surety)

ATTEST:

BY _____
Attorney - in - Fact

(Address)

By _____
Witness as to Surety

(Address)

NOTE: Date of **BOND** must not be prior to date of Contract.
If **CONTRACTOR** is partnership, all partners should execute BOND.

IMPORTANT: Surety companies executing **BONDS** must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the State of New Hampshire.

B-4.1
PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: that

(Name of Contractor)

(Address of Contractor)

a _____, hereinafter called Principal,
(Corporation, Partnership or Individual)

and _____
(Name of Surety)

(Address of Surety)

hereinafter called Surety, are held and firmly bound unto

City of Portsmouth, New Hampshire

(Name of Owner)

1 Junkins Avenue, Portsmouth, New Hampshire 03801

(Address of Owner)

hereinafter called **OWNER**, in the total aggregate penal sum of _____
_____ Dollars, \$ (_____)

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

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the **OWNER**, dated the _____ day of _____ 20 ____, a copy of which is hereto attached and made a part hereof for the construction of:

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

B-4.2

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

PROVIDED, FURTHER, that it is expressly agreed that this BOND shall be deemed amended automatically and immediately, without formal and separate amendments hereto, upon amendment to the Contract not increasing the contract price more than 20 percent, so as to bind the PRINCIPAL and the SURETY to the full and faithful performance of the Contract as so amended. The term "Amendment", wherever used in this BOND and whether referring to this BOND, the contract or the loan Documents shall include any alteration, addition, extension or modification of any character whatsoever.

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

IN WITNESS WHEREOF, this instrument is executed in _____ counterparts, each one of
(number)
which shall be deemed an original, this _____ day of _____, 20 ____.

ATTEST:

By: _____
(Principal) Secretary
(SEAL)

BY

Principal

(Address)

By: _____
Witness as to Principal

(Address)

(Surety)

ATTEST:

BY

By _____
Witness as to Surety

(Address)

Attorney - in - Fact

(Address)

NOTE: Date of **BOND** must not be prior to date of Contract.
If **CONTRACTOR** is partnership, all partners should execute BOND.

IMPORTANT: Surety companies executing **BONDS** must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the State of New Hampshire.

B-5.1
NOTICE TO PROCEED

Dated _____, 20 ____

TO: _____
(Insert Name of Contractor as it appears in the Bid Documents)

ADDRESS: _____

OWNER'S PROJECT NO. _____

PROJECT: **Multi-purpose Recreation Fields & Regional Stormwater Treatment Project**

OWNER'S CONTRACT NO. _____

CONTRACT FOR: **Multi-purpose Recreation Fields & Regional Stormwater Treatment**

You are notified that the Contract Time under the above contract will commence to run on _____, **2020**. By that date, you are to start performing your obligations under the Contract Documents. In accordance with paragraph 3 of the Agreement, the dates of Substantial and Final Completion are as follows:

Before you may start any Work at the site, you must:
Provide a Storm water pollution prevention plan and EPA Notice of Intent, project schedule, project superintendent and work force, and pre-construction video.

(add other requirements)

Copy to ENGINEER

(Use certified Mail, return Receipt Requested)

City of Portsmouth, New Hampshire

(owner)

By

(Authorized Representative)

Peter H. Rice, P.E.

Public Works Director

(Title)

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE TO PROCEED Is hereby acknowledged by:

(Contractor)

this the _____, 20 ____

Employer Identification

Number: _____

By: _____

(Title)

CONTRACTOR'S AFFIDAVIT

STATE OF: New Hampshire

COUNTY OF: _____

Before me, the undersigned, a _____
(Notary Public, Justice of Peace, Alderman)

in and for said County and State personally appeared, _____

_____ (Individual, Partner or duly

_____ who being duly sworn according to law

_____ authorized representative of corporate contractor)

deposes and says that the cost of all the Work, and outstanding claims and indebtedness of whatever

nature arising out of the performance of the contract between the City of Portsmouth, NH

_____ (Owner)

and _____ of _____

_____ (Contractor)

dated _____ for the construction of the **Multi-purpose Recreation Fields & Regional**

_____ **Stormwater Treatment Project**

and necessary appurtenant installations have been paid in full.

(Individual, Partner, or duly authorized representative of corporate contractor)

(Title)

Sworn to and subscribed before me

this _____ day of _____, 20 _____

Notary Public

CONTRACTOR'S FINAL RELEASE AND WAIVER OF LIENProject/OwnerContractor

Project: _____

Name _____

Address: _____

Address: _____

City _____ State _____ Zip _____

City _____ State _____ Zip _____

Owner _____

Contractor License: _____

Contract Date: _____

TO ALL WHOM IT MAY CONCERN:

For good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the undersigned Contractor hereby waives, discharges, and releases any and all liens, claims, and rights to liens against the above-mentioned project, and any and all other property owned by or the title to which is in the name of the above-referenced Owner and against any and all funds of the Owner appropriated and available for the construction of said project, and any and all warrants drawn upon or issued against any such funds or monies, which the undersigned Contractor may have or may hereafter acquire or process as a result of the furnishing of labor, materials, and/or equipment, and the performance of Work by the Contractor on or in connection with said project, whether under and pursuant to the above-mentioned contract between the Contractor and the Owner pertaining to said project or otherwise, and which said liens, claims or rights of lien may arise and exist.

The undersigned further hereby acknowledges that the sum of

Dollars (\$ _____) constitutes the entire ***unpaid*** balance due the undersigned in Connection with said project whether under said contract or otherwise and that the payment of said sum to the Contractor will constitute payment in full and will fully satisfy any and all liens, claims, and demands which the Contractor may have or assert against the Owner in connection with said contract or project.

Dated this ____ day of _____ 20__

Contractor

Witness to Signature

By _____

By _____

Title _____

Title _____

CERTIFICATE OF SUBSTANTIAL COMPLETION

OWNER's Project No.: _____ ENGINEER's Project No.: 1119

Project: **Multi-purpose Recreation Fields & Regional Stormwater
Treatment Project**

CONTRACTOR: _____

**Multi-purpose Recreation Fields
& Regional Stormwater**
Contract For: **Treatment Project** Contract Date: _____

This Certificate of Substantial Completion applies to all Work under the Contract Documents or to the following specified parts thereof:

To: _____
(Owner)

And To: _____
(Contractor)

The Work to which this Certificate applies has been inspected by authorized representatives of OWNER, CONTRACTOR and ENGINEER, and that Work is hereby declared to be substantially complete in accordance with the Contract Documents on

(Date of Substantial Completion)

A tentative list of items to be completed or corrected is attached hereto. This list may not be all-inclusive, and the failure to include an item in it does not alter the responsibility of CONTRACTOR to complete all the Work in accordance with the Contract Documents. The items in the tentative list shall be completed or corrected by CONTRACTOR within _____ calendar days of the above date of Substantial Completion.

B-8.2

The responsibilities between OWNER and CONTRACTOR for security, operation, safety, maintenance, heat, utilities, insurance and warranties shall be as follows:

RESPONSIBILITIES:

OWNER: _____

CONTRACTOR: _____

The following documents are attached to and made a part of this Certificate:

This certificate does not constitute an acceptance of Work not in accordance with the Contract Documents nor is it a release of CONTRACTOR's obligation to complete the Work in accordance with the Contract Documents.

Executed by ENGINEER on _____, 20 _____

(Engineer)

By: _____

CONTRACTOR accepts this Certificate of Substantial Completion on _____, 20 _____

(Contractor)

By: _____

OWNER accepts this Certificate of Substantial Completion on _____, 20 _____

(Owner)

By: _____

B-9.1
CHANGE ORDER

No. _____

PROJECT: **Sagamore Avenue** **DATE OF ISSUANCE:**
Reconstruction – Phase 1

OWNER: City of Portsmouth **OWNER's Project No.**
(Name & Address) 1 Junkins Avenue
Portsmouth, New Hampshire

CONTRACTOR: **ENGINEER:** CMA Engineers, Inc.
35 Bow Street
Portsmouth, New Hampshire

CONTRACT FOR: **Multi-purpose Recreation Fields & Regional Stormwater Treatment Project**

ENGINEER's Project No.

You are directed to make the following changes in the Contract Documents.

Description:

Purpose of Change Order:

Attachments:

CHANGE IN CONTRACT PRICE Original Contract Price \$	CHANGE IN CONTRACT TIME Original Contract Time days (days or date)
Previous Change Orders No. -to No. -	Net change from previous Change Orders 0 days (days)
Contract Price prior to this Change Order \$	Contract Time prior to this Change Order days (days or date)
Net Increase (Decrease) of this Change Order \$	Net Increase (Decrease) of this Change Order 0 days (days)
Contract Price with all approved Change Orders \$	Contract Time with all approved Change Orders days (days or date)

This document will become a supplement to the CONTRACT and all provisions will apply hereto. The attached Contractor's Revised Project Schedule reflects increases or decreases in Contract Time as authorized by this Change Order.

Stipulated price and time adjustment includes all costs and time associated with the above described change. Contractor waives all rights for additional time extension for said change. Contractor and Owner agree that the price(s) and time adjustment(s) stated above are equitable and acceptable to both parties.

Recommended:
By:
Engineer , P.E.

Accepted:
By:
Contractor

Approved:
By:
Public Works Dir. Peter H. Rice, P.E.

Approved:
By:
Finance Dept. Director

Approved:
By:
City Manager Karen Conard

CERTIFICATE OF FINAL COMPLETION

Owner's Project No. _____ Engineer's Project No. _____
Project _____
Owner: _____
Contractor: _____
Engineer: _____

Agreement Date: _____
Notice to Proceed Date: _____
Contractual Substantial Completion Date as modified by Change Orders: _____
Actual Substantial Completion Date: _____
Contractual Final Completion Date as modified by Change Orders: _____

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor, Engineer, the punch list has been completed and the Work of the Contract is hereby declared to be Finally Complete in accordance with the Contract Documents on:

Date of Final Completion

This Certificate does not constitute an acceptance of any Work not in accordance with the Contract Documents nor is it a release of Contractor's obligation to complete the Work in accordance with the Contract Documents. The Warranty for all Work completed subsequent to the date of Substantial Completion expires one year from the date of this Final Acceptance.

Executed by Engineer on: _____, 20_____

By: _____

Contractor Accepts this Certificate of Final Completion on: _____, 20_____

By: _____

Owner Accepts this Certificate of Final Completion on: _____, 20_____

By: _____

Section C
GENERAL CONDITIONS

GENERAL CONDITIONS
SUPPLEMENTARY GENERAL CONDITIONS

C. GENERAL CONDITIONS

JUNE 2012

GENERAL CONDITIONS

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GENERAL CONDITIONS

1. Contract and Contract Documents. The plans, information for bidders, bids, advertisement for bids, bid payment and performance bonds, Agreements, change orders, notice to proceed, specifications and addenda, hereinafter enumerated in the Agreement, shall form part of this Contract and the provisions thereof shall be as binding upon the parties hereto as if they were herein fully set forth. The table of contents, titles, headings, running headlines and marginal notes contained herein and in said documents are solely to facilitate reference to various provisions of the Contract Documents and in no way affect, limit or cast light on the interpretation of the provisions to which they refer.
2. Definitions.
 - 2.1 “Addenda” means written or graphic instruments issued prior to the execution of the Agreement which modify or interpret the Contract Documents, drawings and specifications, by additions, deletions, clarifications or corrections. Such written or graphic instruments will be issued no less than five days before the bid opening.
 - 2.2 “Bid” means the offer or proposal of the bidder submitted on the prescribed form setting forth the prices for the work to be performed.
 - 2.3 “Bidder” means any person, firm or corporation submitting a bid for the work.
 - 2.4 “Bonds” means bid, performance, and payment bonds and other instruments of security, furnished by the Contractor and his surety in accordance with the Contract Documents.
 - 2.5 “Change Order” means a written order to the Contractor authorizing an addition, deletion or revision in the work within the general scope of the Contract Documents, or authorizing an adjustment in the Contract Price or Contract Time.
 - 2.6 “Contract Documents” means the Contract, including any advertisement for bids, information for bidders, bid, bid bond, Agreement, payment bond, performance bond, notice of award, notice to proceed, change orders, drawings, specifications and addenda.
 - 2.7 “Contract Price” means the total monies payable to the Contractor under the terms and conditions of the Contract Documents.
 - 2.8 “Contract Time” means the number of calendar days stated in the Contract Documents for the completion of the Work.
 - 2.9 “Contractor” means the person, firm or corporation with whom the Owner has executed the Agreement.
 - 2.10 “Division” means the state of New Hampshire Department of Environmental Services, Water Division.

2.11 “Drawings” mean the part of the Contract Documents which show the characteristics and scope of the work to be performed and which have been prepared or approved by the Engineer.

2.12 “Engineer” means the person, firm or corporation named as such in the contract documents.

2.13 “Field order” means a written order effecting a change in the work not relating to an adjustment in the contract price or an extension of the contract time and issued by the Engineer to the Contractor during construction.

2.14 “Notice of Award” means the written notice of the acceptance of the Bid from the Owner to the successful Bidder.

2.15 “Notice to Proceed” means the written communication issued by the Owner to the Contractor authorizing him to proceed with the Work and establishing the date of commencement of the Work.

2.16 “Owner” means a public or quasi-public body or authority, corporation, association, partnership, or individual for whom the work is to be performed.

2.17 “Plans” means the contract drawings or exact reproductions thereof which show the scope, character, dimensions and details of the work and which have been prepared or approved by the Engineer.

2.18 “Project” means the undertaking to be performed as provided in the Contract Documents.

2.19 “Resident Project Representative” means the authorized representative of the Owner who is assigned to the Project site or any part thereof.

2.20 “Shop Drawings” means all drawings, diagrams, illustrations, brochures, schedules and other data which are prepared by the Contractor, a Subcontractor, manufacturer, supplier or distributor, which illustrates how specific portions of the Work shall be fabricated or installed.

2.21 “Special conditions” means revisions or additions to these general conditions, Supplemental General Conditions or specifications applicable to an individual project.

2.22 “Specifications” means a part of the contract documents consisting of written descriptions of a technical nature of materials, equipment, construction systems, standards and workmanship.

2.23 “Subcontractor” means an individual, firm or corporation having a direct contract with the Contractor or with any other Subcontractor for the performance of a part of the Work at the site.

2.24 “Substantial Completion” means that date as certified by the Engineer when the construction of the Project or a specified part thereof is sufficiently completed, in

accordance with the Contract Documents, so that the Project or specified part can be utilized for the purposes for which it is intended.

2.25 “Supplemental General Conditions” means modifications to these general conditions required by a Federal agency for participation in the PROJECT and approved by the agency in writing prior to inclusion in the CONTRACT DOCUMENTS, or such documents that may be imposed by applicable State laws.

2.26 “Supplier” means any person or organization who supplies materials or equipment for the Work, including that fabricated to a special design, but who does not perform labor at the site.

2.27 “Work” means all labor necessary to produce the construction required by the contract documents, and all materials and equipment incorporated or to be incorporated in the project.

2.28 “Written Notice” means any notice to any party of the Agreement relative to any part of this Agreement in writing and considered delivered and the service thereof completed, when posted by certified or registered mail to the said party at his last given address, or delivered in person to said party or his authorized representative on the Work.

3. Additional Instructions and Detail Drawings. The Contractor may be furnished additional instructions and detail drawings as necessary to carry out the work included in the contract. The additional drawings and instructions thus supplied to the Contractor will coordinate with the contract documents and will be so prepared that they can be reasonably interpreted as part thereof.

4. Shop or Setting Drawings. Shop or setting drawings shall be in accordance with the following:

4.1 The Contractor shall furnish 6 copies of the manufacturer's shop drawings, specific design data as required in the detailed specifications, and technical literature covering all equipment and fabricated materials which he proposes to furnish under this contract in sufficient detail to indicate full compliance with the specifications. Shop drawings shall indicate the method of installing, the exact layout dimensions of the equipment or materials, including the location, size and details of valves, pipe connections, etc.

4.2 No equipment or materials shall be shipped until the manufacturer's shop drawings and specifications or other identifying data, assuring compliance with these specifications, are approved by the Engineer.

4.3 The Contractor shall check and verify all field measurements and shall be responsible for the prompt submission of all shop and working drawings so that there shall be no delay in the work.

4.4 Regardless of corrections made in or approval given to such drawings by the Engineer, the Contractor will nevertheless be responsible for the accuracy of such

drawings and for their conformity to the plans and specifications. The Contractor shall notify the Engineer in writing of any deviations at the time he furnishes such drawings. He shall remain responsible for the accuracy of the drawings showing the deviations but not for the acceptance of the deviations from the original design shown in the plans and specification. Approval by the Engineer and the Owner of any deviation in material, workmanship or equipment proposed subsequent to approval of the shop drawings or design data, shall be requested in writing by the Contractor.

4.5 When submitted for the Engineer's review, Shop Drawings shall bear the Contractor's certification that he has reviewed, checked and approved the Shop Drawings and that they are in conformance with the requirements of the Contract Documents.

5. Materials, Services, Facilities and Workmanship shall be furnished as follows:

5.1 Except as otherwise specifically stated in the contract documents, the Contractor shall provide and pay for all materials, labor, tools, equipment, water, light, power, transportation, superintendence, temporary construction of every nature, and all other services and facilities of every nature whatsoever necessary to execute, complete, and deliver the work within the specified time.

5.2 Unless otherwise specifically provided for in the specifications, all workmanship, equipment, materials and articles incorporated in the work shall be new and the best grade of the respective kinds for the purpose.

5.3 The Contractor shall furnish to the Engineer for approval the manufacturer's detailed specifications for all machinery, mechanical and other special equipment, which he contemplates installing together with full information as to type, performance characteristics, and all other pertinent information as required.

5.4 Materials which are specified by reference to the number or symbol of a specific standard, such as an ASTM standard, a federal specification or other similar standard, shall comply with requirements in the latest revision thereof and any amendment or supplement thereto in effect on the date of the advertisement for bids, except as limited to type, class or grade, or modified in such reference. The standards referred to shall have full force and effect as though printed therein.

5.5 For equipment or for materials, when requested by the Engineer, the Contractor shall submit certificates of compliance from the manufacturer, certifying that the equipment or the materials comply with the requirements of the specifications or the standards.

5.6 Manufactured articles, materials, and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the manufacturer.

5.7 Materials, supplies, and equipment shall be in accordance with samples submitted by the Contractor and approved by the Engineer.

6. Contractor's Title To Materials. No material, supplies, or equipment to be installed or furnished under this contract shall be purchased subject to any chattel mortgage or under a conditional sale, lease purchase or other agreement by which an interest therein or in any part thereof is retained by the seller or supplier. The Contractor shall warrant good title to all materials, supplies, and equipment installed or incorporated in the work and upon completion of all work, shall deliver the same together with all improvements and appurtenances constructed or placed thereon by him to the Owner free from any claims, liens, or charges. Neither the Contractor nor any person, firm or corporation furnishing any material or labor for any work covered by this contract shall have any right to a lien upon any improvement or appurtenance thereon. Nothing contained in this paragraph, however, shall defeat or impair the right of persons furnishing materials or labor to recover under any bond given by the Contractor for their protection or any rights under any law permitting such persons to look to funds due the Contractor in the hands of the Owner. The provisions of this paragraph shall be inserted in all subcontracts and material contracts and notice of its provisions shall be given to all persons furnishing materials for the work when formal contract is entered into for such materials.
7. Inspection and Testing of Materials shall be as follows:
 - 7.1 All materials and equipment used in the construction of the project shall be subject to inspection and testing by the Engineer in accordance with accepted standards at any and all times during manufacture or during the project construction and at any or all places where such manufacture is carried on.
 - 7.2 The Contractor shall furnish promptly upon request by the Engineer, all materials required to be tested. All tests made by the Engineer shall be performed in such manner and ahead of scheduled installation, as not to delay the work of the Contractor. When required, testing of concrete, masonry, soils, pipe and pipe materials will be made in accordance with provisions in the specifications.
 - 7.3 Material required to be tested which is delivered to the job site shall not be incorporated into the work until the tests have been completed and approval or acceptance given in writing by the Engineer.
 - 7.4 Each sample submitted by the Contractor for testing shall carry an identification label containing such information as is requested by the Engineer. It shall also include a statement that the samples are representative of the remaining materials to be used on the project.
 - 7.5 Approval of any materials shall be general only and shall not constitute a waiver of the Owner's right to demand full compliance with the contract requirements.
 - 7.6 The Engineer may, at his own discretion, undertake the inspection of materials at the source. In the event plant inspection is undertaken, the following conditions shall be met:

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- a. The Engineer shall have the cooperation and assistance of the Contractor and the producer with whom he has contracted for materials.
- b. The Engineer shall have full entry at all reasonable times to such areas as may concern the manufacture or production of the materials being furnished.
- c. If required, the Contractor shall arrange for a building for the use of the inspector; such building to be located near the plant, independent of any building used by the material producer, in which to house and use the equipment necessary to carry on the required tests. Cost for such arrangement shall be paid by the Owner as a stated allowance in the bid.
- d. Adequate safety measures shall be provided and maintained at all times.

7.7 Except as otherwise specifically stated in the contract, the costs of sampling and testing will be divided as follows:

- a. The Contractor shall furnish the Engineer, without extra cost, all samples required for testing purposes. All sampling and testing including the number and selection of samples shall be determined by the Engineer for his own information and use.
- b. When testing of materials is specified in the appropriate section of the specifications, the cost of the same shall be charged to the Owner or Contractor, as detailed in the specifications. However, costs of equipment performance tests shall be borne by the Contractor, as detailed in the appropriate section of the specifications.
- c. When the Contractor proposes a material, article or component as equal to the ones specified, reasonable tests may, or may not, be required by the Engineer. If the Engineer requires tests of a proposed equal item, the Contractor will be required to assume all costs of such testing.
- d. Any material, article or component which fails to pass tests required by the Engineer or by the specifications, will be rejected and shall be removed from the project site. However, if, upon request of the Contractor, retesting or further tests are permitted by the Engineer, the Contractor shall assume all costs related to such retesting or further tests.
- e. Neither the Owner nor the Engineer will in any way be charged for the manufacturer's costs in supplying certificates of compliance.

7.8 If the Contract Documents, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any Work to specifically be inspected, tested or approved by someone other than the Contractor, the Contractor will give the Engineer

timely notice of readiness. The Contractor will then furnish the Engineer with the required certificates of inspection, testing or approval.

7.9 Inspections, tests, or approvals by the engineer or others shall not relieve the Contractor from obligations to perform the Work in accordance with the requirements of the Contract Documents.

8. “Or Equal” Clause, Substitutions and Contractor Options.

8.1 Whenever a material, article, or piece of equipment is identified on the plans or in the specifications by reference to manufacturer's or vendor's names, trade names, catalogue numbers, etc., it is intended merely to establish a standard of quality and performance. Any material, article, or equipment of other manufacturers and vendors, which will perform satisfactorily the duties imposed by the general design, shall be considered equally acceptable provided the material, article, or equipment so proposed is, in the opinion of the Engineer, of equal quality and function. The Engineer shall determine equality based on such information, tests, or other supporting data that may be required of the Contractor.

8.2 Upon acceptance and approval by the Engineer of an equal product, it shall remain the responsibility of the Contractor to coordinate installation of the item with all other items to be furnished to assure proper fitting together of all items. Similar responsibility applies to items which are left to the Contractor's option. Any additional cost of equal items and any additional cost incidental to the coordination and/or fitting together of such items shall be borne by the Contractor at no extra cost to the Owner.

8.3 If a specified or equal item is not available to meet the construction schedule, the Contractor may propose a substitute item of less than equal performance and quality. If this substitute is acceptable to the Engineer, any difference in purchase cost or costs incidental to the installation of such item will be negotiated between the parties to the contract.

8.4 Neither equal nor substitute items shall be installed without written approval of the Engineer.

8.5 The Contractor shall warrant that if substitutes are approved, no major changes in the function or general design of the Project will result.

9. Patents. Patent information is as follows:

9.1 The Contractor shall hold and save the Owner and its officers, agents, servants, and employees harmless from liability of any nature or kind, including cost and expenses for, or on account of, any patented or unpatented invention, process, article, or appliance manufactured or used in the performance of the contract, including its use by the Owner, unless otherwise specifically stipulated in the contract documents.

9.2 License and/or royalty fees for the use of a process used in wastewater plant design which is authorized by the Owner for the project, must be reasonable, and paid to the holder of the patent, or his authorized licensee.

9.3 If the Contractor uses any design, device or materials in the construction methods for the project covered by patents or copyrights, he shall provide for such use by suitable agreement with the owner of such patented or copyrighted design, device or material. It is mutually agreed and understood, that, without exception, the contract prices shall include all royalties or costs arising from the use of such design, device or materials, in any way involved in the work. The Contractor and/or his sureties shall indemnify and save harmless the Owner of the project from any and all claims for infringement by reason of the use of such patented or copyrighted design, device or materials or any trademark or copyright in connection with work agreed to be performed under this contract, and shall indemnify the Owner for any cost, expense or damage which it may be obliged to pay by reason of such infringement at any time during the construction of the work or after completion of the work.

10. Surveys. Surveys of land, property and construction shall be as follows:

10.1 The Owner will provide all land surveys and will establish and locate all property lines relating to the project.

10.2 For structures, the Engineer will establish and stake out one or more base lines as needed and will establish bench marks in and around the project site for the use of the Contractor and for the Engineer's own reference in checking the work in progress. For structures such as pipelines, the Engineer will establish the location of the pipe, manholes and other appurtenances, and will establish bench marks along the route of the pipeline at intervals for the using of the Contractor and for his own reference in checking the pipe and manhole inverts and other elevations throughout the project. The Contractor shall utilize the lines and bench marks established by the Engineer to set up whatever specific detail controls he may need for establishing location, elevation lines and grades of all structures. All this work is subject to checking, approval, and continuous surveillance by the Engineer to avoid error. The Contractor shall provide the Engineer with a qualified man or men to assist in this checking as needed and on request of the Engineer.

10.3 For construction other than pipelines and appurtenances in roadways and cross country, the Contractor shall be responsible for the location and setting lines and grades. The Contractor shall establish the location for pump station and wastewater treatment facility structures, associated yard piping including electrical conduits, internal piping and all equipment. Base lines and benchmarks for setting of the lines and grades for the above shall be provided by the Engineer.

10.4 Protection of stakes. The Contractor shall protect and preserve all of the established baseline stakes, bench marks, or other controls placed by the Engineer. Any of these items destroyed or lost through fault of the Contractor will be replaced by the Engineer at the Contractor's expense.

11. Contractor's Obligations are as follows: The Contractor shall and in good workmanlike manner, do and perform all work and furnish and pay for all supplies and materials, machinery, equipment, facilities and means, except as herein otherwise expressly specified, necessary or proper to perform and complete all the work required by this contract, within the time stated in the proposal in accordance with the plans and drawings covered by this contract, and any and all supplemental plans and drawings, in accordance with the directions of the Engineer as given from time to time during the progress of the work, whether or not he considers the direction in accordance with the terms of the contract. He shall furnish, erect, maintain and remove such construction plant and such temporary works as may be required. The Contractor shall observe, comply with, and be subject to all terms, conditions, requirements, and limitations of the contract documents, and shall do, carry on and complete the entire work to the satisfaction of the Engineer and Owner.

Contractor shall carry on the work and adhere to the progress schedule during all disputes, disagreements or unresolved claims with the Owner. No work shall be delayed or postponed pending the resolution of any disputes, disagreements, or claims except as the Owner and Contractor may otherwise agree in writing.

12. Weather Conditions. In the event of temporary suspension of work, or during inclement weather, or whenever the Engineer shall direct, the Contractor and his Subcontractors shall protect their work and materials against damage or injury from the weather. If, in the opinion of the Engineer, any work or material shall have been damaged or injured by reason of failure on the part of the Contractor or any of his Subcontractors to so protect his work, such materials shall be removed and replaced at the expense of the Contractor.

13. Protection of Work and Property shall be provided as follows:

13.1 The Contractor shall at all times safely guard the Owner's property from injury or loss in connection with this contract. He shall at all times safely guard and protect his own work, and that of adjacent property, from damage. The Contractor shall replace or make good any such damage, loss or injury unless caused directly by errors contained in the contract, or by the Owner, or his authorized representatives. The Contractor will notify owners of adjacent utilities when prosecution of the Work may affect them.

13.2 The Contractor shall take all necessary precautions for the safety of employees on the work site, and shall comply with all applicable provisions of federal, state and municipal safety laws and building codes to prevent accidents or injury to persons on, about or adjacent to the premises where the work is being performed. He shall erect and properly maintain at all times, as required by the conditions and progress of the work, all necessary safeguards for the protection of the workmen and the public and shall post danger signs warning against the hazards created by such features of construction as protruding nails, hoists, well holes, elevator hatchways, scaffolding, window openings, stairways, trenches and other excavations, and falling materials, and he shall designate a responsible member of his organization on the work, whose duty shall be the prevention of accidents. The name and position of any person so designated shall be reported to the

Engineer by the Contractor. The person so designated shall be available by phone during nonworking hours.

13.3 In case of emergency which threatens loss or injury of property, and/or safety of life, the Contractor is allowed to act, without previous instructions from the Engineer. He shall notify the Engineer immediately thereafter. Any claim for compensation by the Contractor due to such extra work shall be promptly submitted in writing to the Engineer for approval.

13.4 When the Contractor has not taken action but has notified the Engineer of an emergency threatening injury to persons or damage to the work or any adjoining property, he shall act as instructed or authorized by the Engineer.

13.5 The intention is not to relieve the Contractor from acting, but to provide for consultations between Engineer and Contractor in an emergency which permits time for such consultations.

13.6 The amount of reimbursement claimed by the Contractor on account of any emergency action shall be determined in the manner provided in Article 17 (extra work and change orders) of the general conditions.

14. Inspection of work for conformance with plans and specifications.

14.1 For purposes of inspection and for any other purpose, the Owner, the Engineer, and agents and employees of the Division or of any funding agency may enter upon the work and the premises used by the Contractor, and the Contractor shall provide safe and proper facilities therefore. The Engineer shall be furnished with every facility for ascertaining that the work is in accordance with the requirements and intention of this contract, even to the extent of uncovering or taking down portions of finished work.

14.2 During construction and on its completion, all work shall conform to the location, lines, levels and grades indicated on the drawings or established on the site by the Engineer and shall be built in a workmanlike manner, in accordance with the drawings and specifications and the supplementary directions given from time to time by the Engineer. In no case shall any work which exceeds the requirements of the drawings and specifications be paid for as extra work unless ordered in writing by the Engineer.

14.3 Unauthorized work and work not conforming to plans and specifications shall be handled as follows:

- a. Work considered by the Engineer to be outside of or different from the plans and specifications and done without instruction by the Engineer, or in wrong location, or done without proper lines or levels, may be ordered by the Engineer to be uncovered or dismantled.

b. Work done in the absence of the Engineer or his agent may be ordered by the Engineer to be uncovered or dismantled.

c. Should the work thus exposed or examined prove satisfactory, the uncovering or dismantling and the replacement of material and rebuilding of the work shall be considered as "Extra Work" to be processed in accordance with article 17.

d. Should the work thus exposed or examined prove to be unsatisfactory the uncovering or dismantling and the replacement of material and rebuilding of the work shall be at the expense of the Contractor.

15. Reports, Records and Data shall be furnished as follows: The Contractor shall submit to the Owner such schedule of quantities and costs, progress schedules, payrolls, reports, estimates, records and other data as are required by the Contract Documents or as the Owner, Division or any funding agency may request concerning work performed or to be performed under this contract.

16. Superintendence by Contractor shall be furnished as follows: At the site of the work, the Contractor shall employ a competent construction superintendent or foreman who shall have full authority to act for the Contractor. The superintendent or foreman shall have been designated in writing by the Contractor as the Contractor's representative at the site. It is understood that such representative shall be acceptable to the Engineer and shall be the one who can be continued in that capacity for the particular job involved unless he ceases to be on the Contractor's payroll. Such representative shall be present on the site at all times as required to perform adequate supervision and coordination of the Work.

17. Extra Work and Change Orders shall be processed as follows:

17.1 The Engineer may at any time by written order and without notice to the sureties require the performance of such extra work or changes in the work as may be found necessary. The amount of compensation to be paid to the Contractor for any extra work so ordered shall be made in accordance with one or more of the following methods in the order of precedence listed below:

a. A price based on unit prices previously approved; or

b. A lump sum price agreed upon between the parties and stipulated in the order for the extra work;

c. A price determined by adding 15 percent to the "reasonable cost" of the extra work performed, such "reasonable cost" to be determined by the Engineer in accordance with the following paragraph.

17.2 The Engineer shall include the reasonable cost to the Contractor of all materials used, of all labor, both common and skilled, of foreman, trucks, and the fair-market rental rate for all machinery and equipment for the period employed directly on the work. The reasonable cost for extra work shall include the cost to the Contractor of any additional

insurance that may be required covering public liability for injury to persons and property, the cost of workmen's compensation insurance, federal social security, and any other costs based on payrolls, and required by law. The cost of extra work shall not include any cost or rental of small tools, buildings, or any portion of the time of the Contractor, his project supervisor or his superintendent, as assessed upon the amount of extra work, these items being considered covered by the 15 percent added to the reasonable cost. The reasonable cost for extra work shall also include the premium cost, if any, for additional bonds and insurance required because of the changes in the work.

17.3 In the case of extra work which is done by Subcontractors under the specific contract, or otherwise if so approved by the Engineer, the 15 percent added to the reasonable cost of the work will be allowed only to the Subcontractor. On such work an additional percentage of the reasonable cost (before addition of the 15 percent) will be paid to the Contractor for his work in directing the operations of the Subcontractor, for administrative supervision, and for any overhead costs. Such percentage shall be in accordance with the following schedule: reasonable cost up to and including \$50,000—10 percent; next \$50,000 to and including \$100,000—7½ percent; greater than \$100,000—5 percent.

17.4 The Engineer may authorize minor changes or alterations in the work not involving extra cost and not inconsistent with the overall intent of the contract documents. These shall be accomplished by a written field order. However, if the Contractor believes that any minor change or alteration authorized by the Engineer entitles him to an increase in the contract price, he may make a claim therefore as provided in article 21.

18. Time For Completion and Liquidated Damages. The following paragraphs address time for completion and liquidated damages:

18.1 It is hereby understood and mutually agreed, by and between the Contractor and the Owner, that the date of beginning and the time for completion as specified in the contract of the work to be done hereunder are Essential Conditions of this contract; and it is further mutually understood and agreed that the work embraced in this contract shall be commenced on a date to be specified in the "Notice to Proceed."

18.2 The Contractor agrees that said work shall be pursued regularly, diligently and continuously at such rate of progress as will insure full completion thereof within the time specified. It is expressly understood and agreed, by and between the Contractor and the Owner, that the time for the completion of the work described herein is a reasonable time, taking into consideration the average climatic range and usual industrial conditions prevailing in this locality.

18.3 If the Contractor shall neglect, fail or refuse to complete the work within the time herein specified, or any proper extension thereof granted by the Owner, then the Contractor does hereby agree, as a part consideration for the awarding of this contract, to pay to the Owner the amount specified in the contract, not as a penalty but as liquidated damages for such breach of contract as hereinafter set forth, for each and every calendar day that the Contractor shall be in default after the time stipulated in the contract for completing the work.

18.4 The liquidated damages amount is fixed and agreed upon by and between the Contractor and the Owner because of the impracticability and extreme difficulty of fixing

and ascertaining the actual damages the Owner would in such event sustain. Said amount is agreed to be the amount of damages which the Owner would sustain and said amount shall be deducted from time to time by the owner from current periodical payments.

18.5 It is further agreed that "time is of the essence" of each and every portion of this contract and of the specifications wherein a definite and certain length of time is fixed for the performance of any act whatsoever; and where under the contract an additional time is allowed for the completion of any work, the new time limit fixed by such extension shall "be of the essence". Provided, that the Contractor shall not be charged with liquidated damages or any excess cost when the Owner determines that the Contractor is without fault and the Contractor's reasons for the time extension are acceptable to the Owner; provided, further, that the Contractor shall not be charged with liquidated damages or any excess cost when the delay in the completion of the work is due to:

- a. A preference, priority or allocation order duly issued by the government;
- b. An unforeseeable cause beyond the control and without the fault or negligence of the Contractor, including, but not restricted to, acts of God, or of the public enemy, acts of the Owner, acts of another Contractor in the performance of a contract with the Owner, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and severe weather;
- c. Any delays of Subcontractors or suppliers occasioned by any of the causes specified in subsections (a) and (b) of this article:

18.6 The Contractor shall promptly notify the Owner in writing of the causes of the delay. The Owner shall ascertain the facts and extent of the delay and notify the Contractor within a reasonable time of his decision in the matter.

19. Defective Work. Defective work shall be processed as follows:

19.1 The Contractor shall promptly remove from the premises all materials and work condemned by the Engineer as failing to meet contract requirements, whether incorporated in the work or not, and the Contractor shall promptly replace and re-execute his own work in accordance with the contract and without expense to the Owner and shall bear the expense of making good all work of other Contractors which was destroyed or damaged by such removal or replacement.

19.2 All removal and replacement work shall be done at the Contractor's expense. If the Contractor does not take action to remove such condemned work and materials within 10 days after receipt of written notice, the Owner may remove them and store the material at the expense of the Contractor. If the Contractor does not pay the expense of such removal and storage within 10 days time thereafter, the Owner may, upon 10 days written notice, sell such materials at auction or at private sale and shall pay to the Contractor any net proceeds thereof, after deducting all the costs and expenses that should have been borne by the Contractor.

20. Differing Site Conditions. Claims for differing site conditions shall be processed as follows:

20.1 The Contractor shall promptly and before such conditions are disturbed, notify the Engineer in writing of:

- a. Subsurface or latent physical conditions at the site differing materially from those indicated in this contract; or,
- b. Unknown physical conditions at the site, differing materially from those ordinarily encountered and generally recognized as inherent in the type of work provided for in this contract.

20.2 The Engineer shall promptly investigate the conditions. If he finds that conditions differ materially and will cause an increase or decrease in the Contractor's cost or the time required to perform any part of the work under this contract whether or not changed as a result of such conditions, the Engineer shall make an equitable adjustment and modify the contract in writing.

20.3 No claim of the Contractor under this clause shall be allowed unless the Contractor has given proper notice as required in paragraph 20.1 of this clause.

20.4 No claim by the Contractor for an equitable adjustment shall be allowed if asserted after final payment under this contract.

21. Claims For Extra Cost. Claims for extra cost shall be processed as follows:

21.1 No claim for extra work or cost shall be allowed unless the same was done pursuant to a written order by the Engineer, approved by the Owner and the claim presented for payment with the first estimate after the changed or extra work is done. When work is performed under the terms of article 17, the Contractor shall furnish satisfactory bills, payrolls and vouchers covering all items of cost when requested by the Owner and shall allow the Owner access to accounts relating thereto.

21.2 If the Contractor claims that any instructions by drawings or similar documents issued after the date of the contract involve extra cost under the contract, he shall give the Engineer written notice after the receipt of such instruction and before proceeding to execute the work, except in an emergency which threatens life or property, then the procedure shall be as provided for under article 17, "Extra Work & Change Orders." No claim shall be valid unless so made.

22. Right of Owner to Terminate Contract:

22.1 In the event that any of the provisions of this contract are violated by the Contractor, or by any of his Subcontractors, the Owner may serve written notice upon the Contractor and the surety of its intention to terminate the contract, and unless within 10 days after the serving of such notice upon the Contractor, such violation or delay shall cease and satisfactory arrangement for correction be made, the contract shall, upon the expiration of said 10 days cease and terminate. In the event of any such termination, the Owner shall immediately serve notice thereof upon the surety and the Contractor and the surety shall have the right to take over and perform the contract; provided, however, that if the surety does not commence performance thereof within 10 days from the date of the mailing to such surety of notice of termination, the Owner may take over the work and prosecute the same to completion by contract or by force account for the account and at the expense of the Contractor and the Contractor and his surety shall be liable to the Owner for any excess cost occasioned the Owner thereby, and in such event the Owner

may take possession of and utilize in completing the work, such materials, appliances, and plant as may be on the site of the work and necessary therefore.

22.2 If the Contractor should be adjudged bankrupt, or if he should make a general assignment for the benefit of his creditors, or if a receiver should be appointed on account of his insolvency, or if he should refuse or should fail, except in cases for which extensions of time are provided, to supply enough skilled workmen or materials, or if he should fail to make payments to Subcontractors or for material or labor, so as to affect the progress of the work, or be guilty of a violation of the contract, then the Owner, upon the written notice of the Engineer that sufficient cause exists to justify such action may, without prejudice to any other right or remedy and after giving the Contractor and his surety 7 days' written notice, terminate the employment of the Contractor and take possession of the premises and of all materials, tools, equipment and other facilities installed on the work and paid for by the Owner, and finish the work by whatever method he may deem expedient. In the case of termination of this contract before completion from any cause whatever, the Contractor, if notified to do so by the Owner, shall promptly remove any part or all of his equipment and supplies at the expense of the Contractor. If such expense exceeds such unpaid balance, the Contractor shall pay the difference to the Owner. The expense incurred by the Owner as herein provided, and the damage incurred through the Contractor's default, shall be approved by the Engineer.

22.3 Where the contract has been terminated by the Owner, said termination shall not affect or terminate any of the rights of the Owner as against the Contractor or his surety then existing or which may thereafter accrue because of such default. Any retention or payment of monies by the Owner due the Contractor under the terms of the contract, shall not release the Contractor or his surety from liability for his default.

22.4 After ten (10) days from delivery of a Written Notice to the Contractor and the Engineer, the Owner may, without cause and without prejudice to any other remedy, elect to abandon the Project and terminate the Contract. In such case the Contractor shall be paid for all Work executed and any expense sustained plus reasonable profit.

22.5 If through no act or fault of the Contractor, the Work is suspended for a period of more than ninety (90) days by the Owner or under an order of court or other public authority, or the Engineer fails to act on any request for payment within thirty (30) days after it is submitted, or the Owner fails to pay the Contractor substantially the sum approved by the Engineer or awarded by arbitrators within thirty (30) days of its approval and presentation, then the Contractor may, after ten (10) days from delivery of a Written Notice to the Owner and the Engineer terminate the Contract and recover from the Owner payment for all Work executed and all expenses sustained. In addition and in lieu of terminating the Contract, if the Engineer has failed to act on a request for payment or if the Owner has failed to make any payment as aforesaid, the Contractor may upon ten (10) days written notice to the Owner and the Engineer stop the Work until paid all amounts then due, in which event and upon resumption of the Work Change Orders shall be issued for adjusting the Contract Price or Extending the Contract Time or both to compensate for the costs and delays attributable to the stoppage of the Work.

22.6 If the performance of all or any portion of the Work is suspended, delayed, or interrupted as a result of failure of the Owner or Engineer to act within the time specified in the Contract Documents, or if no time is specified, within a reasonable time, an adjustment in the Contract Price or an extension of the Contract Time, or both, shall be

made by Change Order to compensate the Contractor for the costs and delays necessarily caused by the failure of the Owner or Engineer.

23. Construction Schedule and Periodic Estimates shall provide for the following:

23.1 Before starting the work or upon request by the Engineer during its progress, the Contractor shall submit to the Engineer a work plan showing construction methods and the various steps he intends to take in completing the work.

23.2 Before the first partial payment is made, the Contractor shall prepare and submit to the Engineer:

- a. A written schedule fixing the dates for submission of drawings; and
- b. A written schedule fixing the respective dates for the start and completion of segments of the work. Each such schedule shall be subject to review and change during the progress of the work.
- c. Respective dates for submission of Shop Drawings and for the beginning of manufacture, the testing, and the installation of materials, supplies, and equipment.
- d. A schedule of payments that the Contractor anticipates will be earned during the course of the Work.

24. Payments to Contractor. Payments to the Contractor shall be made as follows:

24.1 Progress payments. The Owner will once each month make a progress payment to the Contractor on the basis of an estimate of the total amount of work done to the time of the estimate and its value as prepared by the Contractor and approved by the Engineer.

24.2 Retainage by Owner. The Owner will retain a portion of the progress payment, each month, in accordance with the following procedures:

- a. The Owner will establish an escrow account in the bank of the Owner's choosing. The account will be established such that interest on the principal will be paid to the Contractor. The principal will be the accumulated retainage paid into the account by the Owner. The principal will be held by the bank, available only to the Owner, until termination of the contract.
- b. Until the work is 50% complete, as determined by the Engineer, retainage shall be 10% of the monthly payments claimed. The computed amount of retainage will be deposited in the escrow account established above.
- c. After the work is 50% complete, and provided the Contractor has satisfied the Engineer in quality and timeliness of the work, and provided further that there is no specific cause for withholding additional retainage no further amount will be withheld. The escrow account will remain at the same balance throughout the remainder of the project, unless drawn upon by the Owner in accordance with articles 19, 22, and 58.

d. Upon substantial or final completion (as defined in article 25), the amount of retainage will be reduced to 2% of the total Contract Price plus an additional retainage based on the Engineer's estimate of the fair value of the punch list items and the cost of completing and/or correcting such items of work, with specified amounts for each incomplete or defective item of work. As these items are completed or corrected, they shall be paid for out of the retainage until the entire project is declared completed (See article 25). The final 2% retainage shall be held during the one-year warranty period and released only after the Owner has accepted the project.

24.3 In reviewing monthly estimates for payments of the value of work done, the Engineer may accept in the estimate, prior to subtracting the retainage, the delivered cost of certain equipment and nonperishable material which have been delivered to the site or off-site location and which are properly stored and protected from damage. With the estimate, the Contractor shall submit to the Engineer invoices as evidence that the material has been delivered to the site. Prior to submitting the next monthly estimate, the Contractor shall provide the Engineer with paid invoices or other evidence that the materials have been paid for. If the Contractor fails to submit such evidence, the Engineer may then subtract the value of such materials or equipment for which the Owner has previously paid, from the next monthly estimate. The type of equipment and material eligible for payment prior to being incorporated in the work will be at the Engineer's discretion. Material and equipment made specifically for the subject job will be eligible for payment.

24.4 All material and work for which partial payments have been made shall thereupon become the sole property of the Owner. This provision shall not be construed as relieving the Contractor from the sole responsibility for the care and protection of materials and work upon which payments have been made or for the restoration of any damaged work, or as a waiver of the right of the Owner to require compliance with all of the terms of the contract.

24.5 Owner's right to withhold payments and make application. The Contractor agrees that he will indemnify and save the Owner or the Owner's agents harmless from all claims growing out of the lawful demands of Subcontractors, laborers, workmen, mechanics, material men, and furnishers of machinery and parts, equipment, power, tools and all supplies, including commissary, incurred in the furtherance of the performance of this contract. The Contractor shall, at the Owner's request, furnish satisfactory evidence that all claims of the nature hereinabove designated have been paid, discharged, or waived. If the Contractor fails to do so, then the Owner may, upon written notice to the Contractor either pay unpaid bills of which the Owner has written notice directly, or withhold from the Contractor's unpaid compensation a sum of money to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged. Payment to the Contractor shall then be resumed in accordance with the terms of this contract but in no event shall the above provisions be construed to impose any obligations upon the Owner to either the Contractor or his surety or any third party. In paying any unpaid bills of the Contractor, the Owner shall be deemed the agent of the Contractor, and any payment so made by the Owner shall be considered as payment made under contract by the Owner to the Contractor and the Owner shall not be liable to the Contractor for any such payments made in good faith.

24.6 If the Owner fails to make payment forty-five (45) days after approval by the Engineer, in addition to other remedies available to the Contractor, there shall be added to

each such payment interest at an annual rate of 10% commencing on the first day after said payment is due and continuing until the payment is received by the Contractor.

25. Acceptance and Final Payment provisions shall be as follows:

25.1 Substantial completion and payment.

a. Substantial completion shall be that point, as certified by the Engineer, at which the contract has been completed to the extent that the Owner may occupy and/or make use of the work performed for the purposes for which it was intended. Upon substantial completion there may be minor items, such as seeding, landscaping, etc., yet to be completed or items of work to be corrected.

b. Upon receipt of written notice from the Contractor that the work is substantially complete, the Engineer shall promptly make an inspection, and when he finds the work complies with the terms of the contract and the contract is substantially completed, he will issue a signed and dated certificate, and a list of all items to be completed or corrected, stating that the work required by this contract has been substantially completed and is accepted by him.

c. Upon substantial completion, the entire balance due and payable to the Contractor less 2 percent of the Contract Price, and less a retention based on the Engineer's estimate of the fair value for the cost of completing or correcting listed items of work with specified amounts for each incomplete or defective item of work shall be made.

d. The general guarantee period for the work shall begin on the date certified by the Engineer that the work is substantially completed.

25.2 Final completion shall be that point at which all work has been completed and all defective work has been corrected. Unless the Engineer has issued a certificate of substantial completion, the general guarantee period shall begin upon certification by the Engineer of final completion.

25.3 At the end of the general guarantee period for the entire contract which has been certified finally completed or substantially completed, the Owner, through the Engineer, shall make a guarantee inspection of all or portions of the work. When it is found that the work is satisfactory and that no work has become defective under the terms of the contract, the Owner will accept the entire project and make final payment, including the reimbursement of monies retained pursuant to the guarantee period.

25.4 If the guarantee inspection discloses any work as being unsatisfactory, the Engineer will give the Contractor the necessary instructions for correction of such work, and the Contractor shall immediately execute such instructions. Upon correction of the work, another inspection will be made which shall constitute the guarantee inspection, provided the work has been satisfactorily completed.

25.5 Before issuance of final payment, the Contractor shall certify in writing to the Engineer that all payrolls, material bills, and other indebtedness connected with the work have been paid or otherwise satisfied; except that in case of disputed indebtedness or liens, if the contract does not include a payment bond, the Contractor may submit in lieu of certification of payment a surety bond in the amount of the disputed indebtedness or

liens, guaranteeing payment of all such disputed amounts, including all related costs and interest in connection with said disputed indebtedness or liens which the Owner may be compelled to pay upon adjudication.

25.6 If upon substantial completion, full completion is delayed through no fault of the Contractor, and the Engineer so certifies, the Owner may, upon certificate of the Engineer, and without termination of the contract, make payment of the balance due for that portion of the work fully completed and accepted. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

25.7 The acceptance by the Contractor of final payment shall release the Owner from all claims and all liability to the Contractor for all things relating to this work and for every act and neglect of the Owner and others relating to or arising out of this work. No payment, however, final or otherwise, shall operate to release the Contractor or his sureties from any obligations of the performance and payment bond under this contract.

26. Payments by Contractor. The Contractor shall pay the costs:

26.1 For all transportation and utility services not later than the 20th day of the calendar month following that in which services are rendered;

26.2 For all materials, tools, and other expendable equipment to the extent of 90 percent of the cost thereof, not later than the 20th day of the calendar month following that in which such materials, tools and equipment are delivered at the site of the work and the balance of the cost thereof not later than the 30th day following the completion of that part of the work in or on which such materials, tools and equipment are incorporated or used; and

26.3 To each of his Subcontractors, not later than the 5th day following each payment to the Contractor, the respective amounts allowed the Contractor on account of the work performed by his Subcontractors to the extent of each Subcontractor's interest therein.

27. Insurance. The Contractor and any Subcontractor shall obtain all the insurance required under this article and such insurance shall be approved by the Owner.

27.1 The Contractor and all Subcontractors shall procure and shall maintain during the life of this contract workmen's compensation insurance as required by applicable state law. The Contractor shall provide and shall cause each Subcontractor to provide adequate employer's liability insurance.

Limits of Liability: \$100,000 each accident;
\$500,000 disease - policy limit;
\$100,000 disease - each employee.

27.2 The Contractor shall procure and shall maintain during the life of this contract Commercial General liability insurance to include contractual liability, explosion, collapse and underground coverages.

Limits of liability: \$1,000,000 each occurrence bodily injury and property damage;
\$2,000,000 general aggregate - include per project aggregate endorsement;
\$2,000,000 products/completed operations aggregate.

If blasting or demolition or both is required by the contract, the Contractor or Subcontractor shall obtain the respective coverage and shall furnish the Engineer a certificate of insurance evidencing the required coverages prior to commencement of any operations involving blasting or demolition or both.

27.3 The Contractor shall procure and shall maintain during the life of this contract comprehensive automobile liability insurance to include all motor vehicles including owned, hired, borrowed and non-owned vehicles.

Limits of liability: \$1,000,000 combined single limit for
bodily injury and property damage.

27.4 The Contractor shall either:

a. Require each of his Subcontractors to procure and to maintain during the life of his subcontract commercial general liability insurance and comprehensive automobile liability insurance of the type and in the amounts specified in articles 27.2 and 27.3; or

b. Insure the activities of his Subcontractors in his policy.

27.5 The required insurance shall provide adequate protection for the Contractor and his Subcontractors, respectively, against damage claims which may arise from work under this contract, whether such work be by the insured or by anyone employed by him and also against any of the special hazards which may be encountered in the performance of this contract.

27.6 The Contractor shall furnish the Owner with certificates showing the type, amount, class of operations covered, effective dates and dates of expiration of policies. Such insurance shall not be canceled or materially altered, except after 10 days written notice has been received by the Owner.

27.7 For builder's risk insurance (fire and extended coverage) and until the work is completed and accepted by the Owner, the Contractor is required to maintain builder's risk type insurance on a 100 percent completed value basis on the insurable portion of the work for the benefit of the Owner, the Contractor, and Subcontractors as their interests may appear.

27.8 The Contractor shall take out and furnish to the Owner and maintain during the life of this contract, complete Owner's protective liability insurance.

Limits of Liability: \$1,000,000 each occurrence;
\$2,000,000 aggregate.

28. Contract Security. The Contractor shall within ten (10) days after the receipt of the Notice of Award furnish the Owner with a performance bond and a payment bond in penal sums equal to the amount of the contract price conditioned upon the performance by the Contractor of all undertakings, covenants, terms, conditions and agreements of the Contract Documents, and upon the prompt payment by the Contractor to all persons supplying labor and materials in the prosecution of the Work provided by the contract Documents. Such Bonds shall be executed by the Contractor and a corporate bonding company licensed to transact business in the state in which the Work is to be performed

and named on the current list of "Surety Companies Acceptable on Federal Bonds" as published in the Treasury Department Circular Number 570. The expense of these Bonds shall be borne by the Contractor.

29. Additional or Substitute Bond. If at any time a surety on any such Bond is declared as bankrupt or loses its right to do business in the state in which the Work is to be performed, or is removed from the list of Surety Companies accepted on Federal Bonds, the Contractor shall within ten (10) days after notice from the Owner to do so, substitute an acceptable bond (or bonds) in such form and sum and signed by such other surety or sureties as may be satisfactory to the Owner. The premiums on such bond shall be paid by the Contractor. No further payments shall be deemed due nor shall be made until the new surety or sureties shall have furnished such an acceptable bond to the Owner.
30. Assignments. The Contractor shall not assign the whole or any part of this contract or any monies due or to become due hereunder without written consent of the Owner. In case the Contractor assigns all or any part of any monies due or to become due under this contract, the instrument of assignment shall contain a clause substantially to the effect that it is agreed that the right of the assignee in and to any monies due or to become due to the Contractor shall be subject to prior claims of all persons, firms and corporations for services rendered or materials supplied for the performance of the work called for in this contract.
31. Mutual Responsibility of Contractors. If, through acts of neglect on the part of the Contractor, any other Contractor or any Subcontractor shall suffer loss or damage on the work site, the Contractor agrees to settle with such other Contractor or Subcontractor by agreement or arbitration if such other Contractor or Subcontractors will so settle. If such other Contractor or Subcontractors shall assert any claim against the Owner on account of any damage alleged to have been sustained, the Owner shall notify the Contractor, who shall indemnify and save harmless the Owner against any such claim.
32. Subcontracting. When subcontracting, the Contractor:
 - 32.1 May utilize the services of specialty Subcontractors on those parts of the work which, under usual contracting practices, are performed by specialty Subcontractors.
 - 32.2 Shall be as fully responsible to the Owner for the acts and omissions of his Subcontractors, and of persons either directly or indirectly employed by them, as he is for the acts and omissions of persons directly employed by him.
 - 32.3 Shall cause appropriate provisions to be inserted in all subcontracts relative to the work to bind Subcontractors to the Contractor by the terms of the contract documents insofar as applicable to the work of Subcontractors and to give the Contractor the same power as regards terminating any subcontract that the Owner may exercise over the Contractor under any provision of the contract documents.
 - 32.4 Shall not create any contractual relation between any Subcontractor and the Owner.
 - 32.5 Shall not award Work to Subcontractor(s), in excess of fifty percent (50%) of the Contract Price, without prior written approval of the Owner.

33. Authority of the Engineer. In performing his duties, the Engineer or his representative shall:

33.1 Have the authority to suspend the work in whole or in part for such periods as he may deem necessary due to the failure of the Contractor to carry out provisions of the Contract or for failure of the Contractor to suspend work in weather conditions considered by the Engineer to be unsuitable for the prosecution of the work. The Engineer shall give all orders and directions under this contract, relative to the execution of the work. The Engineer shall determine the amount, quality, acceptability, and fitness of the several kinds of work and materials which are to be paid for under this contract and shall decide all questions which may arise in relation to the work. The Engineer's estimates and decisions shall be final and conclusive, except as otherwise provided. In case any question shall arise between the parties hereto relative to said contract or specifications, the determination or decision of the Engineer shall be a condition precedent to the right of the Contractor to receive any money or payment for work under this contract affected to any extent by such question. The Engineer shall decide the meaning and intent of any portion of the specifications and of any plans or drawings where the same may be found unclear. Any differences or conflicts in regard to their work which may arise between the Contractor under this contract and other Contractors performing work for the Owner shall be adjusted and determined by the Engineer.

a. The purpose of the above article is not in any way to relieve the Contractor of his responsibilities for the safety of workmen or general public in the execution of the work. Attention is drawn to Article 13 of these Conditions which refers to the safety obligations of the Contractor.

b. The Engineer, acting on behalf of the Owner, has the authority to enforce corrective action for work not in accordance with the specifications.

c. In addition, the Engineer, acting on behalf of the Owner, is to ensure that the work is in accordance with the Contract documents. He is not held responsible, however, for the methods of construction, sequences, schedules and procedures in the execution of the work. The Engineer does have the opportunity under 33.1 to reject the method of construction, work plan schedule, procedures, as he thinks appropriate.

33.2 Appoint assistants and representatives as he desires, and they shall be granted full access to the work under the contract. They have the authority to give directions pertaining to the work, to approve or reject materials, to suspend any work that is being improperly performed, to make measurements of quantities, to keep records of costs, and otherwise represent the Engineer in all matters except as provided below. The Contractor may, however, appeal from their decision to the Engineer himself, but any work done pending its resolution is at the Contractor's own risk. Except as permitted and instructed by the Engineer, the assistants and representatives are not authorized to revoke, alter, enlarge, relax, or release any requirements of these specifications, nor to issue instructions contrary to the plans and specifications. They are not authorized to act as superintendents or foremen for the Contractor, or to interfere with the management of the work by the Contractor. Any advice which the assistants or representatives of the Engineer may give the Contractor shall not be construed as binding the Engineer or the Owner in any way, nor as releasing the Contractor from the fulfillment of the terms of the contract. All transactions between the Contractor and the representatives of the Engineer which are liable to protest or where payments are involved shall be made in writing.

34. Stated Allowances. The Contractor shall include in his proposal for costs of materials not shown in his bid under “cash allowances” or “allowed materials,” any cash allowances stated in the supplemental general conditions or other contract documents. The Contractor shall purchase the “allowed materials” as directed by the Owner on the basis of the lowest and best bid of at least 3 competitive bids. If the actual price for purchasing the “allowed materials” is more or less than the “cash allowance,” the contract price shall be adjusted accordingly. The adjustment in contract price shall be made on the basis of the purchase price without additional charges for overhead, profit, insurance or any other incidental expenses. The cost of installation of the “allowed materials” shall be included in the applicable sections of the contract specifications covering this work.
35. Use of Premises, Removal of Debris, Sanitary Conditions. In the use of premises or removal of debris, the Contractor expressly undertakes at his own expense: to take every precaution against injuries to persons or damage to property; to maintain sanitary conditions; to store his apparatus, materials, supplies and equipment in such orderly fashion at the site of the work as will not interfere with the progress of his work or the work of any other Contractors; to place upon the work or any part thereof only such loads as are consistent with the safety of that portion of the work; to clean up frequently all refuse, rubbish, scrap materials and debris caused by his operations, to the end that at all times the site of the work shall present an orderly and workmanlike appearance; before final payment to remove all surplus material falsework, temporary structures, including foundations thereof, plant of any description and debris of every nature resulting from his operations, and to put the site in an orderly condition; to effect all cutting, fitting or patching of his work required to make the same conform to the plans and specifications and, except with the consent of the Engineer, not to cut or otherwise alter the work of any other Contractor; to provide and maintain in a sanitary condition such toilet accommodations for the use of his employees as may be necessary to comply with the requirements of the state and local boards of health, or of other bodies or authorities having jurisdiction.
36. Quantities of Estimate. Wherever the estimated quantities of work to be done and materials to be furnished under this contract are shown in any of the documents including the proposal, they are given for use in comparing bids and the right is specifically reserved except as herein otherwise specifically limited, to increase or decrease them as may be deemed reasonably necessary by the Owner to complete the work contemplated by this contract, and such increase or decrease shall in no way invalidate this contract, nor shall any such increase or decrease give cause for claims or liability for damages. Such increases or decreases shall not exceed 25 percent of the estimated quantities of work. An increase or decrease in quantities for subsurface materials (e.g. ledge, unsuitable backfill), which overrun or underrun by 25% or more of the bid quantity may be the basis for a contract price adjustment, at the rate of a negotiated adjusted unit rate. Negotiated unit price rates shall be equitable and shall take into account, but not be limited to the following factors; bid unit rate, distribution of rates and bid balance, and the scope of work as affected by the changed quantities. Claims for extra work resulting from changed quantities shall be processed under article 21.
37. Lands and Rights-of-Way. Acquisition and usage of lands and rights-of-way shall be as follows:

37.1 Prior to issuing the Notice to Proceed, the Owner shall legally obtain all lands and rights-of-way necessary for carrying out and completing the work to be performed under this contract.

37.2 The Contractor shall not (except after written consent from the Owner) enter or occupy with men, tools, materials, or equipment, any land outside the rights-of-way or property of the Owner. A copy of the written consent shall be given to the Engineer.

37.3 The Owner shall provide to the Contractor information which delineates and describes the lands owned and the rights-of-way acquired.

37.4 The Contractor shall provide at its own expense and without liability to the Owner any additional land and access thereto that the Contractor may desire for temporary construction facilities, or for storage of materials.

38. General Guarantee. With reference to warranties, neither the final certificate of payment nor any provision in the contract documents, nor partial or entire occupancy of the premises by the Owner, shall constitute an acceptance of work not done in accordance with the contract documents or relieve the Contractor of liability in respect to any express warranties or responsibility for faulty materials or workmanship. The Contractor shall remedy any defects in the work and pay for any damage to other work resulting therefrom, which appear within the warranty period one year or longer if required by the contract, from the certified date of completion or substantial completion of the work. The Owner will give notice of observed defects within two working days of their discovery.

39. Errors and Inconsistencies. With reference to errors and inconsistency in contract documents, any provisions in any of the contract documents which may be in conflict with the paragraphs in these general conditions shall be subject to the following order of precedence for interpretation:

39.1 Drawings will govern technical specifications.

39.2 General conditions will govern drawings and technical specifications.

39.3 Supplemental general conditions will govern general conditions, drawings and technical specifications.

39.4 Special conditions will govern supplemental general conditions, general conditions, drawings and technical specifications.

39.5 The Contractor shall take no advantage of any apparent error or omission in the plans or specifications. In the event the Contractor discovers such an error or omission, he shall notify the Engineer. The Engineer will then make such corrections and interpretations as may be deemed necessary for fulfilling the intent of the plans and specifications.

39.6 Figure dimensions on Drawings shall govern over general drawings.

40. Notice and Service Thereof. Any notice to the Contractor from the Owner relative to any part of this contract will be in writing and will be considered delivered and the service completed, when said notice is mailed, by certified registered mail, to the Contractor at

his last given address, or delivered in person to the Contractor or his authorized representative on the work.

41. Required Provisions Deemed Inserted. Each and every provision of law and clause required by law to be inserted in this contract shall be deemed to be inserted herein and the contract shall be read and enforced as though it were included herein, and if through mistake or otherwise any such provision is not inserted or is not correctly inserted (example; miswording, etc.), then upon the application of either party the contract shall forthwith be physically amended to make such insertion or correction.
42. Protection of Lives and Health. The work under this contract is subject to the safety and health regulations (CRF 29, part 1926, and all subsequent amendments) as promulgated by the U.S. Department of Labor on June 24, 1974. Contractors are urged to become familiar with the requirements of these regulations.
43. OSHA Construction Safety Program.

43.1 Pursuant to NHRSA 277:5-a, the Contractor shall provide an Occupational Health and Safety Administration (OSHA) 10-hour construction safety program for its on-site employees. All employees are required to complete the program prior to beginning work. The training program shall utilize an OSHA-approved curriculum. Graduates shall receive a card from OSHA certifying the successful completion of the training program.

43.2 Any employee required to complete the OSHA 10-hour construction safety program, and who can not within 15 days provide documentation of completion of such program, shall be subject to removal from the job site.

43.3 The following individuals are exempt from the requirements of the 10-hour construction safety program: law enforcement officers involved with traffic control or jobsite security; flagging personnel who have completed the training required by the Department of Transportation; all relevant federal, state and municipal government employees and inspectors; and all individuals who are not considered to be on the site of work under the federal Davis-Bacon Act, including, but not limited to, construction and non-construction delivery personnel and non-trade personnel.

44. Equal Employment Opportunity. Under equal employment opportunity requirements and during the performance of this contract the Contractor agrees to the following:

44.1 The Contractor will not discriminate against any employee or applicant for employment because of race, creed, color, national origin, or sex. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, creed, color, national origin, or sex. Such action shall include, but not be limited to, the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

44.2 The Contractor will in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment, without regard to race, creed, color, national origin, or sex.

44.3 The Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the labor union or worker's representative of the Contractor's commitment under section 202 of executive order no. 11246 of September 24, 1965, and 11375 of October, 13, 1967, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

44.4 The Contractor will comply with all provisions of executive orders no. 11246 and 11375.

44.5 The Contractor will furnish all information and reports required by executive orders no. 11246 and 11375.

44.6 In the event of the Contractor's noncompliance with the nondiscrimination clauses of this contract or with any of such rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part by the Owner or the Department of Labor and the Contractor may be declared ineligible for further government contracts or federally-assisted construction, however, that in the event the Contractor becomes involved in, or is threatened with, litigation with a Subcontractor or vendor as a result of such direction by the Department of Labor, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

44.7 A breach of this article may be grounds for termination of this contract and for debarment as provided in 29 CFR 5.6.

45. Interest of Federal, State or Local Officials. No federal, state or local official shall be admitted to any share or part of this contract or to any benefit that may arise therefrom, but this provision shall not be construed to extend to this contract if made with a corporation for its general benefit.

46. Other Prohibited Interests. No official of the Owner who is authorized in such capacity and on behalf of the Owner to negotiate, make, accept or approve, or to take part in negotiating, making, accepting, or approving any architectural, Engineering, inspection, construction or material supply contract or any subcontract in connection with the construction of the project, shall become directly or indirectly interested personally in this contract or in any part hereof. No officer, employee, architect, attorney, Engineer or inspector of or for the Owner who is authorized in such capacity and on behalf of the Owner to exercise any legislative, executive, supervisory or other similar functions in connection with the construction of the project, shall become directly or indirectly interested personally in this contract or in any part thereof, any material supply contract, subcontract, insurance contract, or any other contract pertaining to the project.

47. Use and Occupancy Prior to Acceptance. Use and occupancy of a portion or unit of the project, upon completion of that portion or unit, and before substantial completion of the project, shall be a condition of this contract with the following provisions:

47.1 The Owner will make his request for use or occupancy to the Contractor in writing.

47.2 There must be no significant interference with the Contractor's work or performance of duties under the contract.

47.3 The Engineer, upon request of the Owner and agreement by the Contractor, will make an inspection of the complete part of the work to confirm its status of completion.

47.4 Consent of the surety and endorsement of the insurance carrier must be obtained prior to use and/or occupancy by the Owner. Also, prior to occupancy, the Owner will secure the required insurance coverage on the building.

47.5 The Owner will have the right to exclude the Contractor from the subject portion of the project after the date of occupancy but will allow the Contractor reasonable access to complete or correct items.

47.6 The warranty period shall begin upon substantial completion.

48. Suspension of Work. The Owner may, at any time and without cause, suspend the work or any portion thereof for a period of not more than 90 days by notice in writing to the Contractor and the Engineer. The Owner shall fix the date on which work shall be resumed. The Contractor will be allowed an increase in the contract price or an extension of the contract time, or both, directly attributable to any suspension if he makes a claim therefore as provided in articles 17 and 21.

49. [Reserved]

50. [Reserved]

51. [Reserved]

52. Project Sign. Furnish and erect a sign at the project site to identify the project and to indicate that the State Government is participating in the development of the project. Place the sign in a prominent location as directed by the Engineer. Do not place or allow the placement of other advertising signboards at the project site or along rights-of-way furnished for the project work. See Exhibit 1 for details of construction.

53. [Reserved]

54. Public Convenience and Traffic Control requirements:

54.1 The Contractor shall at all times so conduct his work as to assure minimal obstruction to traffic. The safety and convenience of the general public and the residents along the work site route and the protection of property shall be provided for by the Contractor. The Contractor shall be responsible for timely notification to local residents before causing any interruptions of their access.

54.2 Fire hydrants and water holes for fire protection on or adjacent to the work site shall be kept accessible to fire apparatus at all times, and no obstructions shall be placed within 10 feet of any such facility. No footways, gutters, drain inlets, or portions of highways adjoining the work site shall be obstructed. In the event that all or part of a roadway is officially closed to traffic during construction, the Contractor shall provide and maintain safe and adequate traffic accessibility, satisfactory to the Engineer, for residences and businesses along and adjacent to the roadway so closed.

54.3 When the maintenance of traffic is considered by the Engineer to be minimal, the contract may not show this work as a pay item. In such cases, the Contractor shall bear all expense of maintaining traffic over the sections of road undergoing improvement and of constructing and maintaining such approaches, crossings, intersections, and other features as may be necessary, without direct reimbursement.

55. Pre-Construction Conference. The Contractor shall not commence work until a pre-construction conference has been held at which representatives of the Contractor, Engineer, Division and Owner are present. The pre-construction conference shall be scheduled by the Engineer.

56. Maintenance During Construction.

56.1 The Contractor shall maintain the work during construction and until it is accepted by the Owner. This maintenance shall be continuous and effective work prosecuted day by day, with adequate equipment and forces, to the end that roads or structures are kept in satisfactory condition at all times.

56.2 All cost of maintenance during construction and before the work is accepted by the Owner shall be included in the unit prices bid on the various pay items and the Contractor shall not be paid an additional amount for such maintenance.

56.3 If the Contractor, at any time, fails to comply with the provisions above, the Engineer may direct the Contractor to do so. If the Contractor fails to remedy unsatisfactory maintenance within the time specified by the Engineer, the Engineer may immediately cause the project to be maintained and the entire cost of this maintenance will be deducted from money to become due the Contractor on this contract.

57. Cooperation with Utilities.

57.1 The Owner will notify all utility companies, all pipe line owners, or other parties affected, and have all necessary adjustments of the public or private utility fixtures, pipe lines, and other appurtenances within or adjacent to the limits of construction made as soon as practicable.

57.2 Water lines, gas lines, wire lines, service connections, water and gas meter boxes, water and gas valve boxes, light standards, cableways, signals, and all other utility appurtenances within the limits of the proposed construction which are to be relocated or adjusted are to be moved by the owners of such utilities at their expense, except as may otherwise be provided for in the special conditions or as noted on the plans.

57.3 It is understood and agreed that the Contractor has considered in his bid all of the permanent and temporary utility appurtenances in their present or relocated positions as shown on the plans and as evident on the site, and that no additional compensation will be allowed for any delays, inconvenience, damage sustained by him due to any interference from such utility appurtenances or the operation of moving them.

57.4 The Contractor shall cooperate with the Owners of any underground or overhead utility lines in their removal and rearrangement operations in order that these operations may progress in a reasonable manner, that duplication of rearrangements may be reduced to a minimum, and that services rendered by those parties will be minimal.

57.5 In the event of interruption to a water or utility service as a result of accidental breakage or as a result of being exposed or unsupported, the Contractor shall promptly notify the proper authority and shall cooperate with said authority in the restoration of services. If water service is interrupted, repair work shall be continuous until the service is restored. No work shall be undertaken around fire hydrants until provisions for continued service have been approved by the local fire authority. If any utility service is interrupted for more than 4 hours, the Contractor shall make provisions for temporary service at his own expense until service is resumed.

58. Work Performed at Night and on Sundays and Holidays shall comply with the following:

58.1 No work will be permitted at night or on Sundays or holidays except as approved in writing by the Engineer, and provided such work is not in violation of a local ordinance. When working at night, the Contractor shall provide flood lighting sufficient to insure the same quality of workmanship and the same conditions regarding safety as would be achieved in daylight.

58.2 Whenever Memorial Day or Fourth-of-July is observed on a Friday or a Monday and during the weekend of Labor Day, the Contractor may be required to suspend work for the 3 calendar days. Prior to the close of work, the work site shall be placed in a condition acceptable to the Engineer for the comfort and safety of the traveling public. An arrangement shall be made for responsible personnel acceptable to the Engineer to maintain the project in the above conditions.

59. Laws to be Observed. With reference to laws that shall be observed:

59.1 The Contractor shall keep fully informed of all federal and state laws, all local laws, ordinances, and regulations, and all orders and decrees of tribunals having any jurisdiction or authority, which in any manner affect those engaged or employed on the work. He shall at all times observe and comply with all such laws, ordinances, regulations, orders, and decrees; and shall protect and indemnify the state and its representatives against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order, or decree, whether by himself or his employees.

59.2 Indemnification

The Contractor will indemnify and hold harmless the Owner and the Engineer and their agents and employees from and against all claims, damages, losses, and expenses including attorney's fees arising out of or resulting from the performance of the Work, provided that any such claims, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property including the loss of use resulting therefrom; and is caused in whole or in part by any negligent or willful act or omission of the Contractor, and Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable.

In any and all claims against the Owner or the Engineer, or any of their agents or employees, by any employees of the Contractor, and Subcontractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, the indemnification obligation shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by disability benefit or other employee benefit acts.

The obligation of the Contractor under this paragraph shall not extend to the liability of the Engineer, his agents or employees arising out of the preparation or approval of maps, Drawings, opinions, reports, surveys, Change Orders, designs or Specifications.

60. Permits. Permits to be obtained by the Contractor shall be in accordance with the following:

60.1 Permits and licenses of a temporary nature necessary for the prosecution of the work shall be obtained and paid for by the Contractor. Permits, licenses and easements for permanent structures or permanent changes in existing facilities will be secured and paid for by the Owner. Permits may include:

- a. New Hampshire Department of Transportation Highway Trench Permits.
- b. RSA 485-A:17 and 483-A N.H. DES Wetlands Bureau Dredge and Fill Permit.
- c. RSA 485-A:17 - N.H. DES Site Specific Permit (Water Quality)
- d. RSA 149-M:10 N.H. DES Solid Waste Management Bureau - disposal of construction debris and/or demolition waste.
- e. N.H. Department of Environmental Services Air Resources Division (burning permits).
- f. Other permits, as required by State and Local laws and ordinances.
- g. Notice of intent for coverage under EPA's General NPDES Permit for construction dewatering activities.

61. Control of Pollution due to construction shall comply with the following:

61.1 During construction, the Contractor shall take precautions sufficient to avoid the leaching or runoff of polluting substances such as silt, clay, fuels, oils, bitumens, calcium chloride and any other polluting materials which are unsightly or which may be harmful to humans, fish, or other life, into groundwaters and surface waters of the State.

61.2 In waters used for public water supply or used for trout, salmon, or other game or forage fish spawning or nursery, control measures must be adequate to assure that turbidity in the receiving water will be increased not more than 10 standard turbidity units (s.t.u.) in the absence of other more restrictive locally-established limitations, unless otherwise permitted by the Division. In no case shall the classification for the surface water be violated.

61.3 In water used for other purposes, the turbidity must not exceed 25 s.t.u. unless otherwise permitted by the Division.

62. Use of Explosives.

62.1 When the use of explosives is necessary for the prosecution of the Work, exercise the utmost care not to endanger life or property. The Contractor shall be responsible for any and all damage resulting from the use of explosives.

62.2 Store all explosives in a secure manner, in compliance with all State and local laws and ordinances, and legally mark all such storage places. Storage shall be limited to such quantity as may be needed for the work underway.

62.3 Designate as a "Blasting Area" all sites where electric blasting caps are located and where explosive charges are being placed. Mark all blasting areas with signs as required by law. Place signs as required by law from each end of the blasting area and leave in place while the above conditions prevail. Immediately remove signs after blasting operations or the storage of caps is over.

62.4 Notify each property Owner and public utility company having structures in proximity to the site of the work sufficiently in advance to enable the companies to take such steps as they may deem necessary to protect their property. Such notice shall not relieve the Contractor of any of his responsibility for damage resulting from his blasting operation. Warn all persons within the danger zone of blasting operations and do not perform blasting work until the area is cleared. Provide sufficient flagmen outside the danger zone to stop all approaching traffic and pedestrians. Provide watchmen during the loading period and until charges have been exploded. Place adequate protective covering over all charges before being exploded.

63. Arbitration by Mutual Agreement.

63.1 All claims, disputes, and other matters in question arising out of, or relating to, the Contract Documents or the breach thereof, except for claims which have been waived by making an acceptance of final payment as provided in Section 25, may be decided by arbitration if the parties mutually agree. Any agreement to arbitrate shall be specifically enforceable under the prevailing arbitration law. The award rendered by the arbitrators shall be final, and judgment may be entered upon it in any court having jurisdiction thereof.

63.2 Notice of the request for arbitration shall be filed in writing with the other party to the Contract Documents and a copy shall be filed with the Engineer. Request for arbitration shall in no event be made on any claim, dispute, or other matter in question which would be barred by the applicable statute of limitations.

63.3 The Contractor will carry on the Work and maintain the progress schedule during any arbitration proceedings, unless other wise mutually agreed in writing.

64. Taxes. The Contractor shall pay all sales, consumer, use, and other similar taxes required by the laws of the place where the Work is performed.

65. Separate Contracts.

65.1 The Owner reserves the right to let other contracts in connection with this Project. The Contractor shall afford other Contractors reasonable opportunity for the introduction and storage of their materials and the execution of their Work, and shall properly connect and coordinate the Work with theirs. If the proper execution or results of any part of the Contractor's Work depends upon the Work of any other Contractor, the Contractor shall inspect and promptly report to the Engineer any defects in such Work that render it unsuitable for such proper execution and results.

65.2 The Owner may perform additional Work related to the Project or the Owner may let other contracts containing provisions similar to these. The Contractor will afford the other Contractors who are parties to such Contracts (or the Owner, if the Owner is performing the additional Work) reasonable opportunity for the introduction and storage of materials and equipment and the execution of the Work, and shall properly connect and coordinate the Work with theirs.

65.3 If the performance of the additional Work by other Contractors or the Owner is not noted in the Contract Documents prior to the execution of the Contract, written notice shall thereof be given to the Contractor prior to starting such additional Work. If the Contractor believes that the performance of such additional Work by the Owner or others involves it in additional expense or entitles it to an extension of the Contract Time, the Contractor may make a claim thereof as provided in Sections 17 and 18.

SUPPLEMENTAL GENERAL CONDITIONS

Supplemental General Conditions

The following supplemental general conditions modify, change, delete, or add to the "General Conditions." Where any part of the General Conditions is modified or voided by these Sections, the unaltered provisions of that part shall remain in effect.

<u>Section No.</u>	<u>Section Title</u>	<u>Page No.</u>
SGC- 14.1	Inspection	C-1.2
SGC- 15	Reports, Records and Data	C-1.13
SGC-17.1	Extra Work and Change Orders	C-1.13
SGC-20.2	Claims for Differing Site Conditions	C-1.16
SGC-24.2	Payments to Contractor	C-1.18
SGC-27	Insurance; Special Condition to GC27	C-1.21, 1.22
SGC-28	Contract Security	C-1.22
SGC-44.2	Non-Discrimination	C-1.27
SGC-52	Project Sign	C-1.29
SGC-55	Pre-Construction Conference	C-1.30
SGC-59.2	Indemnification	C-1.31
SGC- 62.5	Use of Explosives	C-1.32

SUPPLEMENTAL GENERAL CONDITIONS

SGC 14.1 Inspection

Replace first sentence to read: “For purposes of inspection and for any other purpose, the Owner, the Engineer, and of any funding agency may enter upon the work and the premises used by the Contractor, and the Contractor shall provide safe and proper facilities therefore.”

SGC- 15 Reports, Records and Data

Replace first sentence to read: “The Contractor shall submit to the Owner such schedule of quantities and costs, progress schedules, payrolls, reports, estimates, records and other data as are required by the Contract Documents or as the Owner may request concerning work performed or to be performed under this contract.”

SGC-17.1 Extra Work and Change Orders

The first sentence is modified to read: “The Engineer, with the approval of the Owner, may at any time by written order and without notice to the sureties require the performance of such extra work or changes in the work as may be found necessary.

SGC-18.6 Time for Completion and Liquidated Damages

Add the following to Article 18.6:

“If contractor is delayed in the performance or progress of the work by reasons outlined in Article 18.5a, 18.5b, or 18.5c, then contractor shall be entitled to an equitable adjustment in contract times, if such adjustment is essential to contractors ability to complete the work within the contract times. Such an adjustment shall be the contractor’s soul and exclusive remedy for the delays.”

SGC-20.2 Claims for Differing Site Conditions

Delete paragraph 20.2 in its entirety. **Replace** with the following:

“The Engineer shall promptly investigate the conditions. If he finds that conditions differ materially and will cause an increase or decrease in the Contractor’s cost or the time required to perform any part of the work under this contract whether or not changed as a result of such conditions, the Engineer will notify the Owner and recommend an equitable adjustment. Following recommendations by the Engineer, the Contractor and Owner will enter into negotiations to modify the contract in writing.”

SUPPLEMENTAL GENERAL CONDITIONS

SGC-24.2 Payment to Contractor

Delete paragraph 24.2a in its entirety.

Delete the second sentence of 24.2.b.

Delete the second sentence of 24.2.b. **Replace** with the following:

“The retainage amount will remain at the same balance throughout the remainder of the project, unless drawn upon by the Owner in accordance with articles 19, 22, and 58.”

SGC-27 Insurance (Special Condition to GC27)

Change the following in paragraph two, Article 27.1:

“Limits of Liability: \$100,000	\$1,000,000 each accident
	\$1,000,000 disease-policy limit
\$100,000	\$1,000,000 disease- each employee”

Change the following in paragraph two, Article 27.2:

“Limits of liability:	\$1,000,000	\$2,000,000 each occurrence
		bodily injury and property damage;
	\$2,000,000	general aggregate- include per project
		aggregate endorsement;
	\$2,000,000	products/completed operations aggregate.”

Add the following to Article 27.2:

“Coverage amounts may be satisfied by excess or umbrella policies provided the City of Portsmouth is listed as an additional insured on the excess/umbrella policy as well as the general liability policy. The City of Portsmouth shall be named as additional insured as follows:

City of Portsmouth
Attn: Legal Department
1 Junkins Avenue
Portsmouth, NH 03801”

Change the following in paragraph two, Article 27.3:

“Limits of liability:	\$1,000,000	\$2,000,000 combined single
		limit for bodily injury and property damage.”

Add the following to Article 27.3:

SUPPLEMENTAL GENERAL CONDITIONS

“Coverage amounts may be satisfied by excess or umbrella policies provided the City of Portsmouth is listed as an additional insured on the excess/umbrella policy as well as the general liability policy.”

Change the following in Article 27.6:

The second sentence shall read: “Such insurance shall not be cancelled or materially altered, except after 30 days written notice has been received by the Owner.”

Insert the following article 27.7:

27.7.1 Installation Floater:

For construction projects to which a “Builder’s Risk” type of insurance is not applicable, the Contractor shall purchase and maintain an “Installation Floater” in an amount not less than the value of materials for the project covered under the policy.

Delete Article 27.8 in its entirety.

Change the following in paragraph two, Article 27.8:

“Limits of Liability: \$2,000,000 each occurrence;
 \$2,000,000 aggregate.”

Add Article 27.9:

“For access onto Pike Industries, Inc. property, the Contractor shall maintain worker's compensation, employer's liability, automobile liability (if operating vehicles on the Property), and general liability insurance covering Contractor’s activities on the Property. Before accessing the Property and at any time Owner so requests, the Contractor shall furnish certificates of insurance evidencing the required insurance. The Contractor shall name “Pike Industries, Inc., 3 Eastgate Park Road, Belmont, NH” as an additional insured on a primary basis and Pike's coverage shall be noncontributory.”

SGC-28 Contract Security (Supplement to GC 28)

Add the following paragraphs to Article 28 of the General Conditions:

The payment bond and performance bond furnished by the contractor shall be in the form of the bonds shown on Page C-2.5 and C-2.6 and C-2.7 and C-2.8, unless approved otherwise by the engineer.

The terms contained in the performance bond shall in no way invalidate the provisions of the contract documents or the right of the owner to terminate the contract as specified therein.

SUPPLEMENTAL GENERAL CONDITIONS

SGC-44 Non-Discrimination

Add the following sentence to paragraph 44.2:

“Pursuant to New Hampshire law, the Contractor shall not discriminate on the basis of sexual orientation.”

SGC-55 Pre-Construction Conference

Replace first sentence to read: “The Contractor shall not commence work until a pre-construction conference has been held at which representatives of the Contractor, Engineer, and Owner are present. The pre-construction conference shall be scheduled by the Engineer.”

SGC-59.2 Indemnification (Special Condition to GC 59.2)

Delete the first paragraph in its entirety.

Replace with the following paragraph:

“Contractor will indemnify Owner and Engineer against all suits, claims, judgments, awards, loss, cost or expense (including without limitation attorneys fees) arising in any way out of the Contractor’s negligence or breach of its obligations or warranties under this Contract. Contractor will defend all such actions with counsel satisfactory to the Owner at Contractor’ expense, including attorneys’ fees and will satisfy any judgment rendered against Owner in such action.”

SGC-62.5 Use of Explosives (Special Condition to GC 62)

Add the following after paragraph 62.4:

All blasting shall conform fully with all applicable local, state and Federal laws. See Appendix B for City of Portsmouth Blasting Ordinance.

NHDOT TECHNICAL SPECIFICATIONS AND AMENDMENTS

Work referenced using NHDOT item numbers shall be in accordance with current edition of the State of New Hampshire, Department of Transportation (NHDOT) Standard Specifications for Road and Bridge Construction, (Standard Specifications), and as amended herein. Although NHDOT specifications are not included within this Project Manual, the referenced specifications shall be considered part of the Contract Documents.

The Contractor shall comply with any or all NHDOT specifications referred to by the Contract Documents or referred to by sections of the NHDOT specifications that apply. It is the Contractor's responsibility to obtain copies of these specifications.

NHDOT Standard Specifications for Road and Bridge Construction may be purchased from: NHDOT, Records Section, 1 Hazen Drive, P.O. Box 483, Concord, NH 03302-0483, Phone No.: 603-271-3514.

End of Section

Section D

TECHNICAL SPECIFICATIONS

DIVISION 1	GENERAL REQUIREMENTS
DIVISION 2	SITE WORK
DIVISION 16	SITE ELECTRICAL

DIVISION 1
GENERAL REQUIREMENTS

Scope of Work

The scope of this Division covers the General Administrative Requirements and the general work-related provisions of the Construction Contract.

Contents of Division

<u>Section No.</u>	<u>Section Title</u>
01010	Summary of Work
01020	Coordination
01025	Measurement and Payment
01070	Abbreviations and Symbols
01090	Reference Standards
01200	Project Meetings
01201	Preconstruction Meeting
01310	Construction Schedules
01340	Submittals
01381	Pre-Construction Video Records
01400	Quality Control and Quality Assurance
01510	Temporary Utilities
01516	Temporary Sanitary Facilities
01520	Maintenance of Sewer Flows
01546	Use of Explosives
01562	Dust Control
01570	Traffic Regulation
01611	Owner's Right to Material
01630	Substitution and Product Options
01701	Project Close-out Procedures
01710	Project Cleaning
01720	Project Record Documents

SECTION 01010
SUMMARY OF WORK

PART 1 - GENERAL

1.1 WORK UNDER THIS CONTRACT

- A. The work to be completed under this Contract includes all work as shown on the drawings or identified in the contract documents, including but not limited to:

Earthwork preparation and installing of a new synthetic turf multi-purpose recreational fields including gravel parking, paved areas, site amenities, stormwater improvements (including large regional stormwater BMP systems), utility connections, sport field lighting, gravel access road improvements, fencing & safety netting, landscaping, and other ancillary tasks.

1.2 CONTRACTORS RESPONSIBILITIES

- A. The General Contractor shall have the following responsibilities:
1. The Contractor will perform all work in accordance with the Drawings, Contract, and Specifications.
 2. Traffic Control – Coordinate with and submit to the City of Portsmouth Department of Public Works, a Traffic Control Plan for review and approval (see Prosecution of Work and Section 01570 of these specifications).
 3. Erosion and Sediment Control and Stormwater Management Plan – The Contractor shall submit an Erosion and Sediment Control and Stormwater Management Plan in accordance with Section 02540 and 02650. The Contractor shall also submit a Notice of Intent form to the USEPA (Section 02540) in accordance with the regulations governing construction sites. The plan shall meet the requirements of the USEPA storm water pollution prevention program (SWPPP). (See Special Conditions and Sections 02402 and 02540 of these specifications).
 4. Furnish all labor, materials, equipment and incidentals required to complete all work in accordance with the bid documents within the allotted time schedule and maintain required warranties.
 5. Protect against vandalism. All losses incurred through vandalism are to be reimbursed by the Contractor or Contractor's insurance company.
 6. Coordinate with the City of Portsmouth Department of Public Works, including securing any required permits (i.e., excavation and flagging permits) on all work accomplished within City roadway rights-of-way.
 7. Perform all work within City right-of-way or limits of easements as shown on the drawings unless written authorization is provided for further occupation of private properties.
 8. Coordinate activities involving other utilities with the respective utility companies.
 9. The work also includes but is not limited to furnishing all materials, labor and equipment to perform the following activities:
 - a. Preparation and submittal of contract specified submittals.
 - b. Testing of materials as specified herein.

10. Contractor shall maintain sanitary and storm flow during construction.
11. The work zone is located in commercial neighborhood with high volumes of truck and vehicular traffic. The Contractor shall conduct work in a professional manner. Any unprofessional conduct (i.e., foul language and use of excessive speed) will not be tolerated.
12. Contractor shall maintain access to all homes and businesses while completing the work.

1.3 ENUMERATION OF DRAWINGS

- A. The following drawings which form a part of this contract are:
 1. Sheet No's 1 through 41, entitled **Multi-purpose Recreation Fields & Regional Stormwater Treatment Project**

1.4 ENUMERATION OF SPECIFICATIONS

The following specifications which form a part of this contract are:

- A. Bidding Requirements
- B. Contract
- C. Conditions of Contract
- D. Technical Specifications
- E. NHDOT Standard Specifications and Amendments
- F. Appendices:
 - A. Geotechnical Information
 - B. City of Portsmouth Blasting Ordinance
 - C. Permits

All Addenda issued during the bidding process also form a part of this Contract.

PART 2 - PRODUCTS

2.1 STANDARDS

- A. The contractor shall meet the requirements of the following:
 1. City of Portsmouth standards for water and sewer construction
 2. NHDES standards for water and sewer construction

PART 3 - EXECUTION

3.1 WORK SEQUENCE

- A. No work may commence until a Traffic Control Plan has been approved in writing by the Public Works Department in accordance with Section 01570 – Traffic Regulation and the Special Conditions.
- B. No earthwork may commence until an Erosion Control and Stormwater Pollution Prevention Plan has been submitted and approved. Also, no earthwork may commence until the Contractor has submitted a “Notice of Intent” letter to the USEPA under the NPDES permit system.
- C. It is the intention that the work required to be completed under this Contract be performed in an organized and workmanlike manner. Construction areas shall be restored as soon as practical in an effort to minimize disturbance to private and public property. The contractor is responsible for scheduling work to meet these objectives.

- D. The Contractor shall complete the construction of the Regional Stormwater Treatment System in 2020 and shall organize the work to achieve this requirement.

3.2 SPECIAL REQUIREMENTS

- A. Contractor shall maintain existing utilities to all existing users at all times. Exceptions will be considered; however, the service interruptions to water and sewers shall not exceed 4 hours.
- B. Where possible the Contractor shall maintain access to all properties during construction. Advance notification shall be provided otherwise.
- C. If requested by the Owner, the Contractor shall provide a sewer video inspection (Section 01382) of all completed sewer lines installed or rehabilitated in this project.

3.3 WORK RESTRICTIONS

- A. Hours of Construction - Work on the project shall be conducted between the hours of 7:00 a.m. and 5:00 p.m., excluding weekends and holidays.

3.4 CONTRACTOR SCHEDULE

- A. Contractor shall provide an updated schedule as necessary but no less than every month and for each project meeting.
- B. Provided schedule shall be Gantt chart, Critical Path Method, or other tabular form approved by the Engineer.

END OF SECTION

SECTION 01020
COORDINATION

PART 1 – GENERAL

1.1 DESCRIPTION

- A. All damage to existing structures, utilities, or pipelines, as a result of digging test pits, shall be paid by the Contractor. All materials shall be the responsibility of the Contractor. The Contractor will be responsible for replacing pavement around test pits for this Contract.
- B. Coordinate operation of utilities with the owner of the utility. Do not interrupt utility services to businesses or homeowners without the Owner's prior approval.
- C. The Contractor, by nature of this project, will be working in close proximity to residents, businesses and traveled ways. The Contractor, under this Contract, will be responsible for coordinating construction activities with the City of Portsmouth, where traffic control is involved, and with property owners in a manner that will lessen impacts, to the extent possible, and to ensure that residents, business services, facilities, and safe working conditions are maintained.
- D. Any damage to existing structures, equipment and property as a result of the Contractor's or their subcontractor's operations shall repaired/restored by the Contractor at no additional cost to the Owner.
- E. The Contractor will be responsible for developing a Traffic Control Plan and for coordinating its implementation with the City, local businesses and residents. The Contractor shall coordinate the relocation of Traffic Control measures and devices as needed to move traffic through and/or around the Work Zone or as directed by the Public Works Departments.
- F. The Contractor will be responsible for developing an Erosion and Sediment Control and Storm Water Management Plan, for obtaining all necessary permits and for implementing the Plan.
- G. The contractor shall be responsible for the maintenance of sanitary and storm flows during construction
- H. The Owner will be responsible for the operation of all existing facilities and any new facilities accepted during the construction period.
- I. The Contractor shall notify the Engineer in writing when, in his opinion, a portion of the construction is ready to be accepted by the Owner. After inspection of the work the Engineer will either recommend that the Owner accept the portion of construction or shall identify remedial work needed to be performed by the Contractor.
- J. All damage to existing or accepted equipment or structures, as a result of the Contractor's or his Subcontractor's operations shall be paid by the Contractor at no additional cost to the Owner.

1.2 COORDINATION WITH OTHERS:

- A. It will be the responsibility of the Contractor to complete all coordination required with all other utilities and City sub-contractors to complete the work.
- B. City of Portsmouth:
 - 1. Contractor shall coordinate access, egress, detours and traffic control, if required, with the City of Portsmouth's Police Department. The Contractor shall notify the Portsmouth Police, Fire Department and Rescue Squad at least 24 hours in advance

of any street closings or detours. All fees for police traffic control details shall be paid by the Contractor (Item 6.6).

2. The Contractor shall be responsible for coordinating and maintaining public services to all public and private properties.

C. City of Portsmouth: **Department of Public Works (DPW)**

1. The Contractor shall be responsible for obtaining all opening and utility location permits.
2. The Contractor shall be responsible for coordinating access, egress, detours and traffic control on all City roadways with the City DPW.
3. The Contractor shall be responsible for coordinating the operation of valves and work in the vicinity of water lines with the DPW.

Portsmouth Water/Sewer Division

600 Peverly Hill Road

Portsmouth, NH 03801

(603) 427-1552 (Primary contact, DPW Dispatch)

Dispatch (City Emergency Services)

(603) 427-1530

John Adams (Sewer and Water)

(603) 766-1430

D. Power, Cable, and Phone

1. The Contractor shall be responsible for coordinating all work in and around existing utility facilities (aerial and below ground) and bear all costs of inspection requirements, temporary facilities relocation and all other requirements.

E. Public Services to Private Properties

The Contractor shall be responsible for coordinating and maintaining public services to all properties. The Contractor shall notify police and fire departments and rescue squad at least 24 hours in advance of any street closings and detours.

F. The Contractor shall coordinate and sequence daily operations with all businesses in the project area.

G. The Contractor shall coordinate and sequence daily operations with the City school bus company.

H. The Contractor shall sequence daily operations to accommodate the weekly trash and recycling pickup. The day and time of pick-up may vary based on location of work.

PART 2 - PRODUCTS

(NOT PART OF THIS SECTION)

PART 3 - EXECUTION

(NOT PART OF THIS SECTION)

END OF SECTION

SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. For all items other than those to be paid for by lump sum amounts, after the work is completed and before final payment is made therefore, the Owner's Resident Project Representative (RPR) shall make final measurements to determine the quantities of various items of work accepted as the basis for final settlement. The Contractor, in the case of unit price items, will be paid for the actual amount of work accepted and for the actual amount of materials in place, as shown by the final measurements.
- B. All units of measurement shall be standard United States convention as applied to the specific items of work by tradition and as interpreted by the Engineer.
- C. At the end of each day's work, the Contractor's Superintendent or other authorized representative of the Contractor shall meet with the Owner's RPR and determine and agree upon the quantities of unit price work accomplished and/or completed during the workday.
- D. The RPR will then prepare a "Field Report" which shall be signed by both the RPR and Contractor's Representative indicating complete agreement and approval of the quantities listed.
- E. Once each month the RPR and the Contractor's representative will review a "Monthly Progress Summation" based upon the month's accumulation of "Field Reports." The summation shall be signed by both the RPR and Contractor's Representative indicating complete agreement and approval of quantities listed.
- F. These completed forms will provide the basis of the Contractor's monthly quantity estimate upon which payment will be made. Items not appearing on both the Field Report and Monthly Progress Summation will not be included for payment. Items appearing on forms not properly signed by the Contractor will not be included for payment.
- G. The Contractor shall submit a cost breakdown of all lump sum items for payment purposes. This cost breakdown shall be submitted prior to Contract signing and shall be approved by the Engineer.
- H. Payment Application will only be prepared in a form acceptable to the Owner and approved by the Engineer. The form shall be in a computer spreadsheet format and exportable to MS EXCEL. (Sample Forms attached).
- I. Submit **four (4) signed** copies to the Engineer for approval. **All four (4) copies** shall have an original contractor and notary signatures and notary stamp.

1.2 SCOPE OF PAYMENT

MEASUREMENT AND PAYMENT

- A. Payments to the Contractor will be made for the actual quantities of Contract items performed and accepted in accordance with the plans and specifications. Upon completion of the construction, if these actual quantities show either an increase or decrease from the quantities given in the Bid (form), the Contract unit prices will still prevail, except as provided hereinafter.
- B. The Contractor shall accept compensation, as herein provided, in full payment for furnishing all materials, labor, tools, equipment and incidentals necessary to complete the work and for performing all work included in the Contract; for all loss or damage arising from the nature of the work, or from the action of the elements; or from any unforeseen difficulties which may be encountered during the prosecution of the work and until its final acceptance by the Engineer; and for all risks of every description connected with the prosecution of the work, except as provided herein, also for all expenses incurred in consequence of the suspension of the work as herein authorized.
- C. The payment of any partial estimate or of any retained percentage except by and under the approved final invoice, in no way shall affect the obligation of the Contractor to repair or replace any defective parts of the construction or to be responsible for damage due to such defects.

1.3 PAYMENT FOR INCREASED OR DECREASED QUANTITIES

- A. When alterations in the quantities of work not requiring supplemental agreements are ordered and performed, the Contractor shall accept payment in full at the Contract price for the actual quantities of work done. No allowance will be made for anticipated profits. Increased or decreased work involving supplemental agreements will be paid for as stipulated in such agreements.

1.4 ELIMINATED ITEMS

- A. Should any items contained in the Bid (form) be found unnecessary for the proper completion of the work contracted, the Engineer may eliminate such items from the Contract, and such action shall in no way invalidate the Contract, and no allowance will be made for items so eliminated in making final payment to the Contractor.

1.5 PARTIAL PAYMENTS

- A. Partial payments shall be made monthly as the work progresses. All partial payments shall be subject to correction in the final quantity invoice and payment.
- B. No monthly payment shall be required to be made when, in the judgment of the Engineer, the work is not proceeding in accordance with the provisions of the Contract, or when, in his judgment, the total value of the work done since the last payment amounts to less than \$10,000.00.
- C. The partial payments will be based upon invoices prepared by the Engineer of the value of the work performed, and materials complete in place in accordance with the Contract. Retainage shall be as specified in Paragraph 24.2 of the General Conditions as modified by the Supplemental General Conditions. The Owner shall pay the Contractor within 45 days of receipt of the Engineer approved invoiced amount.

1.6 PAYMENT FOR MATERIAL DELIVERED ON LUMP-SUM PROJECTS

- A. At the discretion of the Owner, the Engineer may act upon the request of the Contractor, prepare an invoice, accompanied by receipted bills for payment of all or part of the value of acceptable, nonperishable materials and equipment which are to be incorporated into lump sum type contracts, and which have been delivered to the site of the work or in acceptable storage places, and not used at the time of such invoice. Materials, when so paid for by the Owner, shall become the property of the Owner, and in the event of default on the part of the Contractor, the Owner may use, or cause to be used, these materials in the construction of the work provided for in the Contract. The Contractor shall be responsible for any damage to, or loss of, these materials in accordance with Contract insurance requirements. The amount thus paid by the Owner shall go to reduce estimated amounts due the Contractor as the material is used in the work.
- B. No partial payment shall be made upon fuels, supplies, lumber, false work, or other materials, or on temporary structures of any kind which are not a permanent part of this Contract.

1.7 SUBSTANTIATING DATA

- A. If a question arises as to the reasoning for a particular line item, the Contractor shall provide the necessary backup information to substantiate the item line. The Contractor shall continue to provide data until the justification for the line items quantity and amount is addressed to the satisfaction of the Owner and Engineer.
- B. Attached to the current application for payment, the Contractor shall submit documentation that subcontractors and suppliers that were due money from previous applications have been paid.

1.8 FINAL PAYMENT

- A. The Engineer shall make, as soon as practicable after the completion of the project, a final quantity invoice of the amount of work performed under the Contract and establish the value of such work.
- B. The Owner shall retain a sum determined in accordance with the General Conditions and Supplemental Provisions of the final Contract cost for a one-year warranty period commencing on the date of substantial completion.
- C. The Owner shall then pay the entire sum found to be due, after deducting there from all previous payments and the aforementioned retainage. In addition, any amounts to be retained or deducted under the provisions of the Contract may be held by the Owner for a period of sixty (60) days after the completion of the final quantity invoice, or until such time as the Contractor submits satisfactory evidence that all bills for labor and materials used under this Contract have been paid and all required documents submitted to the Engineer.

1.9 INCIDENTAL OR SUBSIDIARY WORK

- A. **Subsidiary or Incidental Work:** These terms are used to indicate work for which no direct payment will be made. Such work is incidental to Contract pay items, and the bid prices

MEASUREMENT AND PAYMENT

submitted by the Contractor shall be sufficient to absorb the cost of all work designated as subsidiary or as subsidiary items.

- B. Any work shown or described on the drawings or in the Contract Documents, for which no pay item exists, shall be considered subsidiary to the project and will not constitute additional payment.
- C. Incidental work items for which separate payment is not measured includes the following items:
 - 1. Clean Up.
 - 2. Restoration of property or repairs to any facilities that are impacted from construction performed by the Contractor unless otherwise paid for.
 - 3. Cooperation with utility companies, Owner's representatives, or other Contractors employed by the Owner.
 - 4. Utility crossings, unless otherwise paid for.
 - 5. Utility relocation unless otherwise paid for.
 - 6. Minor items - Such as replacement/relocation of mailboxes, guard rails, rock walls, etc.
 - 7. Dewatering, unless otherwise paid for.
 - 8. Steel and/or wood sheeting utilized by the Contractor other than sheeting left in place or removed when directed by the Engineer and paid for under a separate item.
 - 9. Repair to utilities damaged as a result of Contractor operations
 - 10. Temporary water systems, necessary for the Contractor to perform the work without disruption to the existing facilities, will not be measured for payment.
 - 11. Maintenance of Sanitary/Storm Sewerage flows (by-pass pumping) is subsidiary to sewer construction, unless otherwise included in the bid schedule for payment.
 - 12. Temporary roadway stabilization materials (crushed gravel or reclaimed asphalt product) unless paid for under separate items.
 - 13. Prosecution of Work in accordance with project specifications.
 - 14. Dust control is included in Erosion Control and is required daily.

1.10 DESCRIPTION OF PAY ITEMS

- A. The following sections describe the measurement of and payment for the work to be done under the respective items listed in the Bid (form).
- B. Each unit or lump sum price stated in the Bid (form) shall constitute full compensation, as herein specified, for each item of the work completed.

SCHEDULE 1: COMMON ITEMS

Item No. 1.00: Mobilization

- A. Method of measurement:

1. Measurement for this item shall be by lump sum.
- B. Basis for payment
 1. Said lump sum price shall include full compensation for all bonds, insurances and administrative costs including the costs for maintaining the field office(s) and for the utilities associated therewith.
 2. Said lump sum shall include full compensation for mobilization and demobilization costs including fees associated with transportation, rental fees necessary to secure a staging area and any other work necessary for the project not paid for under a separate item.
 3. Said lump sum shall include the Pre-Construction Video (Section 01381).
 4. An increase in the scope of work shall not be grounds for increase in the value of the mobilization item. Additional bond, insurance and administrative costs shall be included in the change order value that increased the scope of work.
 5. An increase in the installed quantity of an item measured for payment and described in the bid schedule shall not be grounds for increase in the value of the mobilization item.
 6. The mobilization item shall not exceed 8% of the Contract value.
 7. Mobilization is part of the Work, so retainage will be held on this item.
 8. Twenty-five percent of the lump sum price shall be held until all equipment, job trailers, and unused materials have been demobilized and staging areas have been restored.

Item No. 1.01: Storm Water Pollution Prevention Plan (SWPPP) & Monitoring

- A. Method of Measurement:
 1. The Storm Water Pollution Prevention Plan & Monitoring will be measured as a single unit.
 2. Measurement will be made upon approval of the Plan by the Engineer, the Public Works Department and upon receipt of a NPDES permit for construction.
- B. Basis of Payment:
 1. The Erosion and Storm Water Pollution Prevention Plan will be paid for at the Contract unit price.
 2. Said price shall be considered full compensation for development of a detailed plan that shows the location of all erosion and storm water control devices including sedimentation basins, sediment collections bags, etc., for construction dewatering discharges, etc., necessary to complete the work. The Plan shall include appropriate phases that are keyed to specific project milestones.
 3. Erosion and Sediment Control and Stormwater Management items necessary to implement and maintain the Storm Water Pollution Prevention Plan (SWPPP) for the construction site(s) will be paid for under Item No. 1.03.
 4. SWPPP Monitoring required will not be measured separately and should be included in the lump sum price for Item 1.01, including travel time, inspection time, and reports.

Item No. 1.02: Implement & Maintain Approved Dust & Erosion Controls

- A. Method of Measurement:
 - 1. Implement & Maintain Approved Dust & Erosion Controls shall be measured as a lump sum.
 - 2. Measurement will be made based on the percentage of work completed at each payment requisition.
- B. Basis of Payment:
 - 1. Implement & Maintain Approved Dust & Erosion Controls shall be paid for at the Contract unit price.
 - 2. Said price shall be considered full compensation for all materials, labor and equipment necessary for the installation of erosion, sediment control and storm water management devices, the maintenance of the same in good working order, replacement of any devices damaged or filled with sediment and the relocation of devices made necessary by a new phase of the work in accordance with the Erosion and Storm Water Pollution Prevention Plan. These devices shall include, but are not limited to, temporary slope matting, compost sock, and silt fence.
 - 3. Failure to maintain erosion and sediment control and storm water management devices, or failure to fully implement the plan, shall result in a reduction in the compensation for that period.
 - 4. Said price shall include daily dust control using a water truck and sweeping in accordance with Section 01562.
 - 5. Said price shall be full compensation for the construction phase temporary sediment pond.

Item No. 1.03: Maintenance of Traffic

- A. Method of Measurement:
 - 1. Maintenance of Traffic will be measured for payment, based on the percentage of work completed calculated as follows:
 - a. The number of days traffic maintained in accordance with Contract Documents and the approved Traffic Control Plan divided by the Contract time for substantial completion.
 - b. Days that traffic or Dust Control is not maintained in accordance with the approved TCP's and project specifications, will not be measured for payment upon notification of non-compliance by the Engineer.
 - 2. Measurement of this item shall not exceed 1.00 (100%).
- B. Basis of Payment:
 - 1. Maintenance of Traffic shall be paid for at the Contract unit price and shall be considered full compensation for maintenance of traffic, traffic regulation, (Section 01570) and Dust Control Section 01562).
 - 2. Said unit price shall be considered full compensation for all materials, labor and equipment necessary for the installation of traffic control devices, the maintenance of the same in good working order, replacement of any devices

damage or stolen and the relocation of devices made necessary by a new phase of the work in accordance with the Traffic Control Plan.

3. Failure to maintain the traffic control devices or failure to fully implement the Traffic Control Plan shall result in a reduction in the compensation for that period.
4. Said unit price shall be considered full compensation for all materials, labor and equipment necessary for flaggers. Flaggers will be needed for the water main, sewer, and electrical work in Campus Drive.
5. The City of Portsmouth Public Works Departments may require modification of the Traffic Control Plan based on actual field conditions. Modification of the approved Traffic Control Plan shall not constitute a claim for additional compensation under this item. Said lump sum shall include full compensation for making the necessary modifications to the Traffic Control Plan.
6. The Contractor shall maintain Safe Passage through the construction area at the end of each construction day. This shall include work necessary to assure that the full width of the roadway is made useable outside the immediate work zone.
7. Payment under this item shall be considered full compensation for maintaining two (2) portable message boards to be provided by the Contractor.

Item No. 1.04: Site Preparation – Rec Fields

A. Method of Measurement:

1. The quantity to be measured for payment shall be on estimated percentage of the total work completed during each pay period in conformance with Section 02100.

B. Basis of Payment:

1. Site Preparation (see Section 02100) will be paid for on a lump sum basis as a percentage of the work completed. The Engineer shall have final determination as to the percentage of work completed.
2. Said lump sum price shall constitute full compensation for the furnishing of all materials, labor, equipment and tools necessary to complete the work shown on the Site Preparation Plan.
3. Said lump sum price shall constitute full compensation for all labor, equipment and materials required to complete clearing and grubbing; develop an invasive species management plan, and manage invasive species; site preparation; remove all abandoned existing underground pipe and structures; support or replacement of existing utilities; removal of fences; removal of drainage structures; saw cutting pavement; stripping and stockpiling of topsoil; and tree removal. This item shall consist of all site preparation work necessary to complete the project that is not covered under a separate bid item but that is indicated or reasonably implied in the drawings.
4. Said lump sum price shall constitute full compensation for the furnishing of all materials, labor, equipment and tools necessary to windrow, load and transport the excess material to a location designated or approved by the Owner.

Item No. 1.05: Exploratory Test Pit Excavation

A. Method of Measurement:

1. Test pits shall be measured per cubic yard of test pit excavated.
 2. Test pits will only be measured for payment if shown on the drawings or at locations approved by the Engineer. Test pits or exploratory excavation completed in the absence of the Engineer will not be considered for payment.
 3. Locations shown on the drawings are approximated and installation at these locations shall be coordinated with the Engineer.
- B. Basis of Payment:
1. Test pits shall be paid at the Contract unit price per cubic yard.
 2. Payment under this item shall be full compensation for furnishing all equipment, labor, and materials for excavation, location of existing utilities, backfill, property restoration and all else incidental for which separate payment is not provided for under other items.
 3. Said unit price shall constitute full compensation for any repairs to existing utilities that result from exploratory test pit excavation. Sawcutting required for test pits in pavement shall be considered incidental to this work.

Item No. 1.06: Turf Establishment, Cleanup & Restoration

- A. Method of Measurement:
1. The quantity to be measured for payment shall be lump sum for miscellaneous site work, turf establishment, cleanup, and restoring all disturbed property as measured and approved by the Engineer. Work includes weekly cleanup of the project area to be completed on Friday before the weekend.
- B. Basis of Payment:
1. Turf Establishment, Cleanup & Restoration (see Section 02100) shall be paid for at the Contract lump sum price.
 2. Said lump sum price shall constitute full compensation for the furnishing of all labor, equipment and materials associated with performing miscellaneous work and cleanup and restoring all disturbed property in accordance with the Contract Drawings and Specifications. Work shall include removal of accumulated sediment from areas impacted from construction at the end of each work week.
 3. Said lump sum price shall include, but not be limited to: furnishing and placing loam, seed, fertilizer, lime, mulch, erosion control devices; watering seeded area on a regular basis; ensuring proper growth of grass; furnishing and placing crushed gravel to restore existing gravel surfaces; compacting; and all other work required for or incidental to the satisfactory completion of this item.
 4. Said lump sum price shall include, but not be limited to; furnishing, installing, and maintaining erosion control measures; performing all work and providing all material as shown on the drawings and as noted in the specifications, but that is not included in one of the above noted bid items; performing project cleanup; and all other work required for or incidental to the satisfactory completion of this item.

SCHEDULE 2: RECREATIONAL FIELDS EARTHWORK, DRAINAGE & SITE IMPROVEMENTS

Item No. 2.00: Earthwork for Recreational Fields, Earthen Berm, and Parking Lot

- A. Method of Measurement:
 - 1. This item will be measured as the estimated percentage of the total work completed during each pay period.
- B. Basis of Payment:
 - 1. Earthwork (see Section 02100) for recreational fields, earthen berm, ditches, and parking lot shall be paid for at the Contract lump sum price.
 - 2. Said lump sum price shall constitute full compensation for the furnishing of all labor, equipment and materials to excavate and fill as needed to achieve the designed subgrade depths, prepare the subgrade, compact placed material, and construct the earthen berm.
 - 3. Said lump sum price shall consist of all excavation not included as rock or ledge excavation (paid under Item 2.01).

Item No. 2.01: Ledge Removal and Disposal

- A. Method of Measurement:
 - 1. The quantity to be measured for payment shall be on the cubic yard basis for removing ledge and rock via mechanical methods or blasting within the limits described below as measured and approved by the Engineer.
 - 2. For trench excavation, the depth shall be measured from the original ledge surface to a point 6" below the invert of the pipe. For structure excavation, the depth shall be measured to a point 6" below the structure. Field measurements shall be taken prior to excavation where at all possible.
 - 3. The maximum width for trenches shall be the sum of the pipe diameter plus 2' (with a minimum width of 3'). The maximum width for structures shall be the width shall be the outside dimensions of the structure plus 2'.
 - 4. For removal of rock from within trench excavation, rocks shall be removed where encountered within the pipe diameter plus 2', and 6" below the invert of the pipe. For removal of rock within a structure excavation, all rock shall be removed from within 2' of the outside dimensions of the structure, and within 6" of the bottom of the structure.
 - 5. Removal of rocks not in or projecting into of these limits shall be at the Contractor's expense, unless authorized in writing by the Engineer.
 - 6. Rocks measuring less than 2 cubic yards shall not be considered for measurement.
 - 7. The average-end method shall be used to calculate the measured volume.
 - 8. Removal of ledge outside of these limits shall be at the Contractor's expense, unless authorized in writing by the Engineer.
 - 9. Borings taken along the project are included in Appendix A.
- B. Basis of Payment:
 - 1. Ledge excavation shall be paid for at the Contract unit price per cubic yard.
 - 2. Said unit price shall constitute full compensation for the furnishing all labor, equipment, and materials associated with ledge excavation and disposal.

3. Said unit price shall include full payment of the furnishing and installation of suitable backfill for trench.
4. Said unit price shall also include full compensation for all permits, insurances, pre-blast surveys, blast monitoring etc. if the use of explosives is the selected method of ledge demolition.
5. Boulders removed from the trench shall be removed from the work area immediately after measurement.
6. Rock removal shall be consistent with current City Blasting Ordinance.

Item No. 2.02: Stockpile Re-handle and Material Compaction

- A. Method of Measurement:
 1. This item will be measured as the estimated percentage of the total work completed during each pay period.
- B. Basis of Payment:
 1. Stockpile Re-handle and Material Compaction shall be paid for at the Contract lump sum price.
 2. Said lump sum price shall constitute full compensation for the furnishing of all labor, equipment, and materials associated with testing the existing material, re-handling and stockpiling the material; reinstalling the material where needed and performing compaction testing of the material in conformance with the plans and specifications.

Item No.'s. 2.03, 2.04 & 2.05: Gravel Road Sections

This work applies to the following items:

Item 2.03 – Gravel Parking Lot & Emergency Access Drive (General Gravel Section)

Item 2.04 – Gravel Access Road (Access Drive Section)

Item 2.05 – DPW Access Road (Access Drive Section)

- A. Method of Measurement:
 1. Gravel Road Sections shall be measured by the square yard of gravel road section installed within the limits shown in the construction drawings, or as ordered by the Engineer.
- B. Basis of Payment:
 1. Gravel Road Sections shall be paid for at the Contract unit price per square yard.
 2. Excavation and subgrade preparation are included in Item 2.00 - Earthwork for Recreational Fields, Earthen Berm, and Parking Lot.
 3. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to install geotextile fabric, construct the Gravel Road Sections per the applicable details with the specified materials at their required layer thicknesses, and fine grade.

Item No. 2.06: Grass-Lined Swale

- A. Method of Measurement:

1. Grass-Lined Swale shall be measured by the linear foot of grass-lined swale installed as shown on the drawings or as ordered by the Engineer.
- B. Basis of Payment:
 1. Grass-Lined Swale shall be paid for at the Contract unit price per linear foot.
 2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to construct a grass-lined swale as shown in the detail.
 3. Said unit price shall include full compensation to excavate, shape, and prepare the subgrade for the swale; and install loam, seed, and erosion control blanket.

Item No. 2.07: Subsurface Stormwater Chamber

- A. Method of Measurement:
 1. Subsurface Stormwater Chamber shall be measured as the estimated percentage of the total work completed during each pay period.
- B. Basis of Payment:
 1. Subsurface Stormwater Chamber shall be paid for at the Contract lump sum price.
 2. Said price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to construct a Subsurface Stormwater Chamber as shown in the detail.
 3. Said price shall include full compensation to excavate and prepare the subgrade; **furnish and install all perimeter and fill stone**, underdrain, stormwater chamber system, riser pipe, geotextile fabric; and backfill as shown in the plan and details.

Item No. 2.08: BMP-2 Subsurface Gravel Wetlands Construction

- A. Method of Measurement:
 1. BMP-2 Subsurface Gravel Wetlands shall be measured by the square foot of gravel wetlands installed within the limits shown on the construction drawings, or as ordered by the Engineer.
- B. Basis of Payment:
 1. BMP 2 Subsurface Gravel Wetlands Construction shall be paid for at the Contract unit price per square foot.
 2. Said unit price shall constitute full compensation for the furnishing of all materials, labor, equipment, and tools necessary to construct the BMP 2 Subsurface Gravel Wetlands as shown in the construction drawings.
 3. Said unit price shall include full compensation to dewater; excavate and prepare the subgrade; all earthwork (except ledge); excavation support (if required); furnish & install low permeability layer in bottom and sides of facility and low permeability material in berms; furnish & install all impermeable liners; furnish & install all drain pipes and culverts within the pay limits; furnish & install concrete cutoff walls; and all other work not paid for separately (see Basis of Payment Note 4 under this item) as shown on the plans and in the details.
 4. Items paid for separately include: Site Preparation; Ledge Excavation; Wetland Soil; 3/4" Washed Stone; 3/8" Pea Gravel; Stone Fill, Class C; Outlet Control

Structure. All other labor and materials required to construct this BMP facility shall be included in this pay item.

Item No. 2.09: Wetland Soil

- A. Method of Measurement:
 - 1. Wetland Soil shall be measured by the cubic yard of Wetland Soil installed within the limits shown in the construction drawings, or as ordered by the Engineer.
- B. Basis of Payment:
 - 1. Wetland Soil shall be paid for at the Contract unit price per cubic yard.
 - 2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to install the Wetland Soil per the applicable details.

Item No.'s. 2.10 & 2.11: Gravel Wetland Materials

This work applies to the following items:

Item 2.10 – 3/4" Washed Stone (AASHTO #5 Stone)

Item 2.11 – 3/8" Pea Gravel (AASHTO #8 Stone)

- A. Method of Measurement:
 - 1. Gravel Wetland Materials shall be measured by ton, in accordance with NHDOT section 109.01, on the basis of delivery slips provided to the Engineer, but not to exceed the rate ordered.
- B. Basis of Payment:
 - 1. The accepted quantity of Gravel Wetland Materials will be paid for at the Contract unit price per ton complete in place.
 - 2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to install the Gravel Wetland Materials per the applicable details with the specified materials at their required layer thicknesses.

Item No. 2.12: Stone Fill Class C

- A. Method of Measurement:
 - 1. Stone Fill Class C (NHDOT 585.3) shall be measured by ton, in accordance with NHDOT section 109.01, on the basis of delivery slips provided to the Engineer, but not to exceed the rate ordered.
- B. Basis of Payment:
 - 1. The accepted quantity of Stone Fill (NHDOT 585.3) will be paid for at the Contract unit price per ton complete in place.
 - 2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to install Stone Fill (NHDOT 585.3) as shown in the detail.
 - 3. Said unit price shall constitute full compensation for all required geotextile fabric.

Item No. 2.13: Outlet Control Structure (Subsurface Chambers POCS-1)

- A. Method of Measurement:
 - 1. Outlet Control Structure (Subsurface Chambers POCS-1) shall be measured per Outlet Control Structure (Subsurface Chambers POCS-1) installed as shown on the drawings or as ordered by the Engineer.
- B. Basis of Payment:
 - 1. Outlet Control Structure (Subsurface Chambers POCS-1) shall be paid for at the Contract unit price per each.
 - 2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to construct the Outlet Control Structure (Subsurface Chambers POCS-1) as shown in the detail.
 - 3. Said unit price shall include full compensation to excavate and prepare the subgrade; install bedding material and outlet structure; and backfill as shown in the detail.

Item No. 2.14: Outlet Control Structure (BMP-2, POCS-2)

- A. Method of Measurement:
 - 1. Outlet Control Structure (BMP-2, POCS-2) shall be measured per Outlet Control Structure installed as shown on the drawings or as ordered by the Engineer.
- B. Basis of Payment:
 - 1. Outlet Control Structure (BMP-2, POCS-2) shall be paid for at the Contract unit price per each.
 - 2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to construct the Outlet Control Structure (BMP-2, POCS-2) as shown in the detail.
 - 3. Said unit price shall include full compensation to excavate and prepare the subgrade; install bedding material and outlet structure; and backfill as shown in the detail.

Item No.'s. 2.15, 2.16 & 2.17: Perforated Underdrain

This work applies to the following items:

Item 2.15 – 8” Perforated Underdrain

Item 2.16 – 12” Perforated Underdrain

Item 2.17 – 15” Perforated Underdrain

- A. Method of Measurement:
 - 1. Perforated Underdrain shall be measured by the linear foot of perforated underdrain installed within the limits shown in the construction drawings, or as ordered by the Engineer.
- B. Basis of Payment:
 - 1. Perforated Underdrain shall be paid for at the Contract unit price per linear foot.

2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to install the perforated underdrain pipe per the applicable details.
3. Said unit price shall include full compensation to excavate and prepare the subgrade; install geotextile fabric, perforated underdrain pipe, bedding material, and select backfill material; and backfill trench as shown in the detail.

Item No 2.18 Not Used

Item No.'s. 2.19, 2.20, 2.21, 2.22: CPE Plastic Pipe (Smooth Interior)

This work applies to the following items:

Item 2.19 – 12” CPE Plastic Pipe (Smooth Interior)

Item 2.20 – 15” CPE Plastic Pipe (Smooth Interior)

Item 2.21 – 18” CPE Plastic Pipe (Smooth Interior)

Item 2.22 – 24” CPE Plastic Pipe (Smooth Interior)

A. Method of Measurement:

1. CPE Plastic Pipe (Smooth Interior) shall be measured by the linear foot of CPE Plastic Pipe (Smooth Interior) installed within the limits shown in the construction drawings, or as ordered by the Engineer.

B. Basis of Payment:

4. CPE Plastic Pipe (Smooth Interior) shall be paid for at the Contract unit price per linear foot.
5. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to install the CPE Plastic Pipe (Smooth Interior) per the applicable details.
6. Said unit price shall include full compensation to excavate and prepare the subgrade; install CPE Plastic Pipe (Smooth Interior), bedding material, and select backfill material; and backfill trench as shown in the detail.

Item No.'s. 2.23, 2.24, & 2.25: Reinforced Concrete Pipe (Class V)

This work applies to the following items:

Item 2.23 – 15” Reinforced Concrete Pipe (Class V)

Item 2.24 – 18” Reinforced Concrete Pipe (Class V)

Item 2.25 – 24” Reinforced Concrete Pipe (Class V)

A. Method of Measurement:

1. Reinforced Concrete Pipe (Class V) shall be measured by the linear foot of Reinforced Concrete Pipe (Class V) installed within the limits shown in the construction drawings, or as ordered by the Engineer.

B. Basis of Payment:

1. Reinforced Concrete Pipe (Class V) shall be paid for at the Contract unit price per linear foot.

2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to install the Reinforced Concrete Pipe (Class V) per the applicable details.
3. Said unit price shall include full compensation to excavate and prepare the subgrade; install Reinforced Concrete Pipe (Class V), bedding material, and select backfill material; and backfill trench as shown in the detail.

Item No. 2.26: Catch Basin

A. Method of Measurement:

1. Catch Basins will be measured for payment on a “per each” basis for furnishing and installing precast concrete catch basins as measured and approved by the Engineer.

B. Basis of Payment:

1. Catch basins shall be paid at the Contract price per each unit price.
2. Said unit price shall include, but not limited to, sawcutting pavement, excavation (except ledge and rock) to subgrade, installing bedding material, and backfilling structure.
3. Said unit price shall be considered full compensation for furnishing and installing precast concrete structures with penetrations and boots, frames and grates, screened gravel subbase, concrete and masonry materials, waterproofing as specified, construction fabric, catch basin testing, and all work incidental thereto.
4. Said unit price shall constitute full payment to raise structures to finish grade elevation.
5. Said unit price shall constitute payment for all field core penetrations, sealing devices, (i.e., boots) and stub pipes and caps for future connections of the size and type as shown on the drawings and as specified herein.
6. Said unit cost shall include full compensation for additional concrete or brick masonry as necessary to construct special structures as shown on the Drawings
7. Said unit price shall be considered full compensation for maintenance of drain flows through bypass pumping, unless paid for under a separate item.
8. Said unit price shall include full compensation for all construction dewatering work required to pre-drain soils prior to final excavation and to install the pipe and catch basins in the dry as specified under Section 02402 and/or Section 02650 including furnishing, installing, operating and removing of dewatering systems not paid for under separate unit items.
9. Removal and disposal of existing structures for the installation of new structures shall be incidental to this item.

Item No. 2.27: Drainage Manhole

A. Method of Measurement:

1. Drain manholes will be measured for payment on a “per each” basis for furnishing and installing precast concrete drain manholes as measured and approved by the Engineer.

B. Basis of Payment:

1. Manholes shall be paid at the Contract price per each unit price.
2. Said unit price shall include, but not limited to, sawcutting pavement, excavation (except ledge and rock) to subgrade, installing bedding material, and backfilling structure.
3. Said unit price shall be considered full compensation for furnishing and installing precast sections or cast in place structures with penetrations and boots, frames and covers, screened gravel subbase, concrete and masonry materials, waterproofing as specified, construction fabric, manhole testing, and all work incidental thereto.
4. Said unit price shall be considered full compensation for the furnishing of materials, labor, tools and equipment necessary to complete the above described work.
5. Said unit price shall constitute full payment to raise structures to finish grade elevation.
6. Said unit price shall also constitute payment for all field core penetrations, sealing devices, (i.e., boots) and stub pipes and caps for future connections of the size and type as shown on the drawings and as specified herein.
7. Said unit cost shall include full compensation for additional concrete or brick masonry as necessary to construct inverts and special structures as shown on the Drawings
8. Said unit price shall be considered full compensation for maintenance of drain flows through bypass pumping, unless paid for under a separate item.
9. Said unit price shall include full compensation for all construction dewatering work required to pre-drain soils prior to final excavation and to install the manholes in the dry as specified under Section 02402 and/or Section 02650 including furnishing, installing, operating and removing of dewatering systems not paid for under separate unit items.
10. Removal and disposal of existing structures for the installation of new structures shall be incidental to this item.
11. Actual payment for these shall be broken down in accordance with the following percentages:
 - a. Manhole in place and backfilled - 90%.
 - b. Manhole cleaned and invert built – 10%

Item No. 2.28: Not Used

Item No. 2.18: 2” – 6” Washed Stone (Forebay Floor & Forebay Weir)

- A. Method of Measurement:
 - 2. Washed Stone shall be measured by ton, in accordance with NHDOT section 109.01, on the basis of delivery slips provided to the Engineer, but not to exceed the rate ordered.
- B. Basis of Payment:
 - 4. The accepted quantity of Washed Stone will be paid for at the Contract unit price per ton complete in place.
 - 5. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to install Washed Stone as shown in the detail.
 - 6. Said unit price shall constitute full compensation for all required geotextile fabric.

Item No. 2.29: Headwall

- A. Method of Measurement:
 - 1. Headwall shall be measured by the cubic yard of Headwall installed within the limits shown in the construction drawings, or as ordered by the Engineer.
- B. Basis of Payment:
 - 1. Headwall shall be paid for at the Contract unit price per cubic yard.
 - 2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to install the Headwall per the applicable details.
 - 3. Said unit price shall include full compensation to excavate and prepare the subgrade; install bedding material and Headwall; and backfill as shown in the detail.

Item No.'s 2.03 & 2.31: Not Used

Item No. 2.32: Porous Media Infiltration Bed

- A. Method of Measurement:
 - 1. Porous Media Infiltration Bed shall be measured by the square yard of Porous Media Infiltration Bed installed within the limits shown in the construction drawings, or as ordered by the Engineer.
- B. Basis of Payment:
 - 1. Porous Media Infiltration Bed shall be paid for at the Contract unit price per square yard.
 - 2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to construct the Porous Media Infiltration

Bed per the applicable details with the specified materials at the required thickness.

3. Said unit price shall constitute full compensation to excavate and prepare the subgrade, install the Porous Media Infiltration Bed, and fine grade. The underdrain is paid for separately in Items 2.15, 2.16, and 2.17.

Item No. 2.33: Porous Pavement

A. Method of Measurement:

1. Porous Pavement shall be measured by the ton of Porous Pavement installed within the limits shown in the construction drawings, or as ordered by the Engineer.

B. Basis of Payment:

1. Porous Pavement shall be paid for at the Contract unit price per ton.
2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to install the Porous Pavement per the applicable details with the specified materials at the required thickness.
3. Said unit price shall constitute full compensation for the furnishing of all labor, equipment and materials associated with coating existing pavement edges with emulsified asphalt prior to placement of asphalt and tack coating pavement surfaces between pavement lifts.

Item No. 2.34: General Hot Bituminous Pavement

A. Method of Measurement:

1. General Hot Bituminous Pavement shall be measured by the square of pavement installed within the limits and at the thickness shown on the drawings, or as ordered by the Engineer.

B. Basis of Payment:

1. General Hot Bituminous Pavement shall be paid for at the Contract unit price per square yard.
2. Excavation and subgrade preparation are included in Item 2.00 - Earthwork for Recreational Fields, Earthen Berm, and Parking Lot.
3. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to install geotextile fabric and construct the base materials per the detail with the specified materials at their required layer thicknesses.
4. Said unit price shall constitute full compensation to fine grade the base materials prior to paving.
5. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to install General Hot Bituminous Pavement by both hand and machine methods.
6. Said unit price shall constitute full compensation for the furnishing of all labor, equipment and materials associated with coating existing pavement edges with emulsified asphalt prior to placement of asphalt; tack coating pavement surfaces between pavement lifts, furnishing and installing hot bituminous pavement;

compacting; and all other work required for, or incidental to, the satisfactory completion of this item.

Item No. 2.35: Pavement Marking

A. Method of Measurement:

1. The quantity to be measured for payment shall be on the linear foot basis for furnishing and installing retroreflective paint Pavement Markings for 4" center lines, parking space, and fog lines, and retroreflective imbedded thermoplastic 18" stop lines and 12" crosswalk lines as measured and approved by the Engineer.

B. Basis of Payment:

1. Retroreflective paint Pavement Markings, on or embedded in the wearing courses of pavement, as directed by the Engineer, shall be paid for at the Contract linear foot price for single lines or lengths of stop and cross walk bars as applicable. Said unit price shall constitute full compensation for the furnishing of all labor, equipment and materials associated with installing the Pavement Markings in full conformance with the Plans and Specifications.

Item No. 2.36: Pavement Markings Symbols

A. Method of Measurement:

1. Pavement Markings Symbols of the type specified will not be measured but shall be the square foot final pay quantity in accordance with NHDOT Specification Section 632 – Retroreflective Pavement Markings for pavement marking symbols required as shown on the plans.

B. Basis of Payment:

1. Pavement Markings Symbols are final pay item quantities and shall be paid for at the Contract unit prices per square foot in accordance with NHDOT Specification Section 632 – Retroreflective Pavement Markings.
2. Said unit price shall constitute full compensation for the furnishing of all materials, labor, equipment and tools necessary to install the Pavement Markings Symbols in conformance with the Plans and Specifications and in accordance with NHDOT Specification Section 632 – Retroreflective Pavement Markings.

Item No. 2.37: Bituminous Sidewalk

A. Method of Measurement:

1. Bituminous sidewalks shall be measured per square yard as shown on the drawings or as ordered by the Engineer.
2. Measurement shall be by multiplying the ordered width by the ordered length.

B. Basis of Payment:

1. Bituminous sidewalk shall be paid for at the Contract unit price per square yard.
2. Said unit price shall constitute full compensation for the furnishing of all materials, labor, equipment, and tools necessary for installing Bituminous Sidewalks in accordance with NHDOT Specification Section 608.13 (See Part E, NHDOT Specifications and Amendments), including excavation and preparation

of subgrade, base gravel, fine grading, coating existing pavement edges with emulsified asphalt prior to placement of asphalt, installation of bituminous pavement, tack coating pavement surfaces between pavement lifts, and backfill of the installed pavement.

Item No. 2.38: Stone Dust Walk

A. Method of Measurement:

1. Stone Dust Walk shall be measured by the square yard as shown on the drawings or as ordered by the Engineer.
2. Measurement shall be by multiplying the ordered width by the ordered length.

B. Basis of Payment:

1. Stone Dust Walk shall be paid for at the Contract unit price per square yard.
2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to install Stone Dust Walk.
3. Said unit price shall constitute full compensation for the furnishing of all materials, labor, equipment, and tools necessary for excavation and preparation of subgrade, base gravel, fine grading, installation of stone dust, and backfill of the installed Stone Dust Walk.

Item No. 2.39: Wood Guardrail

A. Method of Measurement:

1. Wood Guardrail shall be measured by the linear foot as shown on the drawings or as ordered by the Engineer.

B. Basis of Payment:

1. Wood Guardrail shall be paid for at the Contract unit price per linear foot.
2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to install Wood Guardrail.
3. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to install wooden posts, railings, and bolting.

Item No. 2.40: 6' Chain Link Fence

A. Method of Measurement:

1. 6' Chain Link Fence shall be measured by the linear foot of fence installed as shown on the drawings or as ordered by the Engineer.

B. Basis of Payment:

1. 6' Chain Link Fence shall be paid for at the Contract linear foot unit price.
2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to install a 6' Chain Link Fence as shown in the detail.

Item No. 2.41: Security Gate

- A. Method of Measurement:
 - 1. Security Gate shall be measured per each installed as shown on the drawings or as ordered by the Engineer.
- B. Basis of Payment:
 - 1. Security Gate shall be paid for at the Contract unit price per each installed.
 - 2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to install Security Gate as shown in the detail.

Item No. 2.42: Traffic Signs

- A. Method of Measurement:
 - 1. Traffic Signs shall be measured per each installed as shown on the drawings or as ordered by the Engineer.
- B. Basis of Payment:
 - 1. Traffic Signs shall be paid for at the Contract unit price per each installed.
 - 2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to install Traffic Signs, including signposts where needed.
 - 3. Traffic Signs shall conform to, and be installed per, NHDOT Specification Section 615 – Traffic Signs.

Item No. 2.43: Bollard

- A. Method of Measurement:
 - 1. Bollard shall be measured per each installed as shown on the drawings or as ordered by the Engineer.
- B. Basis of Payment:
 - 1. Bollard shall be paid for at the Contract unit price per each installed.
 - 2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to install Bollard.
 - 3. Said unit price shall include full compensation to excavate and prepare the subgrade; install bedding material, concrete, bollard pipe; and backfill as shown in the detail.

Item No. 2.44: Removable Bollard

- A. Method of Measurement:
 - 1. Removable Bollard shall be measured per each installed as shown on the drawings or as ordered by the Engineer.
- B. Basis of Payment:
 - 1. Removable Bollard shall be paid for at the Contract unit price per each installed.
 - 2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to install Removable Bollard.

3. Said unit price shall include full compensation to excavate and prepare the subgrade; install bedding material, concrete, removable bollard pipe; and backfill as shown in the detail.

Item No. 2.45: Tree Planting (2.5-3" Caliper)

- A. Method of Measurement:
 1. Tree Planting (2.5-3" Caliper) shall be measured per each installed as shown on the drawings or as ordered by the Engineer.
- B. Basis of Payment:
 1. Tree Planting (2.5-3" Caliper) shall be paid for at the Contract unit price per each installed.
 2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to install Tree Planting (2.5-3" Caliper).
 3. Said unit price shall constitute full compensation for all labor, equipment and materials required to furnish and install Tree Planting (2.5-3" Caliper); soil filling; underdrain; mulch; staking; maintenance; 24-month warranty and all other work required for or incidental to the satisfactory completion of this item in full conformance with the Drawings and Specifications.

Item No. 2.46: Landscaping

- A. Method of Measurement:
 1. The quantity to be measured for payment shall be on an estimated percentage of the total work completed during each pay period.
- B. Basis of Payment:
 1. Said lump sum price shall constitute full compensation for all labor, equipment and materials required to furnish and install all landscape plantings; shrubs & perennials; soil filling; underdrain; mulch; staking; maintenance; 24-month warranty and all other work required for, or incidental to, the satisfactory completion of this item in full conformance with the Drawings and Specifications. Trees are paid for separately.

Item No. 2.47: Solar Powered Lights for Parking Lot

- A. Method of Measurement:
 1. Solar Powered Lights for Parking Lot shall be measured per each installed as shown on the drawings or as ordered by the Engineer.
- B. Basis of Payment:
 2. Said unit sum price shall constitute full compensation for all labor, equipment and materials required to furnish and install all solar powered light poles and bases; LED Light Head; solar power system; and all other work required for, or incidental to, the satisfactory completion of this item in full conformance with the Drawings and Specifications.

SCHEDULE 3: UTILITIES

Item No. 3.00: Water Main

A. Method of Measurement:

1. Water Main Pipe shall be measured per linear foot.
2. Pipe shall be measured along the horizontal centerline of the pipe as laid.
3. No deduction shall be made for the space occupied by fittings.

B. Basis of Payment:

1. Pipe shall be paid for at the Contract price per linear foot.
2. Said unit price shall constitute full compensation for furnishing and installing all materials, labor, equipment and tools necessary for hauling, handling, laying, jointing and testing pipe.
3. Said unit price shall include all necessary earth excavation, bedding, sheeting, backfill, compaction, rigid insulation, cleaning and testing and other incidental work including removal, stockpiling and replacement of select reclaimed pavement and roadway gravels.
4. Said unit price shall include full compensation for all construction dewatering work required to pre-drain soils prior to final excavation and to install pipe in-the-dry as specified under Section 02402 and/or Section 02650 including furnishing, installing, operating and removing of dewatering systems not covered under separate unit items.
5. Said price shall include any fittings, tees, wyes, adapters, couplings, thrust restraint fittings and thrust blocks, etc. not covered under separate bid items which are required to connect existing pipe to the proposed water main.
6. Said unit price shall include full compensation for the relocation of utilities (including but not limited to gas, electric and telephone) which interfere with the proposed water main as shown on the Drawings, and for the repair of utilities damaged by the Contractor.
7. Said unit price shall include temporary piping, temporary facilities, and temporary services, not included or paid for under separate items, as necessary to maintain water service during construction.
8. Said unit price shall include removal and proper disposal of (non-asbestos) existing water main, in-line valves, and other items that are abandoned and are required to be removed. Unit price shall include caps for pipes abandoned in place.
9. Said unit price shall include restoration of existing improvements including, but not limited to driveways (paved and gravel), lawns, curbs, drainage, etc., unless specifically paid under a separate pay item.
10. Said unit price shall include sheeting and bracing (if necessary).
11. Said unit price shall include disinfection, de-chlorination, bacteriological, and pressure testing.
12. Said unit price shall include installation and removal of temporary blowoffs, including any corporations, pipes and shut-offs needed to flush lines and chlorinate the system when this cannot be accomplished through an existing hydrant.
13. Actual payment for this item shall be broken down in accordance with the following percentages:
 - a. Water pipe in place and backfilled - 90%

- b. Water pipe successfully cleaned and tested, and cleanup and/or corrections completed - 10%

Item No. 3.01: Water Main Connection

A. Method of Measurement:

- 1. The quantity measured for payment shall be paid at the Contract price for each water main connection completed, tested and accepted by the Engineer.

B. Basis of Payment:

- 1. The water main connection shall be paid for at the Contract price per each. Said unit price shall include the necessary fittings to make connections from the proposed water main to the existing water main.
- 2. Said unit price shall constitute full compensation for furnishing and installing all materials, labor, equipment and tools necessary for hauling, handling, laying, jointing and testing pipe. Said unit price shall include cutting and removing a piece of the existing water main, furnishing and installing the SS tapping sleeve with gate valve, ductile iron pipe and fittings.
- 3. Said unit price shall include all necessary earth excavation, bedding, sheeting, backfill, compaction, rigid insulation, cleaning and testing and other incidental work including removal, stockpiling and replacement of select reclaimed pavement and roadway gravels.
- 4. Said unit price shall include full compensation for all construction dewatering work required to pre-drain soils prior to final excavation and to install pipe in-the-dry as specified under Section 02402 and/or Section 02650 including furnishing, installing, operating and removing of dewatering systems not covered under separate unit items.
- 5. Said price shall include any fittings, thrust restraint fittings and/or thrust blocks, etc. not covered under separate bid items which are required to connect existing pipe to the proposed water main.
- 6. Said unit price shall include full compensation for the repair of utilities damaged by the Contractor.
- 7. Said unit price shall include sheeting and bracing (if necessary).

Item No. 3.02: Fire Hydrant

A. Method of Measurement:

- 1. The quantity measured for payment shall be paid at the Contract price for each hydrant completed, tested and accepted by the Engineer.

B. Basis of Payment:

- 1. Hydrant assemblies shall be paid at the Contract price per each assembly, including 6" ductile iron branch piping from the water main to the hydrant, gate valve, valve box, mechanical joint fittings, thrust restraint(s), hydrant riser regardless of the length, cleaning, testing, and painting as shown on the Drawings and as specified herein.
- 2. Said unit price shall also constitute full compensation for tools, materials, labor and equipment necessary for excavation, dewatering, backfill, compaction, sheeting,

bracing, cleaning and other incidental work not specifically included for payment under other items that are necessary to install the hydrant.

3. Said unit price shall also constitute full compensation for the removal and replacement of curbs, drives (paved and gravel), bushes, plantings, sod, and all necessary grading and reseeding of grassed areas disturbed by the Contractor's operations, not paid for under separate unit items.
4. Actual payment for this item shall be broken down in accordance with the following percentages:
 - a. Hydrant assembly in place and backfilled - 70%
 - b. Hydrant assembly successfully cleaned and tested, and cleanup and/or corrections completed - 30%

Item No. 3.03: Water Service Connection and Valve Box

A. Method of Measurement:

1. The quantity measured for payment shall be paid at the Contract price for each water service connection completed, tested and accepted by the Engineer.

B. Basis of Payment:

1. Water service connections complete in place shall be paid at the Contract price for each.
2. Said unit price shall constitute payment for tapping water main wet or dry; furnishing and installing corporation, service saddle, curb stop, curb box; cleaning, testing and connection to the existing service as shown on the Drawings and as specified herein.
3. Said price shall be considered compensation for furnishing any fittings, tees, wyes, adapters, couplings, etc. not covered under separate bid items which are required to connect the proposed water main to the existing house service, where indicated on the Drawings.
4. Said unit price shall also constitute full compensation for all necessary excavation, dewatering, backfill, compaction, sheeting, bracing, cleaning and other incidental work not specifically included for payment under other items.
5. Said unit price shall also constitute full compensation for the removal and replacement of curbs, drives (paved and gravel), bushes, plantings, sod, and all necessary grading and reseeding of grassed areas disturbed by the Contractor's operations.

Item No. 3.04: Water Service Pipe

A. Method of Measurement:

1. Copper service pipe shall be measured per linear foot.
2. Measurement shall be along the centerline of the pipe including the tapping saddle, corporation stop, through the curb stop to the connection to the existing service line.

B. Basis of Payment:

1. Pipe shall be paid for at the Contract price per linear foot.

2. Said unit price shall constitute full compensation for furnishing and installing all materials, labor, equipment and tools necessary for hauling, handling, laying, jointing and testing pipe.
3. Said unit price shall also include all necessary earth excavation, dewatering, bedding, backfill, sheeting/bracing, compaction, cleaning and testing, and other incidental work.
4. Said unit price shall also constitute full compensation for the removal and replacement of curbs, drives (paved and gravel), bushes, plantings, sod, and all necessary grading and reseeded of grassed areas disturbed by the Contractor's operations.
5. Said unit price shall also constitute full payment for the relocation of copper service pipes relocated or replaced because of sewer or drain interferences.

Item No. 3.05: Water Meter Pit

- A. Method of Measurement:
 1. Water Meter Pit shall be measured by each Water meter Pit installed as shown on the drawings or as ordered by the Engineer.
- B. Basis of Payment:
 1. Water Meter Pit shall be paid for at the Contract price per each.
 2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to install a Water Meter Pit as shown in the detail.

Item No. 3.06: Water Spigot

- A. Method of Measurement:
 1. Water Spigot shall be measured for each Water Spigot installed as shown on the drawings or as ordered by the Engineer.
- B. Basis of Payment:
 1. Water Spigot shall be paid for at the Contract price per each.
 2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to install a Water Spigot as shown in the detail.

Item No. 3.07: Water Fountain

- A. Method of Measurement:
 1. Water Fountain shall be measured for each Water Fountain installed as shown on the drawings or as ordered by the Engineer.
- B. Basis of Payment:
 1. Water Fountain shall be paid for at the Contract price per each unit price.
 2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to install a Water Fountain as shown in the detail.

Item No. 3.08: Gate Valve and Valve Box

- A. Method of Measurement:
 1. Gate Valve and Valve Box shall be measured for each installed as shown on the drawings or as ordered by the Engineer.

B. Basis of Payment:

1. Said unit price shall constitute full compensation for the furnishing of all labor, equipment and materials associated with installing the gate valves and valve box; and associated reducers; couplings; elbows; tees; restrainers; thrust blocks; and other fittings to accomplish the installation in full conformance with the Drawings and Specifications.

SCHEDULE 4: RECREATIONAL FIELD SYNTHETIC TURF & SITE AMENITIES

Item No. 4.00: Field 1 (360' x 225') Synthetic Turf Field

A. Method of Measurement:

1. This item will be measured as the estimated percentage of the total work completed during each pay period.

B. Basis of Payment:

1. Field 1 (360' x 225') Synthetic Turf Field shall be paid for at the Contract lump sum price.
2. Said lump sum price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to construct a synthetic turf field and associated field drainage as shown in the plans.

Item No. 4.01: Ball Netting System

A. Method of Measurement:

1. Ball Netting System shall be measured by the linear foot of Ball Netting installed as shown on the drawings or as ordered by the Engineer.

B. Basis of Payment:

1. Ball Netting System shall be paid for at the Contract linear foot price.
2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to install a Ball Netting System as shown in the detail.

Item No. 4.02: 4' BVCL Fence

A. Method of Measurement:

2. 4' BVCL Fence shall be measured by the linear foot of 4' BVCL Fence installed as shown on the drawings or as ordered by the Engineer.

B. Basis of Payment:

3. 4' BVCL Fence shall be paid for at the Contract linear foot unit price.
4. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to install a 4' BVCL Fence and post foundations as shown in the detail.

Item No. 4.03: 4' BVCL Single Swing Gate

A. Method of Measurement:

1. 4' BVCL Single Swing Gate shall be measured for each installed as shown on the drawings or as ordered by the Engineer.

B. Basis of Payment:

1. 4' BVCL Single Swing Gate shall be paid for at the Contract each unit price.
2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to construct a 4' BVCL Single Swing Gate as shown in the detail.

Item No. 4.04: 10' BVCL Double Swing Gate

A. Method of Measurement:

1. 10' BVCL Fence Gate shall be measured for each installed as shown on the drawings or as ordered by the Engineer.

B. Basis of Payment:

1. 10' BVCL Double Swing Gate shall be paid for at the Contract each unit price.
2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to construct a 10' BVCL Double Swing Gate as shown in the detail.

Item No. 4.05: Goal Posts

A. Method of Measurement:

1. Goal Posts shall be measured per each Goal Post installed as shown on the drawings or as ordered by the Engineer.

B. Basis of Payment:

1. Goal Posts shall be paid for at the Contract each unit price.
2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to construct Goal Posts as shown in the detail.

Item No. 4.06: Soccer Goals

A. Method of Measurement:

1. Soccer Goals shall be measured per each Soccer Goal installed as shown on the drawings or as ordered by the Engineer.

B. Basis of Payment:

1. Soccer Goals shall be paid for at the Contract each unit price.
2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to construct a Soccer Goals as shown in the detail.

Item No. 4.07: Portable Toilets (2) in Shelter on Concrete Pad

A. Method of Measurement:

1. Portable Toilets (2) in Shelter on Concrete Pad shall be measured per each Portable Toilets (2) in Shelter on Concrete Pad installed as shown on the drawings or as ordered by the Engineer.

B. Basis of Payment:

1. Portable Toilets (2) in Shelter on Concrete Pad shall be paid for at the Contract each unit price.

2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to construct a Portable Toilets (2) in Shelter on Concrete Pad as shown in the detail.

Item No. 4.08: Mobile Bleachers

- A. Method of Measurement:
 1. Mobile Bleachers shall be measured per each Mobile Bleacher installed as shown on the drawings or as ordered by the Engineer.
- B. Basis of Payment:
 1. Mobile Bleachers shall be paid for at the Contract each unit price.
 2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to construct a Mobile Bleachers as shown in the detail.

Item No. 4.09: Storage Shed on Concrete Pad

- A. Method of Measurement:
 1. Storage Shed on Concrete Pad shall be measured per each Storage Shed on Concrete Pad installed as shown on the drawings or as ordered by the Engineer.
- B. Basis of Payment:
 1. Storage Shed on Concrete Pad shall be paid for at the Contract each unit price.
 2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to construct a Storage Shed on Concrete Pad as shown in the detail.

Item No. 4.10: Bike Rack

- A. Method of Measurement:
 1. Bike Rack shall be measured per each Bike Rack installed as shown on the drawings or as ordered by the Engineer.
- B. Basis of Payment:
 1. Bike Rack shall be paid for at the Contract each unit price.
 2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to construct a Bike Rack as shown in the detail.

Item No. 4.11: Sport Light Foundations

- A. Method of Measurement:
 1. Sport Light Foundations shall be measured per each Sport Light Foundation installed as shown on the drawings or as ordered by the Engineer.
- B. Basis of Payment:
 1. Sport Light Foundations shall be paid for at the Contract each unit price.
 2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to construct a Sport Light Foundations as shown in the detail.

Item No. 4.12: Sport Light Conduits & Handholes for Future Service

- A. Method of Measurement:
 - 1. This item will be measured as the estimated percentage of the total work completed during each pay period.
- B. Basis of Payment:
 - 1. Sport Light Conduits & Handholes for Future Service shall be paid for at the Contract lump sum price.
 - 2. Said price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to construct a Sport Light Conduits & Handholes for Future Service as shown in the detail.

SCHEDULE 5: REGIONAL STORMWATER TREATMENT SYSTEMS

Item Nos. 5.00A & 5.00B: Site Preparation R1 & Site Preparation R2 & R3

- A. Method of Measurement:
 - 1. Schedule 1, Item 1.04 – Site Preparation for measurement description.
- B. Basis of Payment:
 - 1. Schedule 1, Item 1.04 – Site Preparation for payment description.

Item No. 5.01: Ledge Removal and Disposal

- A. Method of Measurement:
 - 1. Schedule 2, Item 2.01 – Ledge Removal and Disposal for measurement description.
- B. Basis of Payment:
 - 1. Schedule 2, Item 2.01 – Ledge Removal and Disposal for payment description.

Item No. 5.02: BMP-R1 Subsurface Gravel Wetlands Construction

- A. Method of Measurement:
 - 1. Schedule 2, Item 2.08 – BMP-2 Subsurface Gravel Wetlands Construction for measurement description.
- B. Basis of Payment:
 - 1. Schedule 2, Item 2.08 – BMP-2 Subsurface Gravel Wetlands Construction for payment description.

Item No. 5.03: BMP-R2 & R3 Bioretention Basin w/ Internal Storage

- A. Method of Measurement:
 - 1. This item will be measured as the estimated percentage of the total work completed during each pay period.
- B. Basis of Payment:
 - 1. BMP-R2 & R3 Bioretention Basin w/ Internal Storage shall be paid for at the Contract lump sum price.
 - 2. Said price shall constitute full compensation for the furnishing of all materials, labor, equipment, and tools necessary to construct the BMP-R2 & R3 Bioretention Basin w/ Internal Storage as shown in the construction drawings.

3. Said price shall include full compensation to dewater; excavate and prepare the subgrade; all earthwork (except ledge); excavation support (sheeting and shoring, if required); furnish & install low permeability layer in bottom and sides of facility and low permeability material in berms; furnish & install all impermeable liners; furnish & install concrete cutoff walls; furnish & install all drain pipes, and culverts within the pay limits; and all other work not paid for separately (see Basis of Payment Note 4 under this item) as shown on the plans and in the details.
4. Items paid for separately include: Site Preparation; Ledge Excavation; Wetland/Bioretenction Soil; ¾" Washed Stone; 3/8" Pea Gravel; Stone Fill, Class B & C; and the Outlet Control Structures. All other labor and materials required to construct this BMP facility shall be included in this pay item.

Item No.'s 5.04A & 5.04B: Wetland Soil & Bioretention Soil Mix

- A. Method of Measurement:
 1. Schedule 2, Item 2.09 – Wetland Soil for measurement description.
- B. Basis of Payment:
 1. Schedule 2, Item 2.09 – Wetland Soil for payment description.

Item No. 5.05: ¾" Washed Stone (AASHTO #5 Stone)

- A. Method of Measurement:
 1. Schedule 2, Item 2.10 – ¾" Washed Stone (AASHTO #5 Stone) for measurement description.
- B. Basis of Payment:
 1. Schedule 2, Item 2.10 – ¾" Washed Stone (AASHTO #5 Stone) for payment description.

Item No. 5.06: 3/8" Pea Gravel (AASHTO #8 Stone)

- A. Method of Measurement:
 1. Schedule 2, Item 2.11 – 3/8" Pea Stone (AASHTO #8 Stone) for measurement description.
- B. Basis of Payment:
 1. Schedule 2, Item 2.11 – 3/8" Pea Stone (AASHTO #8 Stone) for payment description.

Item No. 5.07: Stone Fill, Class B and C

This work applies to the following items:

Item 5.07A – Stone Fill, Class B (NHDOT Item 585.2)

Item 5.07B – Stone Fill, Class C (NHDOT Item 585.2)

- A. Method of Measurement:
 1. Schedule 2, Item 2.12 – Stone Fill, Class B/C (NHDOT Item 585.2/585.3) for measurement description.
- B. Basis of Payment:
 1. Schedule 2, Item 2.12 – Stone Fill, Class B/C (NHDOT Item 585.2/585.3) for payment description.

Item No.'s 5.08, 5.09, 5.10, & 5.11: Outlet Control Structures

This work applies to the following items:

- Item 5.08 – Outlet Control Structure (BMP-R1 - POCS-3)
- Item 5.09 – Outlet Control Structure (BMP-R2 - POCS-4)
- Item 5.10 – Outlet Control Structure (BMP-R2 - POCS-5)
- Item 5.11 – Outlet Control Structure (BMP-R2 - POCS-6)
- A. Method of Measurement:
 - 1. Schedule 2, Item 2.14 – Outlet Control Structure (BMP-2, POCS-2) for measurement description.
- B. Basis of Payment:
 - 1. Schedule 2, Item 2.14 – Outlet Control Structure (BMP-2, POCS-2) for payment description.

Item No. 5.12: Headwall

- A. Method of Measurement:
 - 1. Schedule 2, Item 2.29 – Headwall for measurement description.
- B. Basis of Payment:
 - 2. Schedule 2, Item 2.29 – Headwall for payment description.

Item No. 5.13: Culvert Cleaning and Inlet Clearing

- A. Method of Measurement:
 - 1. This item will be measured as the estimated percentage of the total work completed during each pay period.
- B. Basis of Payment:
 - 1. Culvert Cleaning and Inlet Clearing shall be paid for at the Contract lump sum price.
 - 2. Said lump sum price shall constitute full compensation for the furnishing of all materials, labor, equipment, and tools necessary to clean the culvert, so it can flow properly at full capacity, and to clear and muck inlet/outlet area of the culvert, so water can effectively enter/exit the culvert.

Item No. 5.14: Riprap VII

- A. Method of Measurement:
 - 1. Riprap Class VII (NHDOT 585.7) shall be measured by ton, in accordance with NHDOT section 109.01, on the basis of delivery slips provided to the Engineer, but not to exceed the rate ordered.
- B. Basis of Payment:
 - 1. The accepted quantity of Riprap Class VII (NHDOT 585.7) will be paid for at the Contract unit price per ton complete in place.
 - 2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to install Riprap Class VII (NHDOT 585.7) as shown in the detail.

3. Said unit price shall constitute full compensation for all required geotextile fabric.

Item No. 5.15: Drainage Manhole

- A. Method of Measurement:
 1. Schedule 2, Item 2.27 – Drainage Manhole for measurement description.
- B. Basis of Payment:
 3. Schedule 2, Item 2.29 – Drainage Manhole for payment description.

Item No. 5.16: 2” – 6” Washed Stone (Forebay Floor & Forebay Weir)

- A. Method of Measurement:
 1. Schedule 2, Item 2.28 – 2” – 6” Washed Stone for measurement description.
- B. Basis of Payment:
 4. Schedule 2, Item 2.28 – 2” – 6” Washed Stone for payment description.

BID ALTERNATE A – SYNTHETIC FIELD 2 TURF

Item No. A1: Field 2 Synthetic Turf

- A. Method of Measurement:
 1. Schedule 4, Item 4.00 – Field 1 (360’ x 225’) Synthetic Turf Field for measurement description.
- B. Basis of Payment:
 1. Schedule 4, Item 4.00 – Field 1 (360’ x 225’) Synthetic Turf Field for payment description.

Item No. A2: Ball Netting System

- A. Method of Measurement:
 1. Schedule 4, Item 4.01 – Ball Netting System for measurement description.
- B. Basis of Payment:
 1. Schedule 4, Item 4.01 – Ball Netting System for payment description.

Item No. A3: 4’ BVCL Fence

- A. Method of Measurement:
 1. Schedule 4, Item 4.02 – 4’ BVCL Fence for measurement description.
- B. Basis of Payment:
 1. Schedule 4, Item 4.02 – 4’ BVCL Fence for payment description.

Item No. A4: Porous Media Infiltration Bed

- A. Method of Measurement:
 1. Schedule 2, Item 2.32 – Porous Media Infiltration Bed for measurement description.
- B. Basis of Payment:
 1. Schedule 2, Item 2.32 – Porous Media Infiltration Bed for payment description.

Item No. A5: Porous Pavement

- A. Method of Measurement:
 - 1. Schedule 2, Item 2.33 – Porous Pavement for measurement description.
- B. Basis of Payment:
 - 1. Schedule 2, Item 2.33 – Porous Pavement for payment description.

Item No. A6: Mobile Bleachers

- A. Method of Measurement:
 - 1. Schedule 4, Item 4.08 – Mobile Bleachers for measurement description.
- B. Basis of Payment:
 - 1. Schedule 4, Item 4.08 – Mobile Bleachers for payment description.

Item No. A7: Tree Planting (2.5-3” Caliper)

- A. Method of Measurement:
 - 1. Schedule 2, Item 2.45 – Tree Planting (2.5-3” Caliper) for measurement description.
- B. Basis of Payment:
 - 1. Schedule 2, Item 2.45 – Tree Planting (2.5-3” Caliper) for payment description.

Item No. A8: Sport Light Foundations

- A. Method of Measurement:
 - 1. Schedule 4, Item 4.11 – Sport Light Foundations for measurement description.
- B. Basis of Payment:
 - 2. Schedule 4, Item 4.11 – Sport Light Foundations for payment description.

Item No. A9: Sport Light Conduits & Handholes for Future Service

- A. Method of Measurement:
 - 1. Schedule 4, Item 4.12 – Sport Light Conduits & Handholes for Future Service for measurement description.
- B. Basis of Payment:
 - 1. Schedule 4, Item 4.12 – Sport Light Conduits & Handholes for Future Service for payment description.

Item No. A10: Gravel Parking Lot (General Gravel Section)

- A. Method of Measurement:
 - 1. Schedule 2, Item 2.03 – Gravel Parking Lot (General Gravel Section) for measurement description.
- B. Basis of Payment:
 - 1. Schedule 2, Item 2.03 – Gravel Parking Lot (General Gravel Section) for payment description.

Item No. A11: Solar Powered Lights for Parking Lot

- A. Method of Measurement:
 - 1. Schedule 2, Item 2.47 – Solar Powered Lights for Parking Lot for measurement description.
- B. Basis of Payment:
 - 2. Schedule 2, Item 2.47 – Solar Powered Lights for Parking Lot for payment description.

BID ALTERNATE B – Sport Field Lighting

Item No. B1: Sport Field Lighting Poles and Fixtures

- A. Method of Measurement:
 - 1. Sport Field Lighting Poles and Fixtures shall be measured per each Sports Field Lighting Pole and Fixtures installed as shown on the drawings or as ordered by the Engineer.
- B. Basis of Payment:
 - 1. Sport Field Lighting Poles and Fixtures shall be paid for at the Contract unit price per each installed.
 - 2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to install Sport Field Lighting Poles and Fixtures.

Item No. B2: Electrical Service Conduit

- A. Method of Measurement:
 - 1. Electrical Conduit shall be measured by the linear foot of Electrical Service Conduit to provide the electrical service connection from Community Campus Drive to the Site per Detail D on Sheet D-106.
- B. Basis of Payment:
 - 1. Electrical Conduit shall be paid for at the Contract unit price per linear foot.
 - 2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to install the Electrical Conduit per the applicable details.
 - 3. Said unit price shall include full compensation to excavate and prepare the subgrade; install Electrical Conduit, bedding material, and select backfill material; and backfill as shown in the Detail D on Sheet D-106.

Item No. B3: Electrical Cabinet and Transformer

- A. Method of Measurement:
 - 1. The quantity to be measured for payment shall be on an estimated percentage of the total work completed during each pay period.
- B. Basis of Payment:
 - 1. Electrical Cabinet and Transformer shall be paid for at the Contract lump sum price.

2. Said lump sum price shall constitute full compensation for all labor, equipment and materials necessary to form and pour concrete pad(s) and set the Electrical Cabinet and Transformer per the plans and details.

Item No. B4: Utility Connection (Eversource)

A. Method of Measurement:

1. This item shall include the allowance identified in the bid schedule.
2. Measurement for the Utility Connection shall be based on the actual invoices submitted with no markup.

B. Basis of Payment:

1. Payment for the Utility Connection shall be on the reimbursement for actual costs and will be based on actual invoices submitted to the Engineer by the Contractor with no mark-up.
2. Said lump sum price shall constitute full compensation for all labor, equipment and materials necessary to coordinate and assist Eversource with activating the Electrical Cabinet and Transformer.

BID ALTERNATE C – Snow Storage Gravel Area & Public Works Access Road Improvements

Item No.'s. C1 & C2: Gravel Road Sections

This work applies to the following items:

Item C1 – Heavy Duty Gravel

Item C2 – DPW Access Road (Access Drive Section)

A. Method of Measurement:

1. Gravel Road Sections shall be measured by the square yard of gravel road section installed within the limits shown in the construction drawings, or as ordered by the Engineer.

B. Basis of Payment:

1. Gravel Road Sections shall be paid for at the Contract unit price per square yard.
2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to excavate and prepare the subgrade for installation of the Gravel Road Section.
3. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to install geotextile fabric, construct the Gravel Road Sections per the applicable details with the specified materials at their required layer thicknesses, and fine grade.
4. Said unit price shall constitute full compensation for preparation of the subgrade prior to construction the Gravel Road Section.

BID ALTERNATE D – Sewer Force Main

Item No. D1: Sewer Force Main

- A. Method of Measurement:
 - 1. Sewer Force Main shall be measured by the linear foot of Sewer Force Main installed within the limits shown in the construction drawings, or as ordered by the Engineer.
- B. Basis of Payment:
 - 1. Sewer Force Main shall be paid for at the Contract unit price per linear foot.
 - 2. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to install the Sewer Force Main and transition pipe into the existing manhole per the applicable details.
 - 3. Said unit price shall include full compensation to excavate and prepare the subgrade; core existing sewer manhole; install sewer force main, bedding material, and select backfill material; and backfill as shown in the detail.

BID ALTERNATE E & F – Alternative Infills – Envirofill with Shock Pad & Safeshell with Shock Pad

- A. Method of Measurement:
 - 1. Alternative Infill – Envirofill with Shock Pad & Safeshell with Shock Pad shall be measured as the estimated percentage of the total work completed during each pay period.
- B. Basis of Payment:
 - 1. Alternative Infills shall be paid for shall be paid for at the Contract lump sum price.
 - 2. Said lump sum price shall constitute full compensation for all labor, equipment and materials necessary to furnish and install this alternative synthetic grass infill system and shock pad in accordance with the plans and specifications.

BID ALTERNATE G – Scoreboard & Footings

Item No. G1: Scoreboard & Footings

- A. Method of Measurement:
 - 1. Scoreboard and footings shall be measured per each scoreboard installed as shown on the drawings or as ordered by the Engineer.
- B. Basis of Payment:
 - 3. Scoreboard and footings shall be paid for at the Contract unit price per each installed.
 - 4. Said unit price shall constitute full compensation for furnishing all materials, labor, equipment, and tools necessary to install the scoreboard and footings.

END OF SECTION

SECTION 01070

ABBREVIATIONS AND SYMBOLS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Where any of the following abbreviations are used in these Specifications, they shall have the meaning set forth opposite each.

AASHTO	American Association of State Highway and Transportation Officials
AC	Alternating Current
ACI	American Concrete Institute
ACP	Asbestos Cement Pipe
AGA	American Gas Association
AIC	Ampere Interrupting Capacity
AGMA	American Gear Manufacturers Association
AIEE (IEEE)	American Institute of Electrical Engineers (Institute of Electrical and Electronics Engineers, Inc.)
AISC	American Institute of Steel Construction
amp	Ampere
125-16	
Amer. Std.	American Standard for Cast Iron Pipe Flanges and Flanged Fittings, Class 125 (ASA B16 11960)
ANSI	American National Standards Institute
API	American Petroleum Institute
ASA	American Standards Association
ASCE	American Society of Civil Engineers
ASH & AE	American Society of Heating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing and Materials
AWG	American or Brown and Sharpe Wire Gage
AWWA	American Water Works Association
BOD	Biochemical Oxygen Demand
c.f.	Cubic Foot
c.f.m	Cubic Foot Per Minute
c.f.s	Cubic Foot Per Second
CI	Cast Iron
CIPRA	Cast Iron Pipe Research Association
CSI	Construction Specifications Institute
c.y.	Cubic Yards
DC	Direct Current
DEP	Department of Environmental Protection

DES	Department of Environmental Services
DI	Ductile Iron
DOT	Department of Transportation
EDR	Equivalent Directional Radiation
EPA	U.S. Environmental Protection Agency
FmHA	Farmers Home Administration (RD)
fps	Feet Per Second
ft.	Feet
gal.	Gallons
gpd	Gallons Per Day
gpm	Gallons Per Minute
HDPE	High Density Polyethylene
HP	Horsepower
IBR	Institute of Boiler and Radiator Manufacturers
in.	Inches
inter.	Interlock
ISA	Instrument Society of America
kva	Kilovolt-ampere
kw	Kilowatt
lb.	Pound
max.	Maximum
MCB	Master Circuit Board
MGD	Million Gallons Per Day
Min.	Minimum
NBS	National Bureau of Standards
NEC	National Electrical Code, Latest Edition
NEMA	National Electrical Manufacturers Association
NEWWA	New England Water Works Association
NPT	National Pipe Thread
OS&Y	Outside Screw and Yoke
PCA	Portland Cement Association
PE	Polyethylene
ppm	Parts Per Million
%	Percent
psi	Pounds Per Square Inch
psig	Pounds Per Square Inch Gage
PVC	Polyvinyl Chloride
R.D.	Rural Development (Formerly FmHA)
rpm	Revolutions Per Minute
s.f.	Square Foot
STL.W.G.	U.S. Steel Wire, Washburn and Moen, American Steel and Wire Cos., or Roebling Gage
s.y.	Square Yard
TDH	Total Dynamic Head
USAS	Standards of the United States of America Standards Institute (formerly American Standards Association)

USS GAGE
VC
WSP
Fed. Spec.

United States Standard Gage
Vitrified Clay
Working Steam Pressure
Federal Specifications issued by the Federal Supply
Service of the General Service Administration,
Washington, D.C.

PART 2 - PRODUCTS

(Not part of this Section)

PART 3 - EXECUTION

(Not part of this Section)

END OF SECTION

SECTION 01090

REFERENCE STANDARDS

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

- A. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard by date of issue current on the date of Contract Documents.
- C. Should specified reference standards conflict with Contract Documents, request clarification from Engineer before proceeding.
- D. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.2 SCHEDULE OF REFERENCES

AA	Aluminum Association
AABC	Associated Air Balance Council
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ADC	Air Diffusion Council
AGC	Associated General Contractors of America
AI	Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Movement and Control Association
ANSI	American National Standards Institute
APA	American Plywood Association
ARI	Air-Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigerating,
ASME	American Society of Mechanical Engineers
ASPA	American Sod Producers Association
ASTM	American Society for Testing and Materials
AWI	Architectural Woodwork Institute
AWPA	American Wood-Preservers' Association
AWS	American Welding Society
AWWA	American Water Works Association
BIA	Brick Institute of America
BOCA	Building Officials and Code Administrators

CDA	Copper Development Association
CLFMI	Chain Link Fence Manufacturers Institute
CRSI	Concrete Reinforcing Steel Institute
DHI	Door and Hardware Institute
EJCDC	Engineers' Joint Contract Documents Committee
EJMA	Expansion Joint Manufacturers Association
FGMA	Flat Glass Marketing Association
FM	Factory Mutual System
FS	Federal Specification
GA	Gypsum Association
ICBO	International Conference of Building Officials
IEEE	Institute of Electrical and Electronics Engineers
IMIAC	International Masonry Industry All-Weather Council
MBMA	Metal Building Manufacturer's Association
MFMA	Maple Flooring Manufacturers Association
MIL	Military Specification
ML/SFA	Metal Lath/Steel Framing Association
NAAMM	National Association of Architectural Metal
NCMA	National Concrete Masonry Association
NEBB	National Environmental Balancing Bureau
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NSWMA	National Solid Wastes Management Association
NTMA	National Terrazzo and Mosaic Association
NWMA	National Woodwork Manufacturers Association
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute
PS	Product Standard
RIS	Redwood Inspection Service
RCSHSB	Red Cedar Shingle and Handsplit Shake Bureau
SDI	Steel Deck Institute
SDI	Steel Door Institute
SIGMA	Sealed Insulating Glass Manufacturers Association
SJI	Steel Joist Institute
SMACNA	Sheet Metal and Air Conditioning Contractors'
SSPC	Steel Structures Painting Council
TCA	Tile Council of America, Inc.
UL	Underwriters' Laboratories, Inc.
WCLIB	West Coast Lumber Inspection Bureau
WWPA	Western Wood Products Association

PART 2 - PRODUCTS

(NOT PART OF THIS SECTION)

PART 3 - EXECUTION

(NOT PART OF THIS SECTION)

END OF SECTION

SECTION 01200

PROJECT MEETINGS

PART 1 - GENERAL

1.1 INTRODUCTION

- A. Project meeting requirements

1.2 PROJECT MEETINGS (FORMAL)

- A. The Contractor shall attend project meetings throughout the progress of the work.
- B. Meetings shall be held at a frequency no less than twice per month; weekly meetings are possible.
- C. The following representatives of the Contractor shall attend:
 - 1. Superintendent or authorized representative
 - 2. Representative of major subcontractors (when requested)
 - 3. Representatives of major suppliers (when requested)
 - 4. Other representatives as appropriate to agenda topics
- D. The Engineer shall prepare and distribute project meeting notes.
- E. Sample Agenda
 - 1. Work progress
 - 2. Progress schedule
 - 3. Delivery schedules
 - 4. Submittals
 - 5. Payment applications
 - 6. Change Orders and Field Orders
 - 7. Other items

1.3 WEEKLY COORDINATION MEETINGS (INFORMAL)

- A. The contractor's superintendent, the owner, and the resident engineer shall meet weekly to informally discuss the project progress/schedule, sequence, and other issues.

PART 2 - PRODUCTS

(NOT PART OF THIS SECTION)

PART 3 - EXECUTION

(NOT PART OF THIS SECTION)

END OF SECTION

SECTION 01201PRECONSTRUCTION MEETINGPART 1 -- GENERAL1.1 INTRODUCTION

- A. Preconstruction meeting requirements.

1.2 PROJECT MEETINGS

- A. The Contractor shall attend preconstruction meetings prior to the commencement of work.
- B. The following representatives of the Contractor shall attend:
1. Project Manager and Superintendent
 2. Representative of major subcontractors (when requested)
 3. Representatives of major suppliers (when requested)
 4. Representatives of utility companies, as applicable.
 5. Other representatives as appropriate to agenda topics
- C. The Engineer shall prepare and distribute project meeting notes.
- D. Sample Agenda
1. Submittal of executed bonds and insurance certificates
 2. Execution and Distribution of the Contracts
 3. Designation of responsible personnel
 4. Contractor's submittals:
 - a. List of subcontractor
 - b. Project Schedule
 - c. Schedule of Values
 - d. Shop drawings
 5. Description of Procedures:
 - a. Submittals
 - b. Substitutions
 - c. Field decisions
 - d. Applications for payment
 - e. Certified payroll
 - f. Proposal requests
 - g. Change orders
 - h. Contract closeout procedures
 6. Critical work scheduling (i.e. night work and tie-ins)
 7. Work of other Contracts
 8. Requirements of various agencies:
 - a. Labor
 - b. Funding agency
 - c. NHDOT/public works

9. Preconstruction and preblast surveys
10. Field Engineering
11. Project Inspection
12. Right-of-Way and easements
13. Utility coordination
14. Security
15. Housekeeping procedures
16. Erosion control plan
17. Chlorination and dechlorination plan
18. Testing procedures
19. Winter maintenance
20. Record drawings
21. Substantial completion
22. Final completion

PART 2 -- PRODUCTS

(NOT PART OF THIS SECTION)

PART 3 -- EXECUTION

(NOT PART OF THIS SECTION)

END OF SECTION

SECTION 01310CONSTRUCTION SCHEDULESPART 1 - GENERAL1.1 DESCRIPTION

- A. Work Included: Within ten days after the effective date of the Agreement between Owner and Contractor, submit to the Engineer an estimated progress schedule.
- B. Form of Schedules:
 - 1. Narrative: Completely describe the construction methods to be employed.
 - 2. Horizontal Bar Chart (i.e., Gantt chart):
 - a. Provide a separate horizontal bar column for each trade or operation.
 - b. Order: Chronological, for each trade and/or operation.
 - c. Horizontal scale: Identify first work day of each week, allow space for updating and revision.
 - 3. Provide electronic copies of updated schedules upon request.
- C. Content of Schedules:
 - 1. Provide complete sequence of construction by activity. Include sequencing of utilities as identified in the Prosecution of Work (POW) Item 3, Temporary Water Systems and/or other utilities will be dependent on the Contractor's sequencing for work that is in the Owner's best interest, as determined by the Engineer. Other items requiring special consideration, to be identified in schedules include:
 - a. Shop Drawings, Project Data and Samples:
 - 1. Submittal Dates
 - 2. Dates reviewed copies will be required.
 - b. Decision dates for:
 - 1. Products specified by allowances.
 - 2. Selection of finishes (when applicable).
 - c. Product procurement and delivery dates.
 - d. Dates for beginning and completion of each element of construction.
 - 2. Identify work of separate phases and logically grouped activities.
 - 3. Show the projected percentage of completion for each item of work as of the first day of each month.
 - 4. Provide separate sub-schedules, if requested by the Engineer, showing submittals, review times, procurement schedules, and delivery dates.
- D. Updating:
 - 1. The schedules shall be updated at least every month and for each project meeting.
 - 2. Show all changes occurring since previous submission.
 - 3. Indicate progress of each activity, show completion dates.
 - 4. Include:
 - a. Major changes in scope.
 - b. Activities modified since previous updating.
 - c. Revised projections due to changes.
 - d. Other identifiable changes.

5. Provide narrative report, including:
 - a. Discussion of problem areas, including current and anticipated delay factors.
 - b. Corrective action taken, or proposed.
 - c. Description of revisions that may affect schedules.

1.2 SUBMITTALS

- A. Submit periodically updated schedules when requested by the Engineer.
- B. Submit 4 copies of initial and updated schedules to the Engineer.

PART 2 - PRODUCTS

(NOT PART OF THIS SECTION)

PART 3 - EXECUTION

(NOT PART OF THIS SECTION)

END OF SECTION

SUBMITTALSPART 1 -- SECTION 01340PART 2 -- GENERAL2.1 DESCRIPTION

A. Work Included:

1. Submit to the Engineer, Shop Drawings, Operation and Maintenance Manuals, Manufacturers' Certificates, Project Data, and Samples required by the Specification Sections.

B. Alternates

1. If the Contractor elects to submit an Alternate that is equivalent or superior, the Contractor will be responsible to make all modifications to the Work resulting from the use of the Alternate at no additional cost to the Owner.
2. If the Contractor elects to submit an Alternate, the Contractor must follow the procedures listed in Section 01630 – Substitutions and Product Options.

2.2 SHOP DRAWINGS

- A. Shop Drawings are required for each and every element of the work. Each shop drawing shall be assigned a sequential number for purposes of easy identification, and shall retain its assigned number, with appropriate subscript, on required resubmission.
- B. Shop Drawings are generally defined as all fabrication and erection drawings, diagrams, brochures, schedules, bills of material, manufacturers data, spare parts lists, and other data prepared by the Contractor, his subcontractors, suppliers, or manufacturers which illustrate the manufacturer, fabrication, construction, and installation of the work, or a portion thereof.
- C. The Contractor shall submit to the Engineer a minimum of six (6) copies of Shop Drawings and approved data. The Engineer will retain three (3) copies (for Owner's, Engineer's and Field Representative's files) and return three (3) copies to the Contractor for distribution to subcontractors, suppliers and manufacturers. If the Contractor requires more than three (3), then the number of copies submitted shall be increased accordingly.
- D. The Contractor shall provide a copy of a completed submittal certification form which shall be attached to every copy of each shop drawing. Shop Drawings shall show the principal dimensions, weight, structural and operating features, space required, clearances, type and/or brand of finish or shop coat, grease fittings, etc., depending on the subject of the drawing. 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 the work.

- E. The Contractor shall be responsible for the prompt and timely submittal of all shop and working drawings so that there shall be no delay to the work due to the absence of such drawings.
- F. No material or equipment shall be purchased or fabricated especially for the Contract until the required shop and working drawings have been submitted as hereinabove provided and reviewed for conformance to the Contract requirements. All such materials and equipment and the work involved in their installation or incorporation into the Work shall then be as shown in and represented by said drawings.
- G. Until the necessary review has been made, the Contractor shall not proceed with any portion of the work (such as the construction of foundations), the design or details of which are dependent upon the design or details of work, materials, equipment or other features for which review is required.
- H. 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. Shop drawings shall be of standardized sizes to enable the Owner to maintain a permanent record of the submissions. Approved standard sizes shall be: (a) 24 inches by 36 inches; (b) 11 inches by 17 inches, and (c) 8-1/2 inches by 11 inches. Provision shall be made in preparing the shop drawings to provide a binding margin on the left-hand side of the sheet. Shop drawings submitted other than as specified herein may be returned for re-submittal without being reviewed.
- I. Only drawings, which have been 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 Drawings and Specifications in all respects. All drawings which are correct shall be marked with the date, checker's name, and indication of the Contractor's approval, and then shall be submitted to the Engineer.
- J. If a shop drawing shows any deviation from the Contract requirements, the Contractor shall make specific mention of the deviations in his letter of transmittal.
- K. Should the Contractor submit equipment that requires modifications to the structures, piping, electrical conduit, wires and appurtenances, layout, etc., detailed on the Drawings, he shall also submit details of the proposed modifications. If such equipment and modifications are accepted, the Contractor, at no additional cost to the Owner, shall do all work necessary to make such modifications.

- L. A maximum of two submissions of each Shop Drawing will be reviewed, checked, and commented upon without charge to the Contractor. Any additional submissions which are ordered by the Engineer to fulfill the stipulations of the Drawings and Specifications, and which are required by virtue of the Contractor's neglect or failure to comply with the requirements of the Drawings and Specifications, or to make those modifications and/or corrections ordered by the Engineer in the review of the first two submissions of each Shop Drawing, will be reviewed and checked as deemed necessary by the Engineer, and the cost of such review and checking, as determined by the Owner, and based upon Engineer's documentation of time and rates established for additional services in the Owner-Engineer Agreement for this Project, may be deducted from the Contractor to make all modifications and/or corrections as may be required by the Engineer in an accurate, complete, and timely fashion.

2.3 SAMPLES

- A. The Contractor shall submit samples when requested by the Engineer to establish conformance with the specifications, and as necessary to define color selections available.

2.4 OPERATION AND MAINTENANCE MANUALS

- A. The Contractor shall furnish the Engineer six (6) copies of a complete instruction manual for installation, operation, maintenance, and lubrication of each item specified. At least three months prior to the expected substantial completion date, the Contractor shall submit to the Engineer all manuals in accordance with the requirements specified herein.
- B. Manuals shall include operating and maintenance information on all systems and items of equipment. The data shall consist of catalogs, brochures, bulletins, charts, schedules, equipment numbers, shop drawings corrected to as-built conditions, wiring diagrams, and assembly drawings which shall describe location, operation, maintenance, lubrication, operating weight, lubrication charts showing manufacturer recommended lubricants for each rotating or reciprocating unit, and other necessary information for the Engineer to establish a complete maintenance program.
- C. The submittal shall also include details of all replacement parts; "Nameplate" data for all equipment; detailed instructions for start-up, normal operation, shutdown procedures, and control techniques; and a guide to troubleshooting the system.

2.5 MANUFACTURER'S CERTIFICATES AND WARRANTY

- A. Prior to accepting the installation, the Contractor shall submit manufacturer's certificates and warranties for each item specified.

- B. Such manufacturer's certificates shall state that the equipment has been installed under either the continuous or periodic supervision of the manufacturer's authorized representative, that it has been adjusted and initially operated in the presence of the manufacturer's authorized representative, that it is operating in accordance with the specified requirements, to the manufacturer's satisfaction and that the installation meets all conditions of the guarantee/warranty period. All costs for meeting this requirement shall be included in the Contractor's bid price.
- C. Certified performance test data will also be submitted to the Engineer as required by the specifications.

2.6 SUBMISSION REQUIREMENTS

- A. Accompany submittals with transmittal letter, containing:
 - 1. Date.
 - 2. Project title and number.
 - 3. Contractor's name and address.
 - 4. The number of each Shop Drawing, Project Data and Sample submitted.
 - 5. Notification of deviations from Contract Documents.
 - 6. Other pertinent data.
- B. Submittals shall include:
 - 1. Date and revision dates.
 - 2. Project title and number.
 - 3. The names of:
 - a. Engineer.
 - b. Contractor.
 - c. Subcontractor.
 - d. Supplier.
 - e. Manufacturer.
 - f. Separate detailer when pertinent.
 - 4. Identification of product or material.
 - 5. Relation to adjacent structure or materials.
 - 6. Field dimensions, clearly identified as such.
 - 7. Specification section number.
 - 8. Applicable standards, such as ASTM number or Federal Specification.
 - 9. A blank space, 4" x 4", for the Engineer's stamp.
 - 10. Identification of deviations from Contract Documents.
 - 11. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of field measurements and compliance with Contract Documents.
 - 12. Where specified or when requested by the Engineer, manufacturer's certification that equipment, accessories and shop painting meet or exceed the Specification requirements.
 - 13. Where specified, manufacturer's guarantee.

2.7 RESUBMISSION REQUIREMENTS

- A. Revise initial drawings as required and resubmit as specified for initial submittal.
- B. Indicate on drawings any changes which have been made other than those required by Engineer.

2.8 ENGINEER'S REVIEW

- A. The review of shop and working drawings hereunder will be general only, and nothing contained in this specification shall relieve, diminish or alter in any respect the responsibilities of the Contractor under the Contract Documents and in particular, the specific responsibility of the Contractor for details of design and dimensions necessary for proper fitting and construction of the work as required by the Contract and for achieving the result and performance specified thereunder.

PART 3 -- PRODUCTS

(NOT PART OF THIS SECTION)

PART 4 -- EXECUTION

(NOT PART OF THIS SECTION)

SUBMITTAL CERTIFICATION FORM

PROJECT: _____

CONTRACTOR'S PROJ. No: _____ ENGINEER'S PROJ. No: _____

CONTRACTOR: _____ ENGINEER: _____

TRANSMITTAL No: _____ SHOP DRAWING No: _____

SPECIFICATION OR DRAWING NUMBER: _____

DESCRIPTION: _____

MANUFACTURER: _____

The above referenced submittal has been reviewed by the undersigned and I/we certify that the material and/or equipment meets or exceeds the project specification requirements with

_____ NO DEVIATIONS

or

_____ A COMPLETE LIST OF DEVIATIONS AS FOLLOWS

By: _____ By: _____
Contractor^b Manufacturer^c

Date: _____ Date: _____

^a Any deviations not brought to the attention of the Engineer for review and concurrence shall be the responsibility of the Contractor to correct, if so directed.

^b Required on all submittals

^c When required by specifications

SECTION 01381

PRE-CONSTRUCTION VIDEO RECORDS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Supply a set of video records to the Engineer clearly indicating pre-construction status of roadway pavement condition, curbing, driveway entrances, lawns, sidewalks, and other pertinent features throughout the project area.
2. Video may be provided in DVD format.
3. Documentation shall include any feature specifically requested by the Engineer.
4. Photographs may be submitted as a substitution with prior approval by the Engineer.

PART 2 - PRODUCTS

2.1 QUALITY

- A. Quality shall be such that the condition of existing items subject to construction damage can be readily determined.

PART 3 - EXECUTION

3.1 SUBMITTAL OF VIDEO RECORDS

- A. Submit all video to the Engineer no later than two weeks prior to construction work.
- B. The quality of the video is subject to approval by the Engineer prior to the start of construction work in the areas shown by the video records.

END OF SECTION

SECTION 01400

QUALITY CONTROL AND QUALITY ASSURANCE

PART 1 -- GENERAL

1.1 REQUIREMENTS INCLUDED

- A. General Quality Control and Quality Assurance.
- B. Workmanship.
- C. Manufacturer's Instructions.
- D. Manufacturer's Certificates.
- E. Testing Laboratory Services.

1.2 RELATED REQUIREMENTS

- A. General Conditions
- B. Section 01340 - Submittals

1.3 GENERAL QUALITY CONTROL AND QUALITY ASSURANCE

- A. The Contractor shall maintain quality control over the suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. The Contractor will employ and pay for consultant or other services to provide quality assurance (QA) tests or reviews. Should the results of QA testing or reviews indicate defective or otherwise non-complying work, the costs for removal and replacement with complying work, and any follow-up QA testing or review shall be borne by the Contractor.

1.4 WORKMANSHIP

The Contractor shall:

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.

1.5 MANUFACTURERS' INSTRUCTIONS

- A. The Contractor shall comply with instructions in full detail, including each step in sequence. Should instructions conflict with Contract Documents, request clarification from the Engineer before proceeding.

1.6 MANUFACTURERS' CERTIFICATES

- A. When required by the individual Specifications Section, the Contractor shall submit manufacturer's certificate, in duplicate, that products meet or exceed specified requirements.

1.7 TESTING LABORATORY SERVICES

- A. The Contractor shall employ and pay for services of an Independent Testing Laboratory to perform scheduled quality assurance inspections, tests, and other services required to perform the specified material testing.
- B. The services will be performed in accordance with the requirements of governing authorities and with specified standards.
- C. The reports will be submitted to the Engineer and Contractor giving observations and results of the tests, indicating the compliance or non-compliance with specified standards and with the Contract Documents.
- D. The Contractor shall cooperate with Testing Laboratory personnel, i.e., furnish tools, samples of materials, design mix, equipment, storage and assistance as requested.
 - 1. Notify the Engineer 72 hours prior to expected time for operations requiring testing services.
 - 2. Make arrangements with the Engineer and pay for additional samples and tests for Contractor's convenience and pay for any additional tests or retests required due to noncompliance.

PART 2 -- PRODUCTS

Not Used

PART 3 -- EXECUTION

Not Used

END OF SECTION

SECTION 01510

TEMPORARY UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Provide and pay for all temporary applicable utilities required to properly perform the Work at no additional cost to the Owner including the placement and removal of the utilities.
2. Completely remove all temporary equipment and materials upon completion of the Work and repair all damage caused by the installation of temporary utilities.
3. Make all necessary applications and arrangements for electric power, light, water, telephone and other utilities with the local utility companies. Notify the local electric power company if unusually heavy loads, such as welders, will be connected.

1.2 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. Obtain permits as required by local governmental authorities.
2. Obtain easements, when required, across private property other than that of the Owner for temporary power service.
3. Comply with the latest National Electrical Code.
4. Comply with all local, State and Federal codes, laws, and regulations.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Electrical:

1. Provide all required facilities, including as applicable, but not limited to, transformers, conductors, poles, conduits, raceways, fuses, switches, fixtures, and lamps.
2. Use new or used material adequate in capacity for the purposes intended.
3. Materials must not create unsafe conditions or violate the requirements of applicable codes.
4. Conductors:
 - a. Wire, cable or busses of appropriate type, sized in accordance with the latest National Electrical Code for the applied loads.
 - b. Use only UL approved wire.
5. Conduit:
 - a. Rigid steel, galvanized: ANSI C80.1.
 - b. Electrical metallic tubing: ANSI C80.3.
 - c. Other material approved by NEC
6. Equipment: Provide appropriate enclosures for the environment in which used in compliance with NEMA Standards.

B. Heating:

1. When heat is required for the protection of the Work, provide and install a non-hazardous type of heating apparatus, and provide adequate and proper fuel.

2. Use heating equipment and materials that are in proper condition.
- C. Water:
 1. Provide drinking water equipment and material that will prevent contamination and health hazards.
- D. Sanitary Accommodations:
 1. Comply with all local, State and Federal codes, laws and regulations.

PART 3 - EXECUTION

3.1 PERFORMANCE

- A. Electrical:
 1. Provide electrical energy to:
 - a. All necessary points on the construction site so that power can be obtained at any desired point with extension cords no longer than 100 feet.
 - b. Construction site offices.
 - c. Lighting as required for safe working conditions at any location on the construction site.
 - d. Night security lights.
 - e. When applicable, Owner's present facilities during the changeover of electrical equipment.
 2. Maintain electrical energy throughout the entire construction period
 3. Capacity:
 - a. Provide and maintain adequate electrical service for construction use by all trades during the construction period at the locations necessary.
 4. Installation:
 - a. Install all work with a neat and orderly appearance.
 - b. Have all installations performed by qualified electricians.
 - c. Locate all installations to avoid interference with construction and materials handling equipment, storage areas, traffic areas and other Work.
- B. Heating:
 1. Maintain a heated environment for the Work at the temperature and for the length of time specified and as otherwise needed.
 2. Precaution:
 - a. Operate temporary heating apparatus in a manner that finished Work will not be damaged.
 - b. Repair all damage, caused by temporary heating operations, to the complete satisfaction of the Engineer, at no additional cost to the Owner.
- C. Water:
 1. Provide and maintain a safe water supply for drinking and construction purposes as required for the proper execution of the Work.
- D. Sanitary Accommodations:
 1. Provide and maintain sanitary accommodations for the use of the employees of the Contractor, subcontractors, and Engineer.
 2. Sanitary accommodations shall meet the requirements of all local, State and Federal health codes, laws and regulations.

END OF SECTION

SECTION 01516TEMPORARY SANITARY FACILITIESPART 1 -- GENERAL1.1 DESCRIPTION

A. Work Included:

1. Furnish, install, and maintain temporary sanitary facilities for use during the entire construction period.
2. Pay for all cost associated with furnishing these facilities.
3. Remove facilities after construction.

PART 2 -- PRODUCTS2.1 MATERIALS

- A. Provide one standard portable sanitary facility including appurtenances.

PART 3 -- EXECUTION3.1 GENERAL

- A. Provide facilities prior to the start of construction. Removal of the facilities shall not be until all construction activities have been completed.
- B. Meet all local, state, and federal regulations.

3.2 MAINTENANCE

- A. Maintain facilities in a clean and operable sanitary condition.
- B. Pump out waste and clean the interior of the facilities on a weekly basis.
- C. Provide adequate supplies.

3.3 REMOVAL

- A. Remove the facilities after all work has been successfully completed.
- B. Repair all damage to, and caused by, the temporary facility.

END OF SECTION

SECTION 01520

MAINTENANCE OF SEWER FLOWS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included:
 - 1. Provide and pay for all temporary systems to assure the uninterrupted flow of Sanitary Sewage around the Work Area at no additional cost to the Owner including the placement, maintenance and removal of these systems.
 - 2. Make all necessary arrangements for power.

1.2 QUALITY ASSURANCE

- A. Comply with all Local, State and Federal requirements forbidding the discharge of untreated effluent into other than a functional sanitary sewer facility.
- B. Contractor is to provide plans detailing Bypass piping and pumping operations. Plans shall include, at a minimum, pipe and pump sizes, locations, backup pump provisions, backup power provisions for unattended pumps, flow diversion options or other means of directing flows around the work area.
- C. If Bypass Pumping is proposed for non-work hours, provide plans and details for operation including automatic dial out for pump failure, automatic operation of backup equipment and an emergency response plan for the Contractor's personnel. Under no circumstances will the Contractor rely on City personnel to operate or maintain operation of the Bypass Pumping system.

PART 2 - PRODUCTS

2.1 PUMPS

- A. Two operable pumps each of which has a discharge rate sufficient to handle peak flow rates. One to be online, the other as back-up.
- B. Adequate discharge piping, free of leaks, to carry the effluent from source to an adequate sanitary discharge point.
- C. Provide adequate plugs to ensure that no effluent flows into the work area.

2.2 PIPING

- A. Piping shall be sufficiently sized to carry combined storm flows (or match existing pipe sizes).

PART 3 - EXECUTION

3.1 PERFORMANCE

- A. Provide power supply from a secure source.
- B. Maintain and operate the system to assure uninterrupted sewage flow around the work area as long as work requires replacement of active sewers.

- C. Protect the discharge piping from damage caused by vehicular traffic or other outside influences.
- D. Maintain all system elements in a sanitary working order free of leaks.
- E. All work shall be performed in a manner to insure the health and welfare of the general public from accidental or intentional discharge of waste into other than a sanitary sewer system.

END OF SECTION

SECTION 01546

USE OF EXPLOSIVES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Provide all materials and perform all work necessary to insure safe use and storage of explosives.
2. Contractor shall be responsible for any and all damage resulting from use of explosives.

1.2 QUALITY ASSURANCE

- A. Requirements of regulatory agencies: Conduct all blasting in accordance with all applicable local and state laws, ordinances and code requirements. (See City of Portsmouth Blasting Ordinance in Appendix B).
- B. See Supplemental General Conditions for additional requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Explosive charges and detonation devices shall be of a type suitable for the intended use.
- B. Store all explosives in a secure manner, in compliance with all State and local laws and ordinances, and legibly mark all such storage places. Storage shall be limited to such quantity as may be needed for the work underway.

PART 3 - EXECUTION

3.1 PERFORMANCE

A. Preparation:

1. Blasting, if required, shall be performed only after approval has been given by the Owner for such operation.
2. Do not bring explosives to the site or use any explosives without obtaining all necessary permits and the written consent of authorities having jurisdiction. Such written consent will not relieve the Contractor of total responsibility for any injury to persons or for any damage to property due to blasting operations.
3. Designate as a BLASTING AREA all sites where electric blasting caps are located and where explosive charges are being placed.
4. Mark all blasting areas with signs as required by law.
5. Place signs, as required by law, at each end of the blasting area and leave in place while the above conditions prevail. Immediately remove signs after blasting operations or the storage of caps is over.
6. The Contractor shall conduct a Pre-blast Survey of all structures within the blasting area and provide the Engineer a written report of the Pre-blast Survey.

7. Notify each property owner and public utility company having structures in proximity to the site of the work sufficiently in advance to enable them to take such steps as they may deem necessary to protect their property. Such notice shall not relieve the Contractor of any of his responsibility for damage resulting from his blasting operation.
 8. Warn all persons within the danger zone of blasting operations and do not perform blasting work until the area is cleared. Provide sufficient flagmen outside the danger zone to stop all approaching traffic and pedestrians.
- B. Blasting:
1. All blasting shall be performed in accordance with all pertinent provisions of the "Manual of Accident Prevention in Construction" issued by the Associated General Contractors of America, Inc.
 2. Provide watchmen during the loading period and until charges have been exploded.
 3. Provide adequate protective covering over all charges before being exploded.
 4. Blasting Log:
 1. The Contractor shall provide the Engineer with a blasting log for the work. The blasting log shall contain the following information:
 - a. Location.
 - b. Time and date.
 - c. Location of explosives.
 - d. Amount and type of explosives used at each location.
 - e. The names of persons, companies, corporations or public utilities that own, lease or occupy property or structures in proximity to the site of the work and were contacted about the Contractor's intention to use explosives.

END OF SECTION

SECTION 01562

DUST CONTROL

PART 1 - GENERAL

1.1 DESCRIPTIONS

- A. Work Included: Furnish water truck and apply water to the road surfaces on a daily basis, unless rain is imminent. Use mechanical street sweeper on paved surfaces or sweep paved surfaces on a daily basis.
- B. The Contractor shall have a water truck on site at all times.
- C. Dust control operations will be required multiple times daily and on weekends when needed.
- D. Dust control work shall be incidental to the appropriate items of the Contract unless a separate unit item is provided

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Water for Sprinkling: Clean, free of salt, oil, and other injurious matter.
- B. Calcium Chloride: Meet the requirements of AASHTO M144.
- C. Street Sweeper: Mechanical street sweeper with watering device able to pick up and haul away debris.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Water: Use suitable equipment including a tank with gauge equipped pump or spray bar. Apply water 2-3 times a day and on weekends as needed.
- B. Calcium Chloride: Apply at a rate sufficient to maintain a damp surface but low enough to assure non-contamination of water courses.

3.2 PROTECTION

- A. Perform all Dust Control Work in a manner that will prevent damage to public and private property from dust and the materials used.
- B. Repair, replace or make payment for all damage caused by Dust Control Work at no additional cost to the Owner.
- C. Street sweeping: Minimum of once per week and as needed or requested by the Engineer.

END OF SECTION

SECTION 01570

TRAFFIC REGULATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included:
 - 1. Contractor shall provide a Traffic Control Plan for approval by the Engineer and the Owner.
 - 2. Provide all materials and perform all work necessary to completely regulate traffic in the area of Work.
 - 3. Provide Dust Control in accordance with Section 01562.
 - 4. Perform all work in such a manner as to provide safe passage at all times for the public and with a minimum of obstruction to traffic.
 - 5. Do not close roads or streets to passage of the public without the permission of the Public Works Department.
- B. The City of Portsmouth DPW will decide if adequate Traffic Control is being maintained and shall have the authority to require the Contractor to take any additional steps necessary to maintain safe passage.

1.2 SCHEDULING WORK

- A. The Contractor shall schedule and maintain work so that one-lane traffic is maintained at all times, unless road closures are approved by the Public Works Department.
- B. Revise the plan of work if it will create a traffic hazard.
- C. Do not start work in any new location without the permission of the Engineer.
- D. Notify all police and fire departments of all scheduled detours and when streets are reopened.

PART 2 - PRODUCTS

2.1 WARNING SIGNS AND BARRICADES

- A. An overview plan of the work area has been provided following this specification for the Contractor's use in developing the traffic control plan.
- B. Do not perform work without providing adequate warning signs, barricades, signal lights, watchmen and take other necessary precautions for the safety of the public.
- C. Provide and illuminate suitable warning signs to show where construction, barricades or detours exist.
- D. Provide barricades of substantial construction and painted with a finish that increases visibility at night.
- E. Keep signal lights illuminated at all barricades and obstructions from sunset to sunrise.
- F. Maintain all necessary signs, barricades, lights, watchmen and other safety precautions during authorized suspension of the Work, weekends, holidays or other times when the Work is not in progress.

- G. Traffic control signs for construction work shall be located and of the size and type as outlined in Manual on Uniform Traffic Control Devices for Streets and Highways (latest edition) as published by U.S. Department of Transportation.

PART 3 - EXECUTION

3.1 DETOURS

- A. Detours will only be allowed with pre-approval from the owner at least 48 hours in advance.
- B. Notify the Public Works Department who will coordinate with the Police and Fire Departments of all scheduled detours and when streets are reopened.
- C. Provide, identify and maintain suitable detours when the project, or any part thereof, is closed to public travel. Closure of public travel on any portion of the project shall be coordinated with the City Police and Fire Departments as well as the Department of Public Works. A minimum of 48-hours notice shall be provided for planned shutdowns and detours are required to complete the work.
- D. When the closed part of the project is reopened, restore the detour area and any other disturbed areas to the original condition and immediately

3.2 INCONVENIENCE TO RESIDENTS OF VICINITY

- A. Whenever a traveled way is closed, perform the Work in such a manner that local travel and residents in the vicinity of the Work will be inconvenienced as little as possible.
- B. Allow access to residents and abutting landowners along the project to driveways and other normal outlets from their property.

3.3 UNIFORMED POLICE OFFICERS

- A. The Contractor shall use uniformed police officers in locations required by the Owner.
- B. Arrange police detail with the local Chief of Police.
- C. Any police officers, whether regular, reserve, special or otherwise, shall be employed by the Contractor.

3.4 PEDESTRIANS

- A. Maintain safe pedestrian corridors throughout project area.
- B. Protect and/or barricade uneven or irregular surfaces impacted by construction.

END OF SECTION

SECTION 01611

OWNER'S RIGHT TO MATERIAL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included:
 - 1. The Owner retains the right to claim all excess suitable and unsuitable material.
 - 2. Load and transport to a location specified by the Owner all reclaimed asphalt product removed to meet existing road plan and section.
 - 3. Deliver all material claimed by the Owner to a location designated by the Owner.
- B. Related Work Specified Elsewhere:
 - 1. See Division 2.
- C. Schedule of Materials claimed by Owner:
 - 1. Reclaimed Asphalt Material (surplus).
 - 2. Manhole and Catch Basin frames, covers and grates.

PART 2 - PRODUCTS

(NOT PART OF THIS SECTION)

PART 3 - EXECUTION

(NOT PART OF THIS SECTION)

END OF SECTION

SECTION 01630

SUBSTITUTIONS AND PRODUCT OPTIONS

PART 1 - DESCRIPTION

1.1 DESCRIPTION

- A. If stated in these Specifications that a substitute that is equal to any material or equipment specified may be furnished, and if the Contractor wishes to furnish or use a substitute, submit a written request to the Engineer for approval of the substitute.
- B. The Engineer shall be the judge of equality.

1.2 SUBMITTALS

- A. Submit approval request promptly after the award of the Contract.
- B. Completely describe the proposed substitution including, as applicable:
 - 1. Manufacturer's catalog data,
 - 2. Illustrations,
 - 3. Specifications,
 - 4. Samples,
 - 5. Copies of previous approvals,
 - 6. Other data that may be requested by the Engineer to determine equality.

PART 2 - PRODUCTS

2.1 CRITERIA

- A. The following criteria will be used by the Engineer in determining the equality of the proposed substitutions:
 - 1. Adaptability to the design,
 - 2. Functional performance,
 - 3. Appearance (when applicable)
 - 4. Quality of materials,
 - 5. Strength of materials,
 - 6. Complexity, frequency and cost of maintenance.

PART 3 - EXECUTION

3.1 ORDERING AND INSTALLING

- A. Do not order and do not install any substituted material or equipment without the written approval of the Engineer.

3.2 RESULTING CHANGES

- A. If proposed substitutions are judged as being acceptable, make all changes to structures, buildings, piping, electrical, and other items necessary to accommodate substitutions, at no additional cost to the Owner.

SECTION 01630
SUBSTITUTIONS AND PRODUCT OPTIONS

- B Whenever it may be written that a manufacturer must have a specified period of experience with his product, a product which does not meet the specified experience period can be considered if the manufacturer is willing to provide a bond or cash deposit for the duration of the specified time period which will guarantee replacement of that product in the event of failure.

3.3 ENGINEERING SERVICES

- A. If the Contractor requests substitutions which require design or other engineering services, the services will be provided only by a Professional Engineer registered in the state in which the project is located.
- B. All engineering services for substitutions shall be performed at the expense of the Contractor.

END OF SECTION

SECTION 01701

PROJECT CLOSE-OUT PROCEDURES

PART 1 - GENERAL

1.1 INTRODUCTION

- A. Contractor's requirements of the Contract to closeout the project.

1.2 PROJECT CLOSE-OUT REQUIREMENTS

- A. Prior to final payment the Contractor shall submit the following to the Engineer:
1. Contractor's Affidavit
 2. Consent of Surety to final payment.
 3. Certificate of Inspections
 4. Evidence of payment and release of liens
 5. Project Record Documents (Section 01720)
 6. Operation and Maintenance data (Section 01730)
 7. Submission of warranties

PART 2 - PRODUCTS

(NOT PART OF THIS SECTION)

PART 3 - EXECUTION

(NOT PART OF THIS SECTION)

END OF SECTION

SECTION 01710
PROJECT CLEANING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included:
1. Maintain premises and public properties free from accumulations of waste, debris, and rubbish, caused by operations.
 2. At completion of Work, remove waste materials, tools, equipment, machinery, and surplus materials, and clean all sight-exposed surfaces. Leave project clean and ready for use.

1.2 QUALITY ASSURANCE

- A. Conduct cleaning and disposal operations in accordance with all applicable local and state laws, ordinances, and code requirements.

PART 2 - PRODUCTS

- A. Use only cleaning materials recommended by manufacturer of surfaces to be cleaned.

PART 3 - EXECUTION

3.1 PERFORMANCE

- A. Cleaning During Construction (where applicable):
1. Execute cleaning operations to ensure that buildings, grounds, and public properties are maintained free from accumulations of waste materials and rubbish.
 2. Entirely remove and dispose of material or debris during the progress of the Work that has washed into or has been placed in watercourses, ditches, gutters, drains, catch basins, or elsewhere as a result of the Contractor's operations.
 3. Wet down dry materials and rubbish to lay dust and prevent blowing dust.
 4. At reasonable intervals during the progress of work, clean the site and dispose of waste materials, debris, and rubbish.
 5. Clean interiors of buildings, when applicable, prior to finish painting, and continue on an as-needed basis until buildings are ready for occupancy.
 6. Handle materials in a controlled manner with as few handlings as possible. Do not drop or throw materials from heights.
 7. Where applicable, schedule cleaning operations so that dust and other contaminants resulting from the cleaning process will not fall on wet, newly painted surfaces.

SECTION 01710
PROJECT CLEANING

- B. Control of Hazards:
 - 1. Store volatile wastes in covered metal containers and remove from premises daily.
 - 2. Prevent accumulation of wastes which may create hazardous conditions.
 - 3. Provide adequate ventilation during use of volatile or noxious substances.
- C. Disposal:
 - 1. Do not burn or bury rubbish and waste material on project site.
 - 2. Do not dispose of hazardous wastes, such as mineral spirits, oil, or paint thinner, in storm or sanitary drains.
 - 3. Do not dispose of wastes into streams or waterways.
- D. Final Cleaning (where applicable):
 - 1. Employ experienced and/or professional cleaners for final cleaning.
 - 2. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials, from all sight-exposed interior and exterior finished surfaces.
 - 3. Repair, patch and touch up marred surfaces to specified finishes.
 - 4. Broom clean paved surfaces.
 - 5. Rake clean non-paved surfaces on the project site.
 - 6. Restore to their original condition those portions of the site not designated for alterations by the Contract Documents.

END OF SECTION

SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included: Keep accurate Record Documents of all additions, substitutions of material, variations in work, and any other additions or revisions to the Contract.

PART 2 - PRODUCTS

2.1 DOCUMENTS

- A. Maintain at the job site, one copy each of:
 - 1. Contract Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Reviewed Shop Drawings.
 - 5. Change Orders.
 - 6. Any other modifications to the Contract.
 - 7. Field Test Reports.

PART 3 - EXECUTION

3.1 STORAGE AND MAINTENANCE

- A. Store Record Documents in approved files and racks apart from documents used for construction.
- B. File Record Documents in accordance with Project Filing Format of Uniform Construction Index.
- C. Maintain Record Documents in clean, dry, legible condition.
- D. Do not use Record Documents for construction purposes.
- E. Make Record Documents available at all times for inspection by the Engineer and Owner.

3.2 RECORDING

- A. Label each document "PROJECT RECORD" in large printed letters.
- B. Keep Record Documents current and do not permanently conceal any work until required information has been recorded.
- C. Contract Drawings: Legibly mark to record actual construction (when applicable)
 - 1. Method of locations and recording shall have prior approval of the Engineer.
 - 2. Depths of various elements of foundations in relation to survey datum.
 - 3. Horizontal and vertical locations of underground utilities and appurtenances referenced to permanent surface improvements.

- a. Include all water, sewer, steam, air, instrumentation and fuel piping systems and all electrical and communications circuits including all direct burial cables.
 - b. Whenever any existing utility line is uncovered in the course of excavation for new utility installation, record the location dimensions of such lines.
- 4. Location of house service connection points with any utility (water, sewer, electrical, telephone, etc.) and the location of capped or plugged ends of these same house service lines.
 - a. Locations shall be recorded by accurate "swing ties" or other methods approved by the Engineer.
 - b. Prior to substantial completion, the Contractor shall provide tie forms for all water and sewer service connections.
- 5. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
 - a. Electrical equipment such as conduits, piping, instrumentation located in slabs, walls and ceilings and to include approximate locations and routing.
 - b. Schematic diagram of actual electric conduit or instrument tubing routing between equipment and supply.
- 6. Field changes of dimension and detail and changes made by Change Order or Field Order.
- 7. Details not on original Contract Drawings.
- D. Specifications and Addenda: Legibly mark up each Section to record:
 - 1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
 - 2. Changes made by Change Order or Field Order.

3.3 SUBMITTALS

- A. At the completion of the project, deliver Record Documents to the Engineer.
- B. Accompany submittal with transmittal letter, in duplicate, containing:
 - 1. Date, project title and number.
 - 2. Contractor's name and address.
 - 3. Title and number of each Record Document with certification that each document is completed and accurate.
 - 4. Signature of Contractor, or his authorized representative.
- C. Failure to record these locations on the Project Record Drawings shall result in non-approval of the final payment to the Contractor and/or if contract time (as specified in the Contract and/or modified in accordance with the Standard General Conditions of the Construction Contract) has elapsed, this shall be grounds for the enactment of the liquidated damages as specified.

END OF SECTION

Scope of Work

Furnish, install and test all site work and appurtenant work in complete accordance with the Drawings and Specifications.

Contractor's Duties

Except as specifically noted, provide and pay for all labor, materials, equipment, tools, machinery, water, heat, other facilities and services necessary for proper execution and completion of the work.

Contents of Division

<u>Section No.</u>	<u>Section Title</u>
02100	Site Work
02110	Clearing
02118	Stripping and Stockpiling Topsoil
02220	Excavation - Earth
02224	Excavation - Ledge
02229	Backfill and Compaction
02275	Construction Fabrics
02276	Linear Low-Density Polyethylene (LLDPE) Liner
02276	Geosynthetic Clay Liner
02290	Seeding
02329	Loam Borrow and Topsoil
02369	Sheeting
02402	Dewatering
02431	Catch Basins, Frames & Grates (NH)
02500	Sidewalks and Ramps
02540	Temporary Erosion Control
02551	Bituminous Concrete Paving
02552	Porous Pavement & Media Bed
02555	Pavement Removal
02558	Fine Grading
02560	Granite Curbing (NHDOT)
02601	Manholes, Covers and Frames
02610	Pipe & Pipe Fittings – General
02611	Ductile Iron Pipe & Fittings
02619	HDPE Water Pipe & Fittings
02622	PVC Pipe & Fittings
02624	Corrugated Polyethylene Drainage Tubing (CPDT)
02625	Corrugated Polyethylene (CPE) Pipe and Fittings
02626	Copper Service Pipe
02630	Couplings, Connectors, Caps & Plugs
02641	Resilient-Seated Gate Valves
02642	Corporation Stops
02643	Curb Stop Assemblies
02644	Hydrant Assemblies
02646	Valve Boxes
02651	Final Sewer Testing
02790	Synthetic Grass Infill System
02801	Recreational Field Site Improvements
02930	Trees and Landscaping

SECTION 02100
SITE WORK

A. WORK INCLUDED

1. Work under this Section includes all work specified herein including Site Preparation, Earthwork and Cleanup & Restoration upon completion of such construction to the extent practicable. Site work shall consist of all work necessary to complete the project that is not covered under a separate bid item but that is indicated or reasonably implied in the drawings, shall be included in Items B through D described below.

B. SITE PREPARATION

1. Clearing and Grubbing
 - a. Clearing & Grubbing shall be done in accordance with Section 02110 and Section 02118 as modified herein.
 - b. Clearing shall be carefully controlled, and exact limits shall be laid out and approved before any clearing is done. Methods shall ensure against damage to trees to remain. Clearing in easements shall be at an absolute minimum of tree removals. Damaged or scarred trees to remain shall be trimmed of damaged branches and treated with wood paint promptly. Burning and/or chipping shall conform to all applicable State and City regulations.
 - c. Clearing & Grubbing shall include tree removal for all trees required to be cleared regardless of diameter.
 - d. The stumps of all trees and brush cleared shall be removed, together with all major roots and satisfactorily disposed of away from the project.
 - e. All clean loam grubbed from the work area shall be stockpiled and used for loaming and seeding at project clean up. The CONTRACTOR shall stockpile at a location approved by the ENGINEER.
2. Demolition, Removal
 - a. Where required, the CONTRACTOR will remove existing fencing. All fence removal shall be coordinated with the OWNER and the landowner, prior to proceeding.
 - b. The contractor shall remove all asphalt, bit. concrete, rubble, debris, boulders, exercise stations, gates, etc., and all material necessary around entire site prior to construction.
 - c. As required to complete the work, remove abandoned utilities, drainage structures, headwalls, and pipe.
 - d. All materials encountered/removed that are not wanted (salvaged) by the City are to be removed and legally disposed of by the Contractor.
3. Invasive Species Management
 - a. Several invasive plant species including phragmites (*Phragmites australis*), reed canary grass (*Phalaris arundinacea*), autumn olive (*Elaeagnus umbellata*), multiflora rose (*Rosa multiflora*), oriental bittersweet (*Celastrus orbiculatus*), and glossy buckthorn (*Frangula alnus*) have been observed on Site. During construction, the Contractor will implement practices to control the spread of invasive plants within the work limits of the project.

- b. The contractor will be required to develop a site-specific Invasive Species Management Plan.
- c. Invasive plants that are excavated for construction will be managed in accordance with “Best Management Practices for the Control of Invasive and Noxious Plant Species,” dated 2018, prepared by the New Hampshire Department of Transportation.
- d. The Contractor shall clean all soils and vegetation from construction equipment and matting before such equipment is moved to the site and prior to demobilization from the site.

C. EARTHWORK

Earthwork shall be done in accordance with applicable technical specifications and as required on the project plans.

1. Earthwork & Miscellaneous Site Work

- a. For all areas outside the limits of the Regional Stormwater Treatment Systems, this work shall consist of excavation of all material; excavation support (sheeting and shoring if required); dewatering; placement and compaction of all material required for the work, and necessary disposal of all other material. Embankment-in-place shall consist of furnishing common borrow, placing and compacting the total volume of embankment material required to construct fills below subgrade and within template lines as shown on the plans.
- b. Earthwork and miscellaneous site work shall consist of support or replacement of existing utilities, sawcutting pavement, stripping and stockpiling of topsoil, excavation of all materials, backfill, cut and fill, providing borrow, compaction and grading required to complete the project, including but not limited to excavation to subgrade, embankment in place, base gravel preparation, swales and blending in of slopes.
- c. Other earthwork not mentioned here but indicated or reasonably implied in the drawings shall be included in the work of this section. Any saw-cutting of pavement, or grinding for transitioning to existing pavement, shall be considered incidental to the site work.

D. CLEANUP & RESTORATION

Cleanup & Restoration shall be done in accordance with applicable technical specifications and as required on the project plans. Restoration shall include items such as turf establishment, project cleanup, removal and replacement of existing signs and similar construction as required for all equipment, materials, labor and incidental work necessary for the satisfactory completion of the work. Any restoration item not specifically mentioned here, but necessary to restore conditions to their original form, is considered incidental to this item.

1. Turf Establishment

Turf Establishment shall include grading; preparation of subgrade and surface; placement, spreading, and furnishing and grading of loam; application of seed, fertilizer, lime & mulch (hydraulic); watering seeded areas on a regular basis; ensuring proper growth of grass; and all work required for turf establishment.

END OF SECTION

SECTION 02110
CLEARING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included: Clearing work, when applicable, includes but is not limited to, removal of trees, brush, stumps, wooded growth, grass, shrubs, poles, signs, fences, culverts and other vegetation and minor structures; the protection of designated wooded growth; the storage and protection of minor structures and materials which are to be replaced; and the disposal of unsalvageable structures and materials, and necessary preliminary grading.
- B. Limits of Work:
 - 1. Perform clearing work within the areas required for construction or as shown on the Drawings and to a depth of 12 inches below the existing grade.
 - 2. Perform additional clearing work within areas and to depths which, in the opinion of the Engineer, interfere with excavation and/or construction.
- C. Work Not Included: Clearing and/or grubbing work performed for the convenience of the Contractor will not be considered for payment.

1.2 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies: Dispose of combustible material by burning only when permitted by and in accordance with all applicable local and state laws, ordinances, and code requirements.
- B. Remove and dispose of unsalvageable structures and material in accordance with all applicable local and state laws, ordinances, and code requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Provide all materials required to complete the Work.
- B. Timber and Wood:
 - 1. All timber and wood greater than 4" in diameter within the limits of clearing for easements across all private property shall become the property of the private property owner. Such timber and wood shall be stacked in log lengths on the private property just beyond the construction easement boundary.
 - 2. All timber and wood removed from within the limits of clearing for construction across the property of the Owner shall become the property of the Contractor.
- C. Restore materials and structures to be replaced to their original condition and location.
- D. Repair all damage to structures using the same materials contained in the structures, to the complete satisfaction of the Owner, Engineer, and the property owner.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Carefully preserve and protect from injury all trees and shrubs not to be removed.
- B. No trees shall be cut until designated by the Engineer. Particular reference is made to fruit, ornamental or shade trees or other plants. Cut or scarred surfaces of trees or shrubs selected for retention shall be painted with an approved wound dressing treated according to other accepted arboricultural practices.
- C. The Contractor may be required to file an intent to cut and shall pay all charges, fees, and taxes as may be required under Chapter 79 of the RSA.
- D. Right-of-Way
 - 1. Where excavation is required on public or private rights-of-way containing trees, shrubs, other growth, or any structure or construction, obtain the Engineer's direction concerning the extent to which such obstacles can be cleared or stripped prior to performing the Work.
 - 2. In all rights-of-way, remove only those particular growths or structures which are, in the opinion of the Engineer, essential for construction operations.
 - 3. Replace all other removals and repair all damage at no additional cost to the Owner.

3.2 PERFORMANCE

- A. Clearing:
 - 1. Remove and dispose of all trees, brush, slash, stubs, bushes, shrubs, plants, debris and obstructions within the area to be cleared, except as otherwise on the Drawings or as directed by the Engineer.
 - 2. Remove all stumps unless otherwise directed by the Engineer.
 - 3. Dispose of material to be removed daily as it accumulates.
 - 4. Take special care to completely dispose of all elm trees and branches immediately after cutting either by burial in approved locations or, when permitted, by burning in areas well removed from standing elm growth.
 - 5. Dispose of all brush and trees, not otherwise removed from cleared right-of-way, by chipping.
- B. Protection of Wooded Growth:
 - 1. Fell trees toward the center of the area being cleared to protect trees and shrubs to be left standing.
 - 2. Cut up, remove, and dispose of trees unavoidably falling outside the area to be cleared.
 - 3. Employ skilled workmen or tree surgeons to trim and repair all trees that are damaged and are to be left standing and paint all cut surfaces with a suitable bituminous paint.

C. Disposal:

1. Remove from the site and dispose of material in locations approved or designated by the Owner.
2. All trees ordered to be cut and debris cleared shall become the property of and shall be disposed of by the Contractor, except as provided hereinafter.
3. Burning of trees, brush, slash, stubs, bushes or other combustible materials on the construction site is not allowed under this Contract.

3.3 REPLACEMENT OF MATERIALS

A. Paving, Curbing and Miscellaneous Material:

1. Remove and replace all paving, subpaving, curbing, gutters, brick, paving block, granite curbing, flagging and minor structures over the areas to be excavated.
2. Remove and replace bituminous asphaltic and Portland cement concrete in accordance with the appropriate Sections of these Specifications.
3. Properly store and preserve all material to be replaced in a location approved or designated by the Owner.

B. Shrubs and Bushes: Remove, store, and replace ornamental shrubs and bushes to be preserved in accordance with accepted horticultural practices.

C. Topsoil: When applicable, carefully remove, store and protect topsoil in accordance with the appropriate Section of this Division.

D. Responsibility: Replace, at no additional cost to the Owner, all materials lost or damaged because of careless removal or neglectful or wasteful storage, disposal or use of these materials.

END OF SECTION

SECTION 02118
STRIPPING AND STOCKPILING TOPSOIL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Segregate topsoil prior to excavation, trenching and grading operations and stockpile it for use in the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Topsoil shall consist of friable loam, reasonably free of subsoil, clay lumps, brush, roots, weeds, and other objectionable vegetation, stones and similar objects larger than two (2) inches in any dimension, litter and other materials unsuitable or harmful to plant growth.
- B. The quality of the topsoil material to be used shall be suitable to perform the Work.

PART 3 - EXECUTION

3.1 PERFORMANCE

- A. Remove topsoil from the areas that are likely to be disturbed as a result of construction operations.
- B. Remove topsoil from all designated areas prior to the performance of normal excavation.
- C. Replace all lost topsoil with new suitable material.

3.2 STORAGE

- A. Transport topsoil and deposit in storage piles convenient to the areas which are subsequently to receive the application of topsoil.
- B. Stockpile topsoil separate from other excavated materials.
- C. Take all necessary precautions to prevent other excavated material and objectionable material from becoming intermixed with the topsoil before, during and after stripping and stockpiling operations.
- D. Neatly trim and grade stockpiles to provide drainage from surfaces and to prevent depressions where water may become impounded.
- E. Construct temporary erosion control devices for all stockpiled material, subject to the Engineer's approval.
- F. Any excess topsoil shall become the property of the Owner.

END OF SECTION

SECTION 02220

EXCAVATION - EARTH

PART 1 -- GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Excavation work includes the removal of all subsurface materials except ledge and rock (as defined in Section 02224 – Excavation – Ledge) necessary to install the facilities as designed.
2. All excavation shall be classified as earth or ledge/rock.

B. Work Specified Elsewhere. This Section is not a stand-alone Section. Other requirements which relate to this Section are noted elsewhere in these documents. The Contractor and all Subcontractors are required to review this entire document along with the Drawings in an effort to identify all requirements.

1.2 JOB CONDITIONS

A. Utilities:

1. The information about known utilities was collected from the owning agency and may or may not have been supplemented by additional field survey or investigation.
2. The approximate locations of known buried and overhead utilities are shown on the Drawings. No guarantee is made as to the accuracy or correctness of the locations shown and to the completeness of the information given. The Contractor is responsible for confirming the location of utilities in the field prior to commencement of work.
3. Discontinue excavation by machinery when the excavation approaches pipes, conduits, or other underground structures of which the approximate locations are known. Use manual excavation methods to locate the utilities.

B. Existing Structures:

1. Perform excavation in such a manner that will prevent any possibility of undermining or disturbing existing structures, utilities, and work previously completed under this Contract.
2. Where existing buildings and other structures are in close proximity to the proposed construction, exercise extreme caution and utilize sheeting, bracing, and all other precautionary measures that may be required.

C. Repairing Damage: Repair all damage to existing utilities, structures, grassed, or paved areas which results from construction operations, at no additional cost to the Owner, to the complete satisfaction of the Owner, the Engineer, the utility company and the property owner.

D. Do not leave any trenches open overnight. Unless otherwise approved by the Owner, all trenches shall be completely backfilled at the end of each day

- E. Unless authorized in writing by the Owner, all roadways shall be opened to full width two-lane traffic at the end of each day.
- F. Erect a barrier around all structure excavations to prevent the entry of unauthorized individuals.

PART 2 -- PRODUCTS

2.1 UNSUITABLE MATERIAL:

- A. If, in the opinion of the Engineer, the material encountered above the indicated grade as shown on the Drawings for excavation is unsuitable the Contractor shall remove the material to the widths and depths as directed by the Engineer. Replace this material as specified in Section 02229 – Backfill and Compaction.
- B. If, in the opinion of the Engineer, the material encountered at or below the indicated invert or grade shown on the Drawings for excavation is unstable (as determined by the Engineer), the Contractor shall remove the material. Replace this material with thoroughly compacted bank run gravel or crushed stone bedding material as shown on the Drawings, or as directed by the Engineer.
- C. Materials made unsuitable by Contractor's construction methods shall be suitably dried for reuse or removed from the site and replaced with suitable materials at no additional cost to the Owner. This material shall not be eligible for payment as unsuitable material.
- D. Materials determined unsuitable only due to moisture content shall be aerated and stockpiled and may be used as suitable backfill with the approval of the Engineer.

2.2 DISPOSAL OF EXCESS MATERIAL:

- A. All excess material that is, in the opinion of the Engineer, suitable shall remain the property of the Contractor unless specified otherwise in Section 01611 - Owner's Right to Materials.

2.3 DISPOSAL OF UNSUITABLE MATERIAL:

- A. All unsuitable material shall become the property of the Contractor unless specified otherwise in Section 01611 - Owner's Right to Materials.

2.4 DISPOSAL OF MATERIAL:

- A. Disposal of excess and unsuitable material shall be the responsibility of the Contractor.
- B. Dispose of suitable and unsuitable material in accordance with applicable environmental law, and if applicable, at the locations acceptable to the Owner and/or funding agency.
- C. The property owners where the material is disposed of shall sign a release form indemnifying the Owner, Engineer, and Contractor from any liability of disposal of the said material.

2.5 EMBANKMENT MATERIAL:

- A. Obtain prior approval and instructions from the Engineer prior to undertaking the excavation for pipe placement of any fill material that has been in an embankment for less than one year.
- B. Prior to the installation of any pipe, determine by means of compaction testing in accordance with Section 02229 – Backfill and Compaction that the base material is suitably dense to support the pipe.

PART 3 -- EXECUTION

3.1 PERFORMANCE

A. Structure Excavation:

- 1. Amount of excavation:
 - a. Excavate areas large enough to provide suitable room for building or placing the structures.
 - b. The extent of open excavation shall be controlled by prevailing conditions.

B. Trench Excavation:

- 1. General:
 - a. Unless otherwise specifically directed or permitted by the Engineer, begin trench excavation at the low end of gravity lines and proceed upgrade.
 - b. Perform excavation for force mains and water mains in a logical sequence.
- 2. Amount of Excavation:
 - a. Trench width: As shown on the Drawings.
 - b. Trench depth: As shown on the Drawings.
 - c. Open Excavation:
 - 1). The extent of open excavation shall be controlled by prevailing conditions.
 - 2). Open excavation shall, at all times, be confined to the limits acceptable to the Owner.

C. Unauthorized Excavation:

- 1. Backfill and compact to the specified grade, any excavation beyond the limits stated above for trench excavation and as shown on the Drawings (unless specifically ordered otherwise by the Engineer) with material approved by the Engineer. Backfill material may be crushed gravel or crushed stone.
- 2. Backfill and compact unauthorized excavation at no additional cost to the Owner.

D. Shoring and Bracing:

- 1. Structures: Provide, install, and maintain sheeting and bracing as necessary to support the sides of the excavation and to prevent any movement of earth which could diminish

the width of the excavation or otherwise injure the Work, adjacent structures and property in accordance with all State and OSHA safety standards.

2. Trenches: As trench excavation progresses, install such shoring and bracing necessary to prevent caving and sliding and to meet the requirements of the Local, State and OSHA safety standards.

See additional requirements in Section 02369 – Sheeting.

E. Dewatering:

1. Control of surface water is a critical requirement of the work. All necessary actions shall be taken to minimize the effect of precipitation and runoff on the work. Upgradient runoff shall be diverted from active or completed work areas, and all work shall be graded and crowned to promote controlled runoff.
2. The Contractor shall prevent surface water and subsurface or groundwater from flowing into excavations or onto any work and from flooding the project site and surrounding area.
3. Water shall not accumulate in excavations. Contractor shall remove water to prevent softening of subgrades and soil changes detrimental to stability of the subgrade. The Contractor shall dewater excavated areas as required to perform the work, and in such a manner as to preserve the undisturbed state of subgrade material.
4. The Contractor shall provide and maintain pumps, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations. Discharge of dewater lines shall be directed through a dewatering filter bag, Ultratech International or equal, to remove sediment prior to discharge into existing drainage basin or stabilized drainage swale.
5. The Contractor shall prevent migration of sediment in accordance with the erosion control requirements of this Contract.

F. Fencing:

1. Structures: Erect barriers around structure excavation and other dangerous locations created by the Work to prevent entry of unauthorized personnel and at no additional cost to the Owner.
2. Trenches: If the end of the trench is allowed to be left open during nonworking hours by the Owner. The Contractor shall place barriers to prevent entry of unauthorized personnel at no additional cost to the Owner.
3. Place fences and/or suitable barriers around equipment and material to prevent damage, theft, and injury to individuals.

END OF SECTION

SECTION 02224
EXCAVATION - LEDGE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Trench excavation work in ledge includes the removal of ledge and rock required for the installation of pipes and/or structures. Blasting shall only be permitted on this project when mechanical means of ledge removal are proven ineffective.
2. All trench excavation shall be classed as earth or ledge.

A. Definitions:

1. "Ledge" shall be defined as any natural compound, natural mixture, and chemical element (e.g. solid piece of rubble concrete or masonry) required to be excavated that, in the opinion of the Engineer, can be removed from its existing position and state only by wedging, drilling and wedging, wedging, hoe-ramming, and breaking with power hand tools, or by extending the use of an approved excavating machine beyond normal and design wear and tear.
2. "Rock" shall be defined as single pieces of rock that are greater than two cubic yards. No boulder, ledge, slab, or other single piece of excavated material less than two cubic yards in total volume shall be considered to be rock unless, in the opinion of the Engineer, it must be removed from its existing position by one of the methods mentioned above.

1.2 REFERENCE STANDARDS

- A. Manual of Accident Prevention issued by the Associated General Contractor's of America, Inc.
- B. United States Bureau of Mines Report of Investigation RI-8507
- C. International Society of Explosives Engineers (ISEE) Field Practice Guidelines for Blasting Seismographs
- D. All blasting work shall comply with the following regulations:
 1. City of Portsmouth Blasting Rules and Procedures (see Appendix C);
 2. City of Portsmouth Ordinance Article VII: Section 5:02;
 3. State of New Hampshire Department of Transportation Standard Specifications for Road and Bridge Construction – latest edition.
 4. Storage and Transportation of explosives shall be in accordance with State of New Hampshire Code of Administrative Rules: Chapter/Part Saf-c 1600. In case of conflict, the more stringent regulation shall govern.

1.3 JOB CONDITIONS

- A. Utilities:
 - 1. The locations of known buried water lines, sewer lines, telephone cables, storm drains, culverts, gas mains, electric conduits and other utilities are shown on the Drawings. No guarantee is made as to the correctness of the locations shown and to the completeness of the information given.
 - 2. Use manual excavation methods to locate existing utilities.
- B. Existing Structures:
 - 1. Perform excavation in such a manner that will prevent any possibility of undermining and disturbing the foundations of any existing structures and any work previously completed under this Contract.
 - 2. Where existing buildings and other structures are in close proximity to the proposed construction, exercise extreme caution and utilize whatever precautionary measure that may be required.
- C. Repairing Damage:
 - 1. Repair, or have repaired, all damage to existing utilities, structures, lawns, other public and private property which results from construction operations, at no additional cost to the Owner, to the complete satisfaction of the Owner, the Engineer, the utility company and the property owner.
- D. Backfill of Trenches:
 - 1. Do not leave any trenches open overnight. Unless otherwise approved by the Owner, all trenches shall be completely backfilled at the end of each day

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Disposal of Suitable Material:
 - 1. All material that is, in the opinion of the Engineer, suitable shall remain the property of the Owner.
 - 2. Stockpile all suitable material in locations approved or designated by the Owner.
- B. Disposal of Unsuitable Material:
 - 1. All unsuitable material shall become the property of the Contractor unless specified otherwise in Division 1.
 - 2. Dispose of unsuitable material at the locations acceptable to or designated by the Owner.

PART 3 - EXECUTION

3.1 PERFORMANCE

- A. General:
 - 1. Unless otherwise specifically directed or permitted by the Engineer, begin excavation at the low end of sewer lines and proceed upgrade.
 - 2. Perform excavation for force mains and/or water mains in a logical sequence.
- B. Amount of Excavation:
 - 1. Trench width: As shown on the Drawings.
 - 2. Trench depth: As shown on the Drawings.
 - 3. Open Excavation:
 - a. The extent of open excavation shall be controlled by prevailing conditions.
 - b. Open excavation shall, at all times be confined to the limits acceptable to the Owner.
 - 4. Unauthorized Excavation:
 - a. Backfill to the specified grade, any excavation beyond the limits stated above and as shown on the Drawings (unless specifically ordered otherwise by the Engineer) with thoroughly compacted crushed stone or screened gravel.
 - b. Backfill unauthorized excavation at no additional cost to the Owner.
- C. Shoring and Bracing:
 - 1. As the excavation progresses, install such shoring and bracing (i.e., trench box) necessary to prevent caving and sliding and to meet the requirements of the State and OSHA safety standards.

END OF SECTION

SECTION 02229
BACKFILL AND COMPACTION

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. Work Included:
 - 1. Work includes backfilling trenches and/or excavation around structures with suitable material removed in the course of excavating and other suitable materials.
 - 2. Testing soils.
- B. Work Specified Elsewhere. This Section is not a stand-alone Section. Other requirements which relate to this Section are noted elsewhere in these documents. The Contractor and all Subcontractors are required to review this entire document along with the Drawings in an effort to identify all requirements.

1.2 REFERENCE STANDARDS

- A. Sieve Analysis of Fine and Coarse Aggregates: ASTM C136
- B. Sampling Aggregates: ASTM D75
- C. Moisture Density Relations of Soils (Modified Proctor): ASTM D1557
- D. Density of Soil In-Place by Nuclear Methods: ASTM D2922
- E. State of New Hampshire Department of Transportation (NHDOT) Standard Specifications for Road and Bridge Construction (latest edition)

1.3 QUALITY ASSURANCE

- A. The Contractor shall obtain and pay for all services of a geotechnical testing firm to perform the necessary soil and compaction tests. The independent soils laboratory shall be approved by the Engineer prior to testing.
- B. The Contractor shall make necessary arrangements to allow compaction testing to be performed at a time, place and elevation determined by the Engineer.
- C. Pre-placement testing.
 - 1. The Contractor shall take one sample of each material proposed to be used on the project. The samples shall be taken in the presence of the Engineer and in accordance with ASTM D75.
 - 2. Subgrade Material: Proctor density tests shall be performed on the existing subgrade in accordance with the following schedule and in accordance with ASTM D1557:
 - a. At the bottom of excavations where structures or slabs will be placed.
 - b. One after every 5,000 cubic yards has been relocated on the site.
 - c. Whenever the material has changed in the opinion of the Engineer.
 - 3. Select and Borrow Materials: Sieve and modified proctor density tests shall be performed on all select and borrow material in accordance with the following schedule and in accordance with ASTM C136 and ASTM D1557:

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- a. Before any materials are brought to the site.
- b. One after every 5,000 cubic yards has been brought to the site.
- c. Whenever the source changes.
4. The result shall be submitted to the Engineer for approval prior to placement.
5. The Contractor shall obtain representative samples for ongoing trench backfill operations.
 - a. Samples may be obtained in-situ at time of testing provided they are, in the Engineers opinion, representative of ongoing operations.
 - b. Samples may be obtained from stockpiles provide the stockpiled material is thoroughly mixed to represent ongoing operations.
 - c. Samples shall also be obtained for select materials such as reclaimed asphalt or gravels previously excavated from the trench.
- D. Post-placement testing:
 1. The trench and/or excavation shall be prepared using the normal backfill technique employed by the Contractor. No special or additional preparation will be allowed.
 2. Determine in-place density in accordance with ASTM D2922 or by other methods as approved by the Engineer.
 3. Compaction tests shall be made in accordance with the following table:

	Material	Testing Frequency	Percent Compaction
Under Slabs or Structures:			
	Native material or borrow material	One for every 500 s.f. of surface area of the slab for every 2 lifts of material placed.	95% 12" lifts
	Structural fill or crushed gravel	One for every 500 s.f. of surface area of the slab for every lift of material placed	95% 6" lifts
Around Structures:			
	Borrow material or other material noted on the drawings	One for every 500 l.f. of wall for every 2 lifts of material placed.	95% 12" lifts
In Trenches:			
	Native material or borrow material	From the blanket material to the underside of the gravel or loam. See Note #1 Below	95% 12" lifts
	Gravels or loam	See requirements for Under paved Areas and Grassed Areas for requirements below	See below

Under Paved Areas:			
	Native material or borrow material	One for every 10,000 s.f. of surface area for every 2 lifts of material placed.	95% 12" lifts
	Gravel	One for every 10,000 s.f. of surface area for every lift of material placed.	95% 6" lifts
	Crushed Gravel	One for every 10,000 s.f. of surface area for every lift of material placed.	95% 6" lifts
Under Grassed or Landscaped Areas			
	Native material or borrow material	One for every 20,000 s.f. of surface area for every 2 lifts of material placed.	90% 12" lifts

Notes:

1. *The Contractor shall propose a method for backfill on the first day of work. This proposed method will be tested and modified as required to meet the compaction requirements noted in the above table. The first day of testing shall include testing of a minimum of 4 lifts. This compaction method shall be used until the soil characteristics have changed in the opinion of the Engineer. At that point new compaction tests shall be performed to determine if the requirements are still being met. If they are, the method shall continue, if they are not, the method shall be modified until the requirements are met. Even if the soil characteristics have not changed, confirmatory compaction tests shall be taken every 3 weeks. Confirmatory testing shall include testing of a minimum of 2 lifts. The Engineer shall determine the location of all tests.*
4. Should compaction tests fail to meet the specified densities, the Contractor shall modify backfill methods as necessary to obtain passing results. The modified method shall be used from that point on.

1.4 SUBMITTALS

- A. The Contractor shall submit at the preconstruction meeting his proposed compaction technique which shall include compaction around field structures (i.e manholes, catch basins, etc.) and valve boxes.
- B. The Contractor shall submit sieve and proctor curves to the Engineer for approval 7 days before any material is brought to the site.
- C. The Contractor shall submit compaction test result sheets to the Engineer no later than 7 days after the test were performed.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Excavated Material Suitable for Reuse:

1. Material shall be friable natural material comprised of gravels, sand, silts, or clayey gravel and sands.
2. Material shall be free from peat, muck, other organic matter, frozen material, ice, and/or snow.
3. Material shall be free from stones, ledge/rock fragments, and asphalt over 8" in the largest dimension.
4. The material shall not have a moisture content over 2% of its optimum moisture content.

B. Common Borrow (Embankment in place):

1. Consist of earth suitable for embankment construction; free from frozen material, perishable rubbish, peat and other unsuitable material.
2. The moisture content shall be sufficient to provide the required compaction and stable embankment. In no case shall the moisture content exceed 4 percent above optimum.
3. The optimum moisture content shall be determined in accordance with AASHTO T 180, Method C or D.
4. 100% shall pass the 3" sieve and 70-100% shall pass the No. 4 sieve.

C. Select and Borrow Materials:

1. Crushed Stone (Drain/Sewer Pipe Bedding Material):

- a. Crushed stone shall be well graded in size from 1/4 inch to 3/4 inch and conform to ASTM C33 stone size No. 67.
- b. Clean, hard, and durable particles or fragments.
- c. Sieve Analysis:

<u>Sieve Designation</u>	<u>% Passing by Weight Square Opening</u>
1"	100
3/4"	90 - 100
3/8"	20 - 55
No. 4	0 - 10
No. 8	0 - 5
No. 200	1% Max.

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2. Sand (Sand Blanket or Water Pipe Bedding):
 - a. Clean, hard and durable particles or fragments.
 - b. Sieve Analysis:

Sieve% Passing by Weight
Designation Square Opening

3/8" 100
 No. 4 95 - 100
 No. 16 50 - 85
 No. 50 10 - 30
 No. 100 2 - 10

3. Roadway Base Course Gravel & Sand Materials:
 - a. Materials shall conform to Division 300 – Base Courses, Section 304 of NHDOT's Standard Specifications, latest edition, as amended herein.

PART 3 -- EXECUTION

3.1 PERFORMANCE

Methods of installation shall be in accordance with Division 300 – Base Courses, Section 304 of NHDOT's Standard Specifications, latest edition, as amended herein.

A. General:

1. Provide and place all necessary backfill material.
2. Do not allow large masses of backfill to be dropped into the excavation, as from a grab bucket, in such a manner that may endanger pipes and structures.
3. Place material in a manner that will prevent stones and lumps from becoming nested.
4. Completely fill all voids between stones with fine material.
5. Do not place backfill on or against new concrete until it has attained sufficient strength to support loads without distortion, cracking, and other damage.
6. Deposit backfill material evenly on all sides of structures to avoid unequal soil pressures.
7. Place backfill material evenly in the trench in an effort to maximize compaction.
8. Do not backfill with, or on, frozen materials.
9. Remove, or otherwise treat as necessary, previously placed material that has frozen prior to placing backfill.
10. Do not mechanically or hand compact material that is, in the opinion of the Engineer, too wet. Fill material that is too wet to be properly placed back in the trench if its current state shall be dried (disced, harrowed, etc.) to within 2% of optimum moisture content. This material shall not be classified as unsuitable material and ineligible for payment as such.
11. Material made unsuitable by the Contractor's construction methods shall be replaced with Gravel Borrow at no additional cost to the Owner.

BACKFILL AND COMPACTION

12. Fill that is too dry shall be uniformly watered. The water shall be placed over a loose lift to allow for the water to migrate through the entire lift before compaction.
 13. Do not continue backfilling until the previously placed and/or new materials have dried sufficiently to permit proper compaction.
 14. When original excavated material is, in the opinion of the Engineer, unsuitable, use only approved gravel borrow for backfilling.
 15. Backfill excavation/trench as early as possible to allow for the maximum time for natural settlement.
 16. Slope grade away from structures at a minimum slope of 1.5%.
 17. The Contractor shall remove excess fill material from the site.
- B. Sheeting:
1. Leave sheeting in place when damage is likely to result from its withdrawal. This shall only be allowed with written approval of the Engineer.
 2. Completely fill with suitable material and thoroughly compact all voids left by the removal of sheeting.
 3. Sheet shall be left in-place and incrementally moved up to allow for a safe work environment in which to properly compact the excavation/trench.
 4. See Section 02369 – Sheeting.
- C. Backfilling Around Trench Obstacles
1. Material must be properly compacted around trench obstacles (i.e. manholes, catch basin, valve boxes, etc.). Uncompacted fill will not be allowed to be placed around these obstacles.
 2. The Contractor shall provide adequate excavation supports to allow for a safe work environment in which to properly compact the excavation/trench.
 3. The Contractor shall use methods that compensate for the space limitations in the immediate area around these obstacles.
- D. Backfilling in Paved Areas:
1. Backfill trenches in streets and other paved areas by maintaining a moisture content within 2% of optimum.
 2. In an effort to allow the road to heave uniformly, backfill material that was removed from the top portion of the trench shall be replaced back into the top of the trench. Similarly, the material removed from the middle of the trench shall be replaced back into the middle of the trench. Existing material removed from the bottom of the trench (i.e. where the pipe box is located) shall be stockpiled for later use.
 3. Backfill in such a manner as to permit the rolling and compaction of the filled trench with the adjoining material to provide the required bearing value for paving immediately after backfilling is completed.
 4. Where required, place excavated material, that is acceptable to the Engineer for surfacing or pavement subbase, at the top of the backfill to the depths as needed to adequately support pavement.

3.2

- A. Backfilling Trenches in Nonpaved Areas:
 - 1. Grade the ground to a reasonable uniformity.
 - 2. Leave the mounding over the trenches in a uniform and neat condition, satisfactory to the Engineer.
- B. Bedding & Backfilling of Pipelines:
 - 1. Install pipe bedding and cushion and primary backfill in accordance with the requirements noted herein, in the specific pipe Specification Section, and on the Drawings.
 - 2. Deposit and thoroughly compact the remainder of the backfill as noted herein.
- C. Placing and Compacting Backfill:
 - 1. Water Jetting: Shall not be allowed without the approval of the Engineer.
 - a.
 - 2. Puddling: Shall not be allowed without the approval of the Engineer.
 - 3. Tamping:
 - a. Deposit and spread the backfill material in uniform parallel layers not exceeding the lift thicknesses noted herein.
 - b. Tamp each layer as required to obtain a thoroughly compacted mass.
 - c. If necessary, furnish and use an adequate number of power-driven tampers, each weighing at least 150 lbs.
 - 4. Rolling:
 - a. Compact material by rolling only when the width and depth of the excavation are sufficient to accommodate the rollers, dozers, mechanical tampers, or other similar powered equipment, as may prove to be acceptable, and when it can be performed without causing damage to pipes and structures installed in the excavation.
 - b. Deposit and spread the backfill material in uniform parallel layers not exceeding the lift thicknesses noted herein.
 - c. Roll each layer as required to obtain a thoroughly compacted mass.
 - 5. Other placing and compacting methods may be employed only when approved by the Engineer.
- D. Improper Backfill
 - 1. When, in the opinion of the Engineer, excavation and trenches have been improperly backfilled, and when settlement occurs, reopen the excavation to the depth required, as directed by the Engineer.
 - 2. Refill and compact the excavation or trench with suitable material and restore the surface to the required grade and condition.
 - 3. Excavation, backfilling, compacting work and testing performed to correct improper backfilling shall be performed at no additional cost to the Owner.

END OF SECTION

LINEAR LOW-DENSITY POLYETHYLENE (LLDPE) LINER

SECTION 02276LINEAR LOW-DENSITY POLYETHYLENE (LLDPE) LINER

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Furnishing of 40-mil LLDPE liner
- B. Quality Control for liner materials
- C. Field installation of the liner

1.02 RELATED REQUIREMENTS

- A. Section 01400 - Quality Assurance/Quality Control

1.03 OPERATIONAL CONDITIONS

The LLDPE geomembranes will be subjected to operating temperatures of no less than -15°C (5°F) and up to 60°C (140°F). The physical properties of the proposed geomembrane shall be thoroughly reviewed to ensure long-term performance.

1.04 APPLICABLE STANDARDS, CODES AND REGULATIONS

Unless otherwise specified, workmanship and materials for the construction of the earthworks and associated geomembranes work shall be in accordance with the requirements of the relevant Federal, State and Local Regulations and other Regulatory Authority requirements, as applicable.

Latest editions of published Codes & Standard, including any other standards referenced therein, shall apply as of the date of issue of this Technical Specification. Where any conflict occurs between mandatory regulations, standards and codes, and other regulatory authority requirements, the most stringent requirement shall apply.

1.04.1 STANDARDS AND CODES

- A. ASTM D792 Standard Test Method for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
- B. ASTM D1004 Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting
- C. ASTM D1204 Standard Test Method for Linear Dimensional Changes of Non rigid Thermoplastic Sheeting or Film at Elevated Temperature.
- D. ASTM D1238 Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer.
- E. ASTM D1505 Standard Test Method for Density of Plastics by the Density-Gradient Technique.

LINEAR LOW-DENSITY POLYETHYLENE (LLDPE) LINER

- F. ASTM D1603 Standard Test Method for Carbon Black Content in Olefin Plastics.
- G. ASTM D3895 Standard Test Method for Oxidation Induction Time of Polyolefin by Differential Scanning Calorimetry.
- H. ASTM D4218 Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle Furnace Technique.
- I. ASTM D4833 Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.
- J. ASTM D5199 Standard Test Method for Measuring Nominal Thickness of Geosynthetics
- K. ASTM D5323 Standard Practice for Determination of 2% Secant Modulus for Polyethylene Geomembranes.
- L. ASTM D5596 Standard Test Method for Microscopic evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics.
- M. ASTM D5617 Standard Test Method for Multi-Axial Test for Geosynthetics.
- N. ASTM D5721 Standard Practice for Air-Oven Aging of Polyolefin Geomembranes.
- O. ASTM D5820 Standard Practice for Pressurized Air Channel Evaluation Testing of Dual Seamed Geomembranes.
- P. ASTM D5885 Test Method for Oxidation Induction Time of Polyolefin Geosynthetics by High Pressure Differential Scanning Calorimetry.
- Q. ASTM D5994 Standard Test Method for Measuring the Core Thickness of Textured Geomembranes.
- R. ASTM D6392 Standard Test Method for Determining the Integrity of Non-Reinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.
- S. ASTM D6693 Standard Test Method for Determining Tensile Properties of Non-Reinforced Polyethylene and Non-Reinforced Flexible Polypropylene Geomembranes.
- T. ASTM D7238 Standard Test Method for Effect of Exposure of Unreinforced Polyolefin Geomembrane Using Fluorescent UV Condensation Apparatus.
- U. ASTM D7240 Standard Practice for Leak Location using Geomembranes with an insulating Layer in Intimate Contact with a Conductive Layer via Electrical Capacitance Technique (Conductive Geomembrane Spark Test).
- V. ASTM D7466 Standard Test Method for Measuring the Asperity Height of Textured Geomembrane.
- W. GRI GM6 Pressurized Air Channel Test for Dual Seamed Geomembranes.
- X. GRI GM9 Cold weather Seaming of Geomembranes.
- Y. GRI GM11 Accelerated Weathering of Geomembranes Using a Fluorescent UVA Condensation Exposure Device.
- Z. GRI GM14 Selecting Variable Intervals for Taking Geomembrane Destructive Seam samples Using the Method of Attributes.
- AA. GRI GM17 Test Properties, Testing Frequency and Recommended Warranty for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes.

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- BB. GRI GM19 Standard Specification for Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes.

1.05 QUALITY SYSTEMS REQUIREMENT

The Engineer reserves the right to inspect the materials and workmanship at any time. Materials or workmanship found not conform to this Specification may be rejected during the execution of the work. The Contractor shall be responsible for the removal and replacement of any work that is rejected, including any other work damaged as a result.

1.06 QUALIFICATIONS

A. Manufacturer Qualifications

The liner manufacturer shall have at least five (5) years continuous experience in the manufacture of polyethylene geomembranes and/or experience totaling 10,000,000 sq. ft. of manufactured polyethylene geomembrane within the past year. The manufacturer shall permit the owner or his authorized representatives to visit the manufacturing plant.

B. Liner Installer

Installation shall be performed according to IAGI Installation Specification.

The Geomembrane Installer shall have installed a minimum of 10 projects of LLDPE or similar geomembrane product during the last 3 years.

The liner installer shall have successful experience in the installation of LLDPE sheet using the dual hot wedge seaming method on projects with similar requirements to this project; and which is acceptable to, or licensed by the manufacturer of the primary materials for the installation of these materials.

(a) Supervisor

Installation shall be performed under the direction of a single competent installation supervisor who shall remain on-site and be in responsible charge throughout the liner installation, including subgrade acceptance, liner layout, seaming, testing and repairs, and all other related activities.

(b) Master Seamer

The Geomembrane Installer shall provide a minimum of one Master Seamer for work on the project. The Master Seamer may be the same person as the Supervisor. The installation supervisor or master seamer must be on-site whenever seaming is being performed.

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(c) Quality Control

The Contractor shall establish a Quality Control (QC) Representative who shall be responsible in the field for the quality and integrity of the LLDPE liner installation. This responsibility shall include the inspection, testing, and documentation of all liner installation work as performed by the installer. The QC Representative may be the same person as the Supervisor.

C. Laboratory

The Engineer shall engage a qualified, independent laboratory acceptable by the Owner for use in completing the off-site tests of destructive samples specified herein.

Results of independent laboratory testing shall be transmitted directly from the lab to the Engineer and Contractor as soon as the data is available.

D. Contractor Responsible for Subcontractors

The roles of any subcontractor shall not relieve the Contractor of any responsibilities whatsoever under this contract. The Contractor shall be responsible for the actions and performance of the manufacturer, installer, supervisor, and QC representative under this contract. A Contractor's representative shall be on-site during all geomembrane installation activities

1.07 SUBMITTALS

A. Prior to release of the geomembrane for shipment to the job site, the Contractor shall submit the following to the ENGINEER:

1. Written certification that the material was manufactured and tested in accordance with the requirements of GRI-GM17.
2. Quality control certificates for each batch of resin and production of geomembrane in accordance with the testing requirements of GRI-GM17.
3. Quality control certificates shall be signed by the responsible Quality Assurance (QA) personnel employed by the Manufacturer.
4. Conformance testing shall be performed in accordance with the requirements and standards specified in GRI-GM17 and as specified herein for the LLDPE membrane and its installation. Certificates of compliance shall be submitted for each roll to be used on the project prior to its release for shipment to the job site. Certificates of Compliance for LLDPE welding rod to be used on the project shall be submitted.
6. Manufacturer's completed projects resume.
7. Installer's completed project resume.
8. Installer's crew identification list and resumes.
9. Installation schedule.
10. Manufacturer's and installer's warranty as described in Part 1.07.

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B. Roll Identification:

1. Each roll shall have a permanently affixed label with the following information:
 - a. Name of manufacturer
 - b. Date of manufacture
 - c. Thickness of material (actual)
 - d. Roll number
 - e. Roll length
 - f. Roll width

C. Record Drawings and QC Reports (See Parts 3 and 4)

1.08 QUALITY ASSURANCE

A. General:

Quality of the liner installation shall be the responsibility of the Contractor. The Contractor, in fulfilling this responsibility, will be assisted by his designated Manufacturer, Installer, and QC representative,. The Contractor will be responsible for performing the Quality Assurance/Quality Control tasks outlined herein. The Engineer may conduct additional independent testing and inspections. These actions will not remove any responsibility of the Contractor under this Contract.

B. Lines of Authority:

The Contractor shall establish an Installation Supervisor and a QC Representative who will assist the Contractor in his responsibilities in the quality of the liner installation. The QC Representative shall assist in coordinating the timing and sequencing of liner installation and testing with the Engineer.

C. Manufacturer QC Documentation:

All materials must strictly comply with the requirements of this Specification. For all materials, a Manufacturer QC documentation shall be provided to the Engineer before the materials are to be installed.

The Manufacturer QC documentation shall include, but is not limited to, the following:

- Roll Number;
- Resin Lot;
- Product Code;
- Manufacturing Date;
- Roll Length;
- Roll Test Data Report;
 - o Average Thickness (ASTM D5994)

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- o Minimum Thickness (ASTM D5994)
- o Asperity Height (ASTM D7466)
- o Tensile Properties (ASTM D6693)
- o Tear Resistance (ASTM D1004)
- o Puncture Resistance (ASTM D4833)
- o Density (ASTM D1505)
- o Carbon Black Content (ASTM D4218)
- o Standard Oxidative Induction Time (ASTM D3895) or
- o High Pressure Oxidative Induction Time (ASTM D5885)
- o Oven Aging at 85°C, % Retained after 90days (ASTM D5885)
- o UV Resistance, % Retained after 1600hours (ASTM D7238 / ASTM D5885)

1.09 MATERIAL AND WORKMANSHIP WARRANTY

A. Contractor shall provide a written material warranty signed by the Manufacturer and a workmanship warranty signed by the Installer, both for the repair/replacement of defective materials and workmanship characterized by leakage, abnormal aging or deterioration of materials, and other failures of the flexible membrane to perform as required. The specified warranty period is ten (10) years for materials and two (2) years for workmanship after date of final acceptance. The terms and conditions of the warranties are presented in Exhibits D and E to the Agreement.

B. The warranty shall be a direct warranty from the Manufacturer (or Installer as the case may be) to the Owner. The warranties shall be signed and presented to the Owner prior to Substantial Completion. No payment in excess of 90 percent of all payments to be due under the appropriate payment items for LLDPE liner shall be made until the warranties, in their correct form hereunder, are received and approved by the Owner.

1.10 GEOMEMBRANE PRE-CONSTRUCTION MEETING

D. As soon as practical after the Contractor mobilizes the installation crew, but before any installation activities occur, a specific pre-construction conference shall be held.

The following persons shall be present:

1. Engineer Project Manager and Resident Engineer
2. General Contractor and Superintendent
3. Engineer Subconsultant QA Representative (if applicable)
4. Geomembrane Installer Site Superintendent and Quality Control Representative
5. Affected Subcontractors

E. Agenda:

1. Introductions and Explanation of Roles
2. General Overview of Specifications and Plans

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3. Review Proposed Installation Schedule
4. Review of Installer/Contractor QC Procedures
5. Review of Engineers QA Procedures
6. Destructive Test Sites
7. Leak Location Survey
8. Review of Contractor Personnel - Roles and Responsibilities
9. Reports and Record Drawing Information
10. Site Cleaning

PART 2 MATERIALS

2.01 GENERAL

All materials must strictly comply with the requirements of this Specification. For all materials, a Technical Data Sheet with the required testing shall be provided to and approved by the Engineer before the materials are to be installed.

The Contractor shall allow sufficient time for the Engineer to review the certified test results provided to not impact the geomembrane delivery schedule.

Materials not protected against solar radiation, mud, dirt, dust, puncture, cutting or any other damaging or deleterious conditions. Materials and equipment damaged prior to, and during installation shall not be used and must be replaced at the Contractor's expense.

Production samples of materials shall be provided to the Engineer and will be held throughout the period of the contract for the purpose of providing a reference against which all subsequent items may be gauged for compliance with this Specification.

The LLDPE geomembrane shall be a new, first-quality product designed specifically for the purpose of hydraulic containment and of the thickness specified. The membrane shall be uniform, free of holes, blisters, bubbles, gels, nicks, cuts, undispersed raw materials, or any sign of contamination by foreign matter.

The rolls shall be handled and stored with care to prevent any damage to the geomembrane. During the transport of the material from the manufacturing plant to site and storage of the geomembrane rolls on site, the geomembrane shall not be stacked higher than 3 rolls high.

2.02 GEOMEMBRANE MATERIAL

The geomembranes shall be comprised of Linear Low Density Polyethylene (LLDPE) and shall meet the required physical, mechanical and endurance properties shown in Table 5 (below).

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Table 5: 40-mil LLDPE Geomembrane (Textured) Technical Properties

Property	Test Method	Frequency ⁽¹⁾	Unit	Test Value
Thickness (min.avg)	ASTM D5994	Every Roll	mils	40
Thickness (min)				40
Asperity Height ⁽³⁾ (min.avg)	ASTM D7466	Every Roll	mils	20
Resin Density	ASTM D1505	1/Batch	g/cm ³	<0.92
Melt Index (max)	ASTM D1238	1/Batch	g/10min	1
Sheet Density ⁽⁸⁾	ASTM D1505	Every 10 Rolls	g/cm ³	<0.939
Carbon Black Content ⁽⁹⁾	ASTM D4218	Every 2 Rolls	%	2-3
Carbon Black Dispersion	ASTM D5596	Every 6 Rolls	Category	1&2
OIT - Standard (avg)	ASTM D3895	Per Formulation	min	140
Tensile Properties (min.avg) ⁽²⁾	ASTM D6693	Every 2 Rolls		
Strength at Break			ppi	112
Elongation at Break			%	400
Tear Resistance (min.avg)	ASTM D1004	Every 5 Rolls	lbf	25
Puncture Resistance (min.avg)	ASTM D4833	Every 5 Rolls	lbf	50
Dimensional Stability	ASTM D1204	Certified	%	± 2

Notes:

- (1) Testing Frequency based on standard roll dimensions and one batch is approximately 180,000 lbs (or one railcar)
- (2) Machine Direction (MD) and Cross Machine Direction (XMD or TD) average value should be on the basis of 5 specimens each direction.
- (3) ASTM D7466 is identical to GRI-GM12.
- (8) Correlation table is available for ASTM D792 vs ASTM D1505. Both methods give the same results.
- (9) Correlation table is available for ASTM D1603 vs ASTM D4218. Both methods give the same results.
- (10) Condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. Condensation at 60°C.
- (11) UV Resistance is base on percentage retained value regardless of the original HP-OIT value.

*All values are nominal test results, except when specified as minimum or maximum.

2.03 GEOMEMBRANE MANUFACTURING QUALITY CONTROL

The geomembrane shall be monitored throughout the manufacturing process for product integrity and consistency. The manufacturer shall test rolls in accordance with Table 5 (above) with results showing conformance with the required physical properties listed in Table 5 (above).

Certified test results shall be submitted to and approved by the Engineer before the LLDPE geomembrane rolls are to be installed from the manufacturing plant. The Geomembrane Installer shall allow sufficient time for the Engineer to review the certified test results provided to not impact the geomembrane delivery schedule.

The Geomembrane Installer shall submit a list which indicates date of production, resin batch number, manufacturing line number and identification number and square feet of each geomembranes roll. Rolls shall be listed in the order of production with the status of the roll (rejected or approved for shipment). All rolls shall be included in the list whether or not approved for shipment.

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Any roll(s) that do not meet the required physical properties or have not been tested at the required frequency Table 5 shall be rejected and removed from site.

2.04 LLDPE RESIN

Resin used in the manufacture of LLDPE geomembranes shall be first quality single source, compounded polyethylene resin manufactured specifically for the purpose of producing LLDPE geomembranes.

Reclaimed polymer shall not be added to the resin. The manufacturer may rework its own pre-consumer material from the rolls being produced. Reworked material from the same formulation as the parent material shall not exceed 10% of the total resin required.

The manufacturer shall sample and test for the properties listed in Table 6 (below) per batch resin. Certified test results shall be submitted to and approved by the Engineer before the LLDPE geomembrane rolls are to be installed. The Geomembrane Installer shall allow sufficient time for the Engineer to review the certified test results provided to not impact the geomembrane delivery schedule.

Table 6: Resin Physical Properties

Property	Test Method	Unit	Test Value
Density ⁽¹⁾	ASTM D1505	g/cm ³	<0.915
Melt Flow Index	ASTM D1238	g/10 min.	<1

Notes:

(1) Base resin density without carbon black added.

2.05 EXTRUDATE MATERIAL

The extrudate rod or bead shall be high quality polyethylene and shall be of the same resin type as the resin used to produce the geomembranes. All additives shall be thoroughly dispersed throughout the extrudate rod or bead. There shall be no contamination by foreign matter in the extrudate rod or bead.

2.06 ROLL IDENTIFICATION

Geomembrane shall be supplied in rolls of width accordance to the product Technical Data Sheet in Table 5. The rolls supplied should not allow any longitudinal seams. As a minimum, each roll shall be labeled as follows:

- Roll Number;
- Name of Manufacturer;
- Batch Number of Raw Material;
- Date of Manufacture;
- Material Thickness;
- Roll Length and Area;
- Product Type and Grade.

Rolls will need to have permanent marking every 16 feet along the smooth edges that include, as a minimum, the following information:

- Roll Number;
- Distance from start of the roll (in feet or meters).

2.07 DELIVERY

Rolls of geomembrane will be prepared to ship by appropriate means to prevent damage to the material and to facilitate off-loading.

2.08 STORAGE

The on-site storage location for geomembrane rolls, provided by the Contractor to protect the geomembranes from puncture, abrasion and excessive dirt and moisture should have the following characteristics:

- Level (no wooden pallets);
- Smooth;
- Dry;
- Protected from theft and vandalism;
- Adjacent to the area to be lined.

The rolls shall be handled and stored with care to prevent any damage to the geomembrane. During the transport of the material from the manufacturing plant to site and storage of the geomembrane rolls on site, the geomembrane shall not be stacked higher than 3 rolls high.

2.09 HANDLING

Materials are to be handled so as to prevent damage.

2.10 SAMPLES

The Contractor shall submit samples of the geomembrane material and field seams to the Engineer for approval prior to the start of construction. The Contractor shall submit 8.5''x 11'' samples of geomembrane materials which have been made in conformance with this Specification.

2.11 GEOMEMBRANE WARRANTY

The Contractor shall provide warranties for the geomembrane manufacturing and geomembrane installation in accordance with this specification.

2.11.1 MATERIAL WARRANTY

The geomembrane manufacturer shall furnish a written geomembrane warranty, which warrants the geomembrane material for a minimum of ten (10) years from the date of installation and final acceptance of the geomembrane.

The warranty shall be against manufacturing defects and workmanship. The warranty shall be limited to replacement of material only and shall be pro-rated.

2.11.2 INSTALLER WARRANTY

The Geomembrane Installer shall guarantee the geomembranes installation against defects in the installation and workmanship for two (2) years, commencing with the date of final acceptance of the geomembrane. A written geomembrane warranty will be required.

PART 3 SUBGRADE INSTALLATION

3.01 SUBGRADE PREPARATION

The Geomembrane Installer shall ensure that all surfaces to be lined including corners and around penetrations shall be finished smooth and free of rocks, stones, sticks, roots, sharp objects and debris of any kind or any object which may damage the geomembrane. The surface is to provide a firm unyielding compacted subgrade for the geomembrane. All desiccation cracking shall be repaired by the Contractor to the satisfaction of the Engineer.

Where a suitable surface cannot be achieved by treatment of in-situ material, an imported smoothing fine course shall be placed. The smoothing fine course shall consist of sandy clay which shall be free of organic matter and coarse or sharp particles. The smoothing course shall be the minimum thickness necessary to maintain 6" minimum cover over irregularities or protrusions in the sub-grade formation unless shown otherwise on the Drawings. The surface shall be watered and rolled with a smooth steel drum roller to obtain a smooth uniform finish.

All subgrade damaged by construction equipment and deemed unsuitable for geomembranes deployment, in the opinion of the Engineer, shall be repaired prior to placement of the geomembranes. All repairs shall be approved by the Engineer.

3.02 SUBGRADE MAINTENANCE

Where surface finishing is completed ahead of geomembrane installation, the surface shall be maintained until immediately prior to geomembrane installation. This surface will need to be re-inspected again by the Engineer and approved prior to installation of the geomembrane. Sufficient equipment shall remain on the site until and during installation to enable reinstatement of the surface in the event of damage due to inclement weather or desiccation cracking. Any reinstatement work shall be at the expense of the Contractor. The Engineer reserves the right to instruct the Contractor to perform remedial work to satisfy the criteria.

PART 4 GEOMEMBRANE INSTALLATION

4.01 GENERAL

Geomembrane installation shall be performed in accordance with the International Association of Geosynthetic Installers (IAGI) HDPE and LLDPE Geomembrane Installation Specification. Where there is discrepancy between the IAGI HDPE and LLDPE Geomembrane Installation Specification and this Specification, this Specification shall govern.

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Rolls of geomembrane shall be handled and securely stored to prevent damage prior to installation. Geomembrane shall be unrolled in a controlled manner directly into the final position. The method of unrolling shall not cause scratches or crimps in the material, nor shall it disrupt the integrity of the finished sub-grade.

The geomembrane shall be placed in a relaxed state such that the material can respond to thermal changes without excessive buckling, wrinkling or tensioning. Slack shall be included in the geomembrane on the batter side of the tie-in seam along the toe of all internal slopes. The included slack at the tie-in seam will minimize tension on the tie-in seam due to contraction of the geomembrane at temperatures cooler than ambient during installation.

For material temperatures between 5°F and 32°F, the deployment and seaming will be performed in accordance with GRI GM9. No geomembranes material shall be unrolled or deployed if the material temperatures are lower than 5°F, unless otherwise approved in writing by the Engineer. Only the quantity of geomembranes that will be anchored and seamed together in one day shall be deployed.

In general, seams shall be orientated parallel to the line of maximum slope. In corners and odd shaped geometric locations, the total length of the field seam shall be minimized. Seams shall not be located at low points in the subgrade unless geometry requires seaming at such locations as approved by the Engineer.

All LLDPE panels that are to be welded together shall be manufactured by the same geomembrane manufacturer, made from the same resin type and made using the same formulation. Adjacent LLDPE panels that do not satisfy all of these requirements shall not be welded together. Any panels welded together that violate any of these criteria shall be rejected and removed from site at the Geomembrane Installer's expense.

The geomembranes shall not be allowed to "bridge" over voids or low areas in the subgrade. The geomembranes shall rest in intimate contact with the subgrade.

Temporary ballasting such as sand bags or tires shall be placed on the geomembrane to prevent wind damage during and after installation. It should be noted that this temporary ballasting shall be of a suitable construction to prevent against damage of the geomembrane. The Contractor shall be required to ensure that the spacing of these sand bags / tires are appropriately designed (this could include tying the sand bags / tires together in a horizontal and vertical direction) to prevent against uplift and potential damage of the geomembrane. Any geomembrane material that has been damaged as the result of the wind, in the opinion of the Engineer, shall be removed and replaced at the Contractor's expense.

All personnel working on the geomembrane surface shall wear soft-soled shoes and shall not engage in any activity which may damage the geomembrane.

Machinery, other than seam welding machinery or All-Terrain Vehicles (ATV) approved for use by the Engineer in writing, shall not be operated on the geomembrane.

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The use of ATVs for the deployment of the geomembrane will be allowed. For ATVs to be used, the Contractor must demonstrate that the ATV exerts a maximum allowable pressure on the ground surface (or geomembrane surface) of 8 psi. The maximum allowable pressure on the ground surface (or geomembrane surface) is influenced by the tread pattern of the tires on the ATV. The maximum allowable ground surface (or geomembrane surface) pressure is not the reading from a tire pressure gauge. The ATVs shall only be used to deploy rolls of geomembrane and shall not be used to transport personnel, equipment, sandbags or the like.

Equipment used for placing and compacting the sand blanket or stone fill shall not be driven directly on the geomembrane or composite. Such equipment shall be closely monitored during placement to ensure that no damage occurs to the geomembrane or composite.

4.02 SEAMING

A. General

Seaming of geomembranes shall be carried out strictly in accordance with the manufacturer's written instructions and in accordance with GRI GM19. The contractor shall provide a complete description of the processes to be used, and shall identify the equipment proposed for accomplishing the seaming.

No geomembranes material shall be seamed when the sheet temperature is below 5°F and above 170°F as measured by an infrared thermometer (or surface thermocouple), unless otherwise approved by the Engineer. For material temperatures between 5°F and 32°F, seaming shall be performed in accordance with GRI GM9.

B. Personnel

The Contractor shall nominate a Project Seam Welding Supervisor before commencing work and shall demonstrate that the Seam Welding Supervisor has a proven background in installation of lining systems and materials similar to those specified. All personnel employed in welding shall be competent and experienced in the use of the equipment. The Contractor shall ultimately be responsible for ensuring the quality assurance program is followed.

C. Seam Welding Equipment

Only specialized purpose-designed equipment approved by the Engineer shall be used. For long-run work, the machine shall be mounted on a carriage to operate at a controlled speed. In all cases, the temperature at the point of fusion shall be monitored and controlled with an interlock to the drive mechanism so that welding is stopped if the temperature falls outside the range at which satisfactory welding can be achieved.

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Where the welding procedure includes provision for heated extrudate to be incorporated in the weld, any degraded extrudate, which has been overheated or heated and cooled in the barrel, shall be purged with fresh material prior to the resumption of welding.

Equipment shall be maintained on a regular basis to ensure efficient performance throughout.

The field tensiometer shall have a current certificate of calibration in accordance with the manufacturer's calibration recommendations.

D. Seam Strength Requirements

Each test specimen should fail in the parent material and not in the weld as demonstrated by test welds and destructive test samples in accordance with Part 5: Geomembrane Inspection & Testing. Breadth and depth of fusion between sheets shall be as required to meet these criteria. Where heated extrudate is included in the weld, the extrudate material after fusion shall be fully compatible physically and chemically with the geomembrane material.

The geomembrane material shall not be overheated during welding such that crystallization, oxidation, perforation or degradation of the geomembrane occurs.

E. Weather Conditions

Welding shall not be commenced or continued during rain, fog, excessive winds, snowing, sleeting or hailing. Welding shall not be commenced or continued when ambient temperatures (as measure 3' above the seam being welded) is outside the range of 5°F to 100°F. When ambient temperatures are between 5°F and 32°F, seaming shall be performed in accordance with GRI GM9.

The seams adjacent to the corners of the ponds and the toe of the slopes shall be made during the coolest part of the day and shall not be made when the geomembrane is exposed to direct sunlight.

F. Geomembrane Preparation

The surface of the geomembrane to be welded shall be clean, dry and free from any foreign matter and contaminants, such as clay and sand.

G. Seam Lap

The minimum lap of adjacent geomembrane sheets shall be 6'', unless specified as greater by the geomembrane manufacturer or the welding equipment supplier.

Fishmouths, or excessive wrinkles at the seam overlap, shall be minimized. When necessary, cut along the ridge of the wrinkles back into the panel to create a flat overlap. The cut shall be terminated with a keyhole cut (nominal 0.5'' diameter hole) so as to minimize crack/tear propagation. The overlay shall subsequently be seamed. The keyhole cut shall be patched with an oval or round patch, of the same

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base geomembrane material extending a minimum of 6'' beyond the cut in all directions.

H. Fusion Welding (Primary Welds)

Seam welding of LLDPE geomembranes shall be accomplished primarily by fusion welding using either a hot wedge or hot air welder.

Geomembrane surface area to be fusion welded must be cleaned from dust, mud, debris and shall be protected against moisture build-up between sheets.

The seam shall consist of a double weld produced by surface fusion with an air gap between. Pressure nipping rollers shall press the molten surfaces together immediately behind the hot air or hot wedge welder to complete the weld.

All seams shall be labeled on the geomembrane with the following information:

1. Machine identification number
2. Operator, date, time
3. Direction of travel of seaming equipment
4. Date of testing and results

I. Extrusion Welding (Secondary Welds)

Extrusion welding shall only be used where fusion welding is not possible, such as at pipe penetrations, patches, repairs, and short runs of seams (less than a roll width).

Geomembrane surface area to be extrusion welded must be cleaned by using disc grinder or equivalent to remove the oxidized layers and dirt. The leading edge of the upper geomembrane needs to be beveled or tapered to a 45° angle and the bottom geomembrane grind marks shall be about 5% of the liner thickness.

Extrusion welding shall be achieved by fusion of an extrudate to the top surface of both sheets at the lap. The depth and width of engagement of the extrudate shall be as required to achieve the strength requirements. The means of deposition of the extrudate shall provide for full integration with the surface of the sheets, so that the weld becomes homogeneous with the geomembrane.

All seams shall be labeled on the geomembrane with the following information:

1. Machine identification number
2. Operator, date
3. Direction of travel of seaming equipment
4. Date of testing and results

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J. Connections at Penetration and to Structures

Connections to geomembrane penetrations and adjoining structures shall be made in accordance with the details shown on the construction drawings. Connections shall be at least equivalent in strength to the normal lap seams and the security of containment shall not be diminished. Local stresses in the geomembrane at connections shall be minimized.

Penetrations shall be constructed from the base geomembranes material, flat stock, prefabricated boots and accessories as shown in the construction drawings.

K. Geomembrane Anchorage

Anchor trenches shall be excavated in accordance with the details on the construction drawings. The anchor trenches shall be kept well drained to avoid softening during rain periods and maintained so as to not dry, desiccate and crack.

The Contractor shall seek approval from the Engineer prior to the commencement of anchor trench backfilling. Backfilling shall be carried out in planned, logical sequence to avoid overstressing of the geomembrane. The front edge of the anchor trench will be rounded, with no sharp stones that might damage the liner. The backfill material shall be compacted to prevent future settling.

L. Cleaning Up

On completion of the work on site, the Contractor shall clean up and leave the whole area to the satisfaction of the Engineer.

PART 5 GEOMEMBRANE INSPECTION, TESTING & REPAIR

All areas found to be defective shall be repaired at the expense of the Geomembrane Installer. The Engineer shall be notified of defective areas prior to the repair taking place.

The Geomembrane Installer shall ensure a plan is marked up showing the locations of repairs made and the type of repair made. The Geomembrane Installer shall submit a marked up drawing showing the locations of the repairs to the Engineer for review and approval.

5.01 VISUAL INSPECTIONS

The entire surface of every sheet of geomembrane material shall be inspected by the Geomembrane Installer during placing to identify any tears, abrasions, indentations, cracks, thin areas, or other defects.

Any defects such as holes, tears, blisters, lamination, undispersed raw materials or visible non-uniformity or contamination by foreign matter which in the opinion of the Engineer is detrimental to the long service life required of the membrane geomembrane, shall be grounds for rejection of the membrane geomembrane material.

Where additional faults are found, the Engineer reserves the right to reject the roll. The Contractor shall replace any rejected rolls and repair any defects to the Engineer's satisfaction at the Geomembrane Installer's expense.

5.02 SEAM TESTING

All geomembrane weld seams shall be subjected to both non-destructive and destructive field testing. Additionally, representative samples of field seams shall be taken for laboratory testing by an independent, appropriately qualified geosynthetic testing laboratory.

The tests in this Section shall be carried out at the specified frequencies.

Testing of each length of seam shall be carried out within 48 hours of its completion.

The acceptance criteria for peel and shear strength testing shall be in accordance with GRI GM19.

Site Test Equipment: The Contractor shall maintain on -site, in good working order, the following items:

1. Field Tensiometer

- a. The tensiometer shall be motor driven and have jaws capable of traveling at a measured rate of 2 in/min.
- b. The tensiometer shall be equipped with a gauge which measures the force in unit pounds exerted between the jaws.
- c. The tensiometer shall be calibrated and certified for use on this project. A copy of the calibration certificate shall be submitted to the Engineer.

1. Coupon Cutter

A die cutter machined to cut 1"x5" liner sample coupons for field testing shall be provided and maintained in good working condition.

3. Vacuum Box

- a. The vacuum box shall consist of a rigid housing with a transparent viewing window on the top and a soft, closed-cell neoprene gasket completely attached to the bottom of the housing.
- b. The housing shall be equipped with a bleed valve.
- c. A separate vacuum source shall be connected to the vacuum box such that a negative pressure of 2 - 3 psi (5" - 6" mercury) can be created and maintained inside the box.
- d. A solution consisting of soap and water shall be dispensed on the seam immediately ahead of the vacuum box.
- e. Vacuum box testing shall not proceed when temperatures are below 32°F.

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4. Air Pressure Test Equipment - This method shall apply when the split hot wedge seaming method is used.
 - a. Equipment shall consist of an air pump capable of generating and maintaining a positive pressure of between 20 and 30 psi.
 - b. A manometer capable of reading up to 30 psi attached to a needle or nipple shall be used to pressurize the air channel in the seam.

A. Test Welds (In Field)

Test seams shall be made by each welding technician and tested in accordance with ASTM D6392 at the beginning of each seam period. Test seaming shall be performed under the same conditions and with the same equipment and operator combination as production seams. The test seam shall be approximately 6 feet long for fusion welding and 3 feet long for extrusion welding with the seam centered lengthwise.

At a minimum, trial welds shall be made by each technician as follows:

- Prior to commencement of each shift;
- One time every 4 hour thereafter;
- Following any break in operation;
- Following any significant adjustment to welder controls.

Additional tests may be required with changes in environmental conditions.

Two 1 inch wide specimens shall be die-cut by the Geomembrane Installer from each end of the test seam. These specimens shall be tested by the Geomembrane Installer using a field tensiometer testing both tracks for peel strength and direct shear strength tests.

The test weld will be considered acceptable if the test piece fails in the un-welded geomembrane away from the seam. If the field test fails then further test welds shall be made after appropriate adjustment of the welder controls, and retested until an acceptable weld is obtained. Field test results shall be recorded and test pieces marked and stored. The Engineer reserves the right to take further test pieces from the test welds for independent tests off-site.

Testing shall be conducted on three specimens for peel strength, and two specimens for shear strength.

B. Test Weld Strength Requirements

Prior to field testing a test weld, a representative specimen from the parent material on the upper and lower section of geomembrane used to conduct the test weld shall be collected and tested on the field tensiometer. The resulting strength shall be used as a benchmark for the criteria used to measure passing weld specimens.

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Welds shall be considered passing when 100% of welds fail at locations away from the weld with a strength equal to or greater than 90% of parent strength in shear and 60% of parent strength in peel.

C. Non-Destructive Testing (In Field)

All seams shall be non-destructively tested in accordance with the following sections.

Air Pressure Testing

Double fusion seams with an enclosed channel shall be air pressure tested by the Geomembrane Installer in accordance with ASTM D5820 and ASTM D4437. Every geomembrane seam shall be subjected to air pressure testing. The testing shall be achieved by inflation of the space between the welds to approximately 30 psi pressure and following the 2 minute "relaxing period" (whereby the air temperature and pressure stabilizes), the air pressure will be monitored 5 minutes and the pressure loss recorded.

If pressure loss does not exceed 4 psi after 5 minutes, the seam shall be considered leak tight and therefore considered to be acceptable.

Vacuum Testing

For single welded seams testing shall be achieved using vacuum testing. Vacuum testing shall be performed by the Geomembrane Installer in accordance with ASTM D4437 and ASTM D5641.

The Vacuum pump shall be charged and the tank pressure adjusted to approximately 5 psi. If no bubbles appear while the vacuum is held for 5 seconds, then the seam is satisfactory. Penetration Testing(in field)

Penetrations: The membrane shall be installed around pipes as shown on the Drawings. Install to provide an effective, watertight seal. Construction and installation of the pipe boot shall be performed in the presence of the Engineer or his designated representative. Testing of all pipe boots shall be required.

Liner installer shall coordinate with Contractor on space required for extrusion welding and vacuum testing around pipe/boot penetrations.

Boot fabrication and testing shall be as follows:

1. Boots shall be fabricated in the field to fit the pipe penetration.

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2. The boot shall be temporarily removed, skirt attached to a temporary base sheet with the barrel of the boot welded shut, and air tested to 2-3 psi (min/max); apply soapy water to all prefabricated seams to locate any leaks.
3. If no leaks are found, remove temporary base sheet, open boot barrel, and reinstall on pipe.
4. Extrusion weld boot flap to liner, and boot barrel to HDPE pipe.
5. Place liner sleeve over boot barrel covering end of boot and weld sleeve to boot barrel and pipe.
6. Air test sleeve (2-3 min/max psi) for 5 minutes to evaluate boot barrel seal. If no pressure drop is observed, grind and extrude air test penetration and vacuum test extrusion.
7. Vacuum test extrusion seams of boot and skirt joint with liner.

All pipe boots, vents, and patches shall be of the same material as the membrane sheet. Gaskets, sealing materials, or other means used to secure the membrane shall be compatible with and have a lifespan at least equal to that of the LLDPE membrane.

5.03 GEOMEMBRANE DEFECTS

A. Identification of Defects

Panels and seams shall be inspected by the Geomembrane Installer, Contractor and Engineer during and after panel deployment to identify all defects, including holes, blisters, undispersed raw materials and signs of contamination by foreign matter.

B. Evaluation of Defects

Each suspect location on the geomembrane (both in geomembranes seam and non-seam areas) shall be non-destructively tested using one of the methods described in Section 5.2.2: Non-Destructive Testing. Each location which fails non-destructive testing shall be marked, numbered, measured and posted on the daily "installation" drawings and subsequently repaired.

If a destructive sample fails the field or laboratory test, the Geomembrane Installer shall repair the seam between the two nearest passed locations on both sides of the failed destructive sample location.

C. Wrinkles

Any wrinkles that can fold over shall be repaired either by cutting out excess material or, if possible, allowing the geomembrane to contract as the temperature decreases. In no case shall material be placed over the geomembrane that could result in the geomembrane folding. All folded geomembrane shall be removed. No material shall be placed in areas where the geomembrane is not in contact with the supporting subgrade.

5.04 GEOMEMBRANE REPAIR

A. Geomembrane Repair Procedures

Any portion of the geomembrane with a flaw or that fails a non-destructive test shall be repaired by one of the following methods:

- Patching for holes, defects or tears 0.5 inch or larger in diameter or length – used to repair large holes, tears, large panel defects, and destructive sample locations that are less than 20 ft² (total area);
- Extrusion – used to repair relatively small defects in panels and seams, but not greater than 0.5 inch in length;
- Capping – used to repair failed welds or geomembrane seams where welds cannot be non-destructively tested;
- Removal – used to replace areas with large defects where the preceding methods are not appropriate. Also used to remove excess material (wrinkles) from the installed geomembrane.

Once the repair has been completed, further non-destructive or destructive testing shall be carried out to ensure the repairs are completed to the requirements of this Specification.

B. Verification of Seam Repairs

Each repair shall be non-destructively tested using either vacuum box or spark testing methods. Tests which pass the non-destructive test shall be taken as an indication of a successful repair. Failed tests shall be re-seamed and retested until a passing test results. The number, date, location, technician and test outcome of each patch shall be recorded.

5.05 TESTING & INSPECTION RECORDS

Full records of geomembrane testing and inspection shall be submitted progressively to the Engineer, as the work proceeds. Final completion will not be certified until all records have been submitted and approved by the Engineer.

Records shall include, but not limited to, the following:

- Contractor's panel layout drawing showing panel numbers and seam numbers, to be marked up progressively with the roll number used for each panel, and with the locations of samples taken for destructive testing;

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- Manufacturer's roll production test reports for all rolls used in the work;
- Subgrade certification reports;
- Daily vacuum box or seam inflation test reports referenced to seam numbers;
- Daily test weld field test reports referenced to seam numbers, equipment identification, and operator, and including weather and temperature conditions and any adjustments to equipment controls;
- Destructive test field report and record of submission for laboratory testing referenced to seam number;
- Laboratory test reports to be available within two weeks of testing;
- Record drawing indicating geomembrane seam locations, destructive test locations, cap strip locations, patches and all repairs for the geomembrane system.

Part 6 GEOMEMBRANE COMPLETION

The Geomembrane Installer shall undertake post installation testing of geomembrane as soon as practical after installation. Installation and material defects detected by post installation testing shall be covered under the Installation warranty and shall be repaired to the satisfaction of the Engineer.

6.01 GEOMEMBRANE COMPLETION ACCEPTANCE CRITERIA

Upon completion of the geomembrane completion phase (complete with repair and re-testing of leaks), the geomembrane installation shall be deemed as substantially complete and handover shall be approved by the Engineer.

Following handover, leakage rates shall be monitored by the Owner during first filling for the presence of leakage. If leakage is detected within the first year, the installer shall re-mobilize on-site and locate and repair the leaks per the requirements of Section 2.11.2: Geomembrane Installer Warranty.

The Engineer shall release the work as being complete upon receipt and approval of the following:

- Checks on application and final finish;
- The installation of LLDPE geomembranes has been completed and signed off;
- Repairs to defects have been completed;
- Site has been left clean with no litter;
- All required documentation has been provided to the Engineer in accordance with Section 5.5: Testing & Inspection Records.

END OF SECTION

SECTION 02279
GEOSYNTHETIC CLAY LINER

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

- A. This work shall consist of furnishing and installing geosynthetic clay liner beneath the primary liner, under the primary leachate pipe, as described or shown in the Contract drawings or specifications.
- B. Panel Layout Plan.

1.02 RELATED REQUIREMENTS

- A. Section 01300 - Submittals
- B. Section 01400 - Quality Control/Quality Assurance
- C. Section 02223 - Filling
- D. Section 02234 - Select Sand
- E. Section 02276 - High Density Polyethylene (HDPE) Liner

1.03 APPLICABLE STANDARDS, CODES AND REGULATIONS

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM D6496 - Standard Test Method for Determining Average Bonding Peel Strength Between the Top and Bottom Layers of Needle Punched Geosynthetic Clay Liner.
 - 2. ASTM D4643 - Determination of Water (Moisture) Content of Soil by the Microwave Oven Method.
 - 3. ASTM D4833 - Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
 - 4. ASTM D5199 - Test Method for Measuring Thickness of Geotextiles and Geomembranes.
 - 5. ASTM D5261- Standard Test Methods for Measuring Mass per Unit Area of Geotextiles.
 - 6. ASTM D5887 - Standard Test Method if Index Flux Through Saturated Geosynthetic Clay Liner Specimens using a Flexible Wall Permeameter.
 - 7. ASTM D5890 - Standard Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liner.
 - 8. ASTM D5993 - Test Method for Measuring the Mass Per Unit Area of Geosynthetic Clay Liner.
 - 9. ASTM D6768 - Standard Test Method for Tensile Strength of Geosynthetic Clay Liners.

10. ASTM D6243 - Standard Test Method for Determining Internal and Interface Shear Resistances of Geosynthetic Clay Liner by the Direct Shear Method.

1.04 QUALIFICATIONS

A. Installer:

The installer shall be trained and experienced in field handling, storing, deploying, and installing GCL. Alternatively, the Contractor shall engage an experienced Subcontractor who shall meet the experience requirements.

- B. Contractor Responsible for Subcontractors - The roles of any subcontractor shall not relieve the Contractor of any responsibilities whatsoever under this contract. The Contractor shall be responsible for the actions and performance of the manufacturer and installer.

1.05 SUBMITTALS

- A. Manufacturer's Certificate of Compliance shall be submitted and reviewed prior to installation.
- B. The Contractor shall submit to the Engineer samples of the proposed GCL, and quality control certificates issued by the manufacturer for each roll of GCL. The certificates shall include roll number and identification. The certificates shall also include results of quality control tests completed at the minimum frequency specified, and at least one per lot, for the properties identified in Part 2.03. A lot is defined as a group of rolls manufactured from the same production line. The QC certificates shall be signed by the responsible Quality Assurance personnel employed by the manufacturer. This submittal shall be made at least 10 days prior to delivery of materials to the site.
- C. The Engineer shall complete laboratory tests for Peel Strength of the on-site GCL in accordance with ASTM D6496, at a minimum frequency of one (1) test per 50,000 sf of GCL to be placed.
- D. The Engineer shall also complete interface and internal shear strength testing of material proposed for use at the site in accordance with Part 2.02 B and 2.03 B.

1.06 MATERIAL HANDLING

- A. Material shipping, storage, and handling shall be in accordance with the manufacturer's recommendations. The Contractor shall be responsible for the shipping, handling, storage, and care of the GCL from the time of delivery to the site until final acceptance of the completed work by the Owner and shall be liable for all damages to the materials during such time.

- B. Inform Owner a minimum 72 hours before any delivery.
- C. Roll Identification:
 - 1. Provide GCL rolls wrapped in relatively impermeable and opaque protective covers and marked or tagged with the following information:
 - a. Manufacturer's name.
 - b. Product identification.
 - c. Date of manufacture.
 - c. Shipping lot - keyed to acceptable Certificate of Compliance.
 - d. Roll number.
 - e. Roll dimensions.
 - f. Roll weight.
 - 2. Indicate special handling marked on GCL itself, e.g., "This Side Up".
 - 3. Conformance testing shall be conducted by the Manufacturer in accordance with Part 2.03 to indicate Conformance with the Specifications.
- D. Handle GCL to ensure panels are not damaged.
- E. Store GCL in a dry place under a roof or other protective cover; protect from moisture by placing on skids, pallets, or dry ground.
- F. Any damaged packaging or rolls shall be cause for rejection, subsequent removal from the site, and replacement at no additional cost to the Owner.
- G. The Engineer shall observe rolls upon delivery and prior to deployment at the site and report any deviations from the above requirements to the Contractor.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. BentoLiner; GSE
- B. Bentomat; CETCO Lining Technologies
- C. Or approved equivalent.

2.02 GENERAL

- A. Except when specifically authorized, do not furnish special run or value added products.

B. GCL:

1. Flexible, layered liner consisting of continuous layer of sodium bentonite sandwiched between two non-woven geotextile carrier layers, and reinforced with needle-punched fibers.
2. GCL shall be of type to maintain integrity during installation, placement, and covering procedures.
3. Bentonite adhesive shall be non-toxic and water soluble.

2.03 GEOSYNTHETIC CLAY LINER (GCL)

- A. The GCL shall have the following minimum physical properties as determined by the appropriate test method:

Material Property	Test Method	Frequency	Required Value
Non-Woven Carrier Layer			
Cap carrier sheet, non-woven polypropylene geotextile	ASTM D5261	1/200,000 ft ²	6.0 oz/yd ²
Bottom carrier sheet, non-woven polypropylene geotextile	ASTM D5261	1/200,000 ft ²	6.0 oz/yd ²
Bentonite			
Montmorillonite Content			90 Meq. min.
Bentonite Swell Index	ASTM D5890	1/100,000 lb	24 mL/2 g min.
Bentonite Fluid Loss	ASTM D5891	1/100,000 lb	18 mL max.
Bentonite Moisture Content	ASTM D4643	1/100,000 lb	12% max.
GCL			
Bentonite Mass/Area	ASTM D5993	1/40,000 ft ²	0.75 lb/ft ²
Nominal Thickness	ASTM D5199	1/40,000 ft ²	0.24 in. min.
GCL Grab Strength	ASTM D6768	1/200,000 ft ²	150 lb
GCL Grab Elongation	ASTM D6768	1/200,000 ft ²	100% Typ.
GCL Peel Strength	ASTM D6496	1/200,000 ft ²	3.5 lbs/in min.
Puncture Resistance	ASTM D4833	1/200,000 ft ²	220 lbs Typ.
GCL Hydraulic Conductivity	ASTM D 5084	1/week	5 x 10 ⁻⁹ cm/sec max.
GCL Index Flux	ASTM D 5887	1/week	1 x 10 ⁻⁸ m ³ /m ² /sec max.
GCL Hydrated Internal Shear Strength	ASTM D 6243	Periodic	500 psf Typ.

PART 3 EXECUTION

3.01 SUBGRADE

- A. The bentonite mat shall be installed over a surface graded to the tolerances shown on the Contract drawings or geosynthetic materials fully installed as described in other specification sections.
- B. The underlying subgrade shall exhibit no ruts or other surface deformities.

3.02 ACCEPTANCE

- A. The Contractor shall submit in writing the installer's certificate that the surface to be lined is acceptable. After submittal of written acceptance, the Contractor may proceed incrementally according to the installation schedule.

3.03 INSTALLATION

- A. The GCL mat shall be placed over the prepared subgrade and under leachate piping below the primary 60-mil HDPE liner to the limits shown on the Plans. GCL shall extend a minimum of three (3) feet beyond the limit of the primary leachate collection pipe trenches.
- B. Each panel of GCL shall be laid out and installed in accordance with the approved Shop Drawings. Any changes must be submitted to the Engineer in writing for approval prior to installation of liner.
- C. Installation of the GCL shall be done in the presence of the Engineer or his designated representative.
- D. Deployment:
 - 1. No equipment or tools shall damage the mat by handling, traffic or other means.
 - 2. No personnel working on the geomembrane shall engage in activities that could damage the mat.
 - 3. The method used to unroll the panels shall not cause scratches or crimps in the liner and shall not damage the supporting soil or underlying liner.
 - 4. Methods used to place panels shall minimize wrinkles, especially differential wrinkles between adjacent panels or sheets, while providing sufficient material to prevent bridging.
 - 5. GCL must be covered by geomembrane by the end of the day.

GEOSYNTHETIC CLAY LINER

6. Direct contact by machinery with the GCL shall be avoided. The mat shall be protected by geotextiles, extra geomembrane, or other suitable materials.
7. If the GCL panels do not include the Supergroove Technology: Overlap of adjacent panels shall be 6 in minimum at each side, 24 in at each end. Contacting surfaces shall be cleaned prior to installation of overlapping sheets. Seams shall receive additional granular bentonite at a minimum of 1/4 pound per linear foot. This strip of bentonite shall be 2 in wide (minimum), approximately 4 in from the edge. Additional fasteners or adhesives may be required to hold panels in place. These shall be reviewed by the Engineer prior to installation.

If the GCL panels include the Supergroove Technology supplemental bentonite is not required on the longitudinal overlaps. Longitudinal seams should be overlapped a minimum of 6 inches. End-of-panel overlapped seams should be overlapped 24 inches for Bentomat. End of panel overlap seams shall receive additional granular bentonite at a minimum of 1/4 pound per linear foot.

8. Installation shall be performed in a manner which protects underlying geosynthetics, and must meet the requirements for low ground pressure equipment, as applicable.
- E. Penetrations: The GCL shall be installed around pipes as shown on the Drawings. Install to provide a watertight seal.

3.04 PROTECTION

- A. A minimum of 12 in of soil cover shall be placed prior to operation of machinery.
- B. Only low ground pressure (LGP) tracked equipment will be allowed on soil over liner covered surfaces. LGP is defined as equipment that distributes no greater than 4.7 psf.
- C. Rips or tears shall be repaired with additional bentonite mat with a minimum of 12 in overlap on all edges. Additional bentonite powder shall be placed between the patch and original liner at a rate of 1/4 psf. This strip of bentonite shall be 2 in wide (minimum), approximately 4 in from the edge.
- D. No GCL shall be placed in wet conditions. It is the Contractor's responsibility and sole risk to accurately assess the probability of rain or other precipitation in scheduling installation activities. Any GCL exposed to moisture prior to covering shall be removed and replaced at no additional cost to the Owner.
- E. Prevent wind uplift by providing adequate temporary loading or anchoring (for example, sandbags, tires) that shall not damage GCL.

3.05 WRINKLES AND SHRINK COMPENSATION

- A. All wrinkles shall be removed and patched (see 3.04.C) prior to placement of cover materials.
- B. The Contractor shall allow for shrink compensation to avoid wrinkles and to assure the specified adjacent panel seam overlap.

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, LOAM BORROW AND TOPSOIL

1.03 SUBMITTALS:

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

- A. Six copies of 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
- B. Information detailing proposed limestone, fertilizers, mulch materials, hydroseeding materials (as required), and slope protection material (as required) to be applied to seeded areas.
- C. Information on watering, fertilizing and maintenance schedule.

- D. Marked up print 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;

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

- 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.

- 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. Grass seed for general lawn areas shall conform to the following requirements:

Botanical and Common Names	Proportion by Weight	Germination Rate	Purity Minimum
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Chewing's Fescue (Festuca rubra commutata)	33%	70%	97%
'Kentucky 31' Tall Fescue (Festuca arundinacea 'Kentucky 31')	33%	90%	98%
Kentucky Bluegrass (Poa pratensis)	24%	80%	85%
Perennial Ryegrass (Lolium perenne)	10%	90%	98%

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. Hay Mulch shall consist of mowed and properly cured grass, clover or other acceptable plants. No salt hay shall be used.
 - b. 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 PROTECTION:

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 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.
- C. 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.
- D. 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 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 SURFACE PREPARATION:

- A. Refer to Section 02329, LOAM BORROW AND TOPSOIL for surface preparation.

3.03 BROADCAST SEEDING, PLACING MULCH AND SLOPE EROSION PROTECTION:

- A. The seed mix shall be broadcast at 6 pounds per 1000 square feet, as recommended by the seed supplier, 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.
- C. Hay or Straw Mulch shall be used based on time of seeding as previously specified over all seeded areas, as designated on the plans, or as otherwise directed. If mulch is to be used, it shall be loosely spread to a uniform depth at a rate of 4-1/2 tons per acre to provide 1/4 inch of cover, or as otherwise directed. The seed and mulch shall then be firmed into the soil with a roller that will apply a pressure between 75 and 100 pounds per foot of width.
- D. Hay or Straw Mulch may be applied by mechanical apparatus, if in the judgment of the Engineer, the apparatus spreads the mulch uniformly and forms a suitable mat to control slope erosion. The apparatus shall be capable of spreading at least 80 percent of the hay or straw in lengths of 6-inches or more, otherwise it shall be spread by hand without additional compensation.
- E. Slope erosion control blankets shall be placed as indicated on the plans or as directed by the Engineer.

3.04 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 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.
- D. 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.
- E. The Contractor shall immediately cleanup hydroseed oversprays from plant materials, pavements, furnishings, etc., to the satisfaction of the Engineer.

3.05 MAINTENANCE:

- A. The Contractor shall maintain the entire seeded area, as necessary to ensure dense healthy growth, until completion of the guarantee period and final acceptance of the project which is two full growing seasons. If lawns are planted in late summer or during the fall, maintenance shall continue through the following fall. 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 owner or 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, FOR TWO COMPLETE GROWING SEASONS AFTER INSTALLATION 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 field protection fencing is to be 6' tall chain link with driven posts and two 10' gates to allow access for maintenance and shall remain the property of the Contractor and shall be removed by the Contractor upon final acceptance by the Engineer.
- F. Pavement shall be kept clean and clear of cuttings and debris at all times during the maintenance period to the satisfaction of the Engineer.

3.06 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.
- C. 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.

3.07 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 fall.
- 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 natural disasters, including but not limited to, catastrophic fire, hurricanes, 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.

3.08 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 02329
LOAM BORROW AND TOPSOIL

PART 1 - GENERAL

1.01 SCOPE OF WORK:

- A. Under this Section, the Contractor shall furnish all labor, materials, equipment and transportation required to furnish and place 6" Loam Top Soil as shown on the drawings and as specified. Where proposed tree and shrub planting mix and/or sod or seed is noted on the drawings, it shall be composed of Loam Borrow, or Topsoil in compliance with this specification.

1.02 SAMPLES/TESTS:

- A. The Contractor shall furnish a Certified Laboratory Report showing the soils classification and nutrient analysis of representative samples of the proposed Loam to be used, including the extent of lime and fertilizer required. Samples submitted for approval must be representative of the total volume to be furnished, taken in the presence of the Engineer, and delivered to a certified laboratory by the Contractor; all costs for such shall be borne by the Contractor.
- B. At least ten (10) days prior to shipment/delivery of materials, the Contractor shall submit to the Owner a one (1) cubic foot representative sample, certifications, certified test results for materials as specified below. The Contractor shall provide a listing of the addresses (locations) identifying the origin of the soil to be delivered. If the origin is from multiple locations, all locations shall be provided at the time of submission of required information specified above. No materials shall be ordered or delivered until the required submittals have been reviewed and approved by the Owner. Delivered materials shall closely match the approved samples. Approval shall not constitute final acceptance. The Owner shall reserve the right to reject, on or after delivery, any material that does not meet these Specifications.
- C. If the material does not conform to the above requirements it shall be rejected and additional sources shall be found. Sampling and testing shall be accomplished as specified herein until an approved material is found, all at the Contractor's expense.
- D. To assure that materials fulfill specified requirements regarding textural analysis, organic matter content, pH, and fertility testing may be undertaken:
 - 1. Prior to site delivery; at source;
 - 2. At time of delivery; on-site; and/or
 - 3. Immediately following spreading on site. Soil sampling shall also indicate

if specified soil was supplied uniformly to the minimum specified depth.

1.03 STANDARDS:

- A. ASTM - American Society for Testing and Materials.

1.04 NOTIFICATION:

- A. The Contractor shall notify the Owner in writing at least ten (10) days in advance of the time he intends furnishing Screened Loam Borrow stating the location and amount of such deposit, the name and address of the supplier and also shall furnish such facilities, transportation and assistance as the Owner may require for collecting and forwarding samples.

PART 2 - MATERIALS

2.01 LOAM TOPSOIL:

- A. In accordance with the specific requirements of this project, existing on-site soil may be re-used as Loam Borrow only if it meets this Specification. Existing topsoil that does not meet this Specification may be re-used only up to the subgrade elevation within the limits of areas to receive new Loam Borrow. The Contractor shall furnish all required Loam Borrow, from off site sources, as necessary, to complete the project.
- B. Screened Loam shall be “fine sandy loam” or “sandy loam” determined by mechanical analysis (ASTM D-422) and based on the “USDA” Classification System”. Screened Loam has the following mechanical analysis:

<u>Textural Class</u>	<u>Percentage of Total Weight</u>	<u>Average Percentage</u>
Sand (0.05 – 2.0mm)	45 – 75	60
Silt (0.002 – 0.05mm)	15 – 35	25
Clay (Less than 0.002mm)	5 – 20	15

- C. Screened Loam shall be a natural product consisting primarily of natural topsoil, free from subsoil, and obtained from an area that has never been stripped, as noted above, the location of the source of the loam must be submitted to the Owner. Loam shall not contain less than five percent (5%) nor more than ten percent (10%) organic matter as determined by the loss on ignition of oven-dried samples, at 100°C ± 5°C. To adjust organic matter content, the soil may be amended, prior to site delivery, by the addition of composted leaf mold or peat moss. Use of

organic amendments is accepted only if random soil sampling indicates a thorough incorporation of these materials. No mixing or amending of Loam will be permitted on site. The Loam shall not be delivered when in a wet or frozen condition.

- D. Loam shall consist of fertile, friable, natural loam capable of sustaining vigorous plant growth. Loam shall be without admixture of subsoil, and refuse, resulting in a homogeneous material free of stones greater than ½" in the longest dimension, be free of lumps, plants, glass, roots, sticks, excessive stone content, debris, and extraneous matter as determined by the Owner. Loam shall be within the pH range of 6.0 to 6.5 except as where noted on plans and details. It shall be uncontaminated by salt water, foreign matter and substances harmful to plant growth. The maximum soluble salt index shall be 100. Screened Loam shall not have levels of aluminum great than 200 parts per million.
- E. If limestone is required to amend the screened loam to bring it within a pH range of 6.0 to 6.5 no more than 200 pounds of limestone per 1,000 square feet of loam, incorporated into the soil, or 50 pounds of limestone per 1,000 square feet of loam, surface application, within a single season.
- F. The Owner will reject any material delivered to the site that does not meet these Specifications after post-delivery testing. If the delivered screened loam does not meet the specifications stated in this document, the delivered screened loam will be removed by the Contractor at the Contractor's expense and at the time of rejection.
- G. The topsoil shall not be handled or moved when in a wet or frozen condition.
- H. Topsoil structure shall not be destroyed through excessive and unnecessary handling or compaction. Inappropriate handling leading to the compaction or deterioration of soil structure will result in rejection of topsoil for use.
- I. At no time should equipment or material rest on the soil.
- J. Loam Topsoil shall be free of plants and their roots, debris and other extraneous matter. It shall be uncontaminated by salt water, foreign matter and substances harmful to plant growth. The electrical conductivity (EC2) of a 1:2 soil-water suspension shall be equal to, or less than, 1.0 millimhos/cm. (test material passing #4 sieve).

PART 3 - EXECUTION

3.01 PLACEMENT:

- A. The Contractor shall furnish and spread Loam topsoil to the depths shown on the contract drawings, which depth shall be the minimum required depth after settlement. No compaction shall be required beyond that extent necessary to

place sod or to plant trees and shrubs to ensure against unevenness or settling below accepted growth lines.

3.02 ADDITIVES:

- A. The Contractor shall apply all necessary fertilizer and lime to the soil in accordance with the manufacturer and laboratory's recommendations and as required by the sodding, seeding and/or planting specifications referenced elsewhere.

END OF SECTION

SECTION 02369
SHEETING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included: Furnish, install and maintain sheeting and bracing in the location(s) shown on the Drawings and as required to comply with all applicable State and Federal Regulations including the Occupational Safety and Health Act.
- B. Design: Ensure that the sheeting is properly designed and installed to sustain all existing and expected loads to prevent all movement of earth which could in any way cause injury to workmen, delay the work or endanger adjacent structures. Submit details of proposed temporary lateral support systems to the Engineer for review before excavation.

1.2 JOB CONDITIONS

- A. Utilize dewatering devices to facilitate excavation within the sheeted area.
- B. Dewatering shall be considered incidental to excavation and no separate payment for dewatering will be made, unless specified elsewhere.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All materials shall conform to all applicable State and Federal regulations including the Occupational Safety and Health Act.
- B. Sheeting shall consist of driving timber or steel uprights ahead of open excavation to be held rigidly opposite each other forming the walls of the trench and to be held rigidly by horizontal cross members (braces) and longitudinal members (walers).
- C. Trench Box.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install sheeting in accordance with all applicable State and Federal regulations including the Occupational Safety and Health Act.
- B. Backfill as specified in these Specifications. When the level of compacted backfill reaches the location of bracing and wales, remove these items from the trench or other excavation.
- C. Cut the sheeting as shown on the Drawings.
- D. Complete backfilling as specified in these Specifications.

END OF SECTION

SECTION 02402

DEWATERING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included:
 - 1. The Contractor shall provide all materials, equipment, and labor necessary for the removal of water and as required to provide silt and erosion control devices.
 - 2. The Contractor shall build all drains and do all ditching, pumping, bailing, and all other work necessary to keep the excavation clear of ground water, or storm water during the progress of the work and until the finished work is safe from damage.

1.2 RECOMMENDED GUIDES

- A. AASHTO Highway Drainage Guidelines, Volume III, Guidelines for Erosion and Sediment Control in Highway Construction, American Association of State Highway and Transportation Officials, Inc., 444 North Capital St. N.W., Suite 249, Washington, D.C. 20001.
- B. Stormwater Management and Erosion and Sediment Control Handbook for Urban and Developing Areas in New Hampshire, New Hampshire Department of Environmental Services, Public Information Office, P.O. Box 95, 6 Hazen Drive, Concord, New Hampshire.
- C. Storm Water Phase II Compliance Assistance Guide, Section 5 Small Construction Activity, United State Environmental Protection Agency, Publication No. 833-R-00-003.

1.3 SUBMITTALS

- A. The Contractor shall furnish to the Engineer an Erosion and Sediment Control and Stormwater Management Plan (ESCSMP) plan for dewatering and diverting surface water before beginning the construction work for which the diversion is required. Acceptance of this plan will not relieve the Contractor of responsibility for completing the work as specified.
- B. The Contractor shall provide the appropriate National Pollutions Discharge Elimination System (NPDES) permit number prior to the start of construction.

1.4 SUBSURFACE CONDITIONS

- A. When available, locations of test borings and pits are shown on the Drawings. The boring logs are included in the Appendix of these Specifications.
- B. Variations in subsurface conditions should be anticipated by the Contractor when planning and estimating the work due to seasonal water level fluctuation.

PART 2- PRODUCTS

2.1 MATERIALS

- A. Provide, operate, and maintain a dewatering system to remove all water from excavations and trenches containing pumps, drains, wellpoints, piping and any other facilities necessary to keep the excavations and trenches free of water, including spare units available for immediate use in the event of equipment breakdowns.

PART 3 – EXECUTION

3.1 REMOVAL OF WATER

- A. The Contractor shall install and maintain any required dewatering systems such that all work shall be done in dry conditions. The Contractor shall construct and maintain all necessary protective works, shall furnish all materials required and shall furnish, install, maintain and operate all necessary equipment for the removal of water and control of water in the work area as required.

Water pumped from excavations shall be piped to points discharging into approved treatment facilities prior to discharging into water courses.

3.2 DIVERTING SURFACE WATER

- A. The Contractor shall build, maintain, and operate all cofferdams, channels, flumes, sumps, and other temporary diversion and protection works needed to divert drainage, streamflow, stormwater discharge and other surface water through or around the construction site and away from the construction work while construction is in progress. Unless otherwise specified, stream diversion must discharge into the same natural drainageway it originally flowed into.

3.3 EXCAVATION DEWATERING

- A. At least two weeks prior to the start of construction in any areas of anticipated dewatering, submit a proposed initial plan for removal of water, method of excavation and support of the excavation to the Engineer for review. Do not proceed with construction in any of these areas until the initial plan has been reviewed and commented upon by the Engineer. Concurrence by the Engineer with the Contractor's initial plan shall be the Engineer's agreement that the plan is satisfactory for initial trial.
- B. Evaluate the impact of the anticipated subsurface soil/water conditions on the proposed method of excavation and removal of water.

- C. Construct all elements of the BMP facilities in the dry. Excavate in the dry and not until the water level, as indicated by groundwater observation wells, is a minimum of six inches below the proposed bottom of final excavation. Where groundwater level is above the bottom of the proposed excavation level, install and operate a pumped dewatering system, including well points and/or sumps or closely spaced wells.
- D. Provide and maintain, at all times during construction, proper facilities and equipment, including standby pumps, to promptly and adequately remove and dispose of all water entering excavations.
- E. Conduct dewatering and excavation, at all times, in such a manner to preserve the natural undisturbed capacity of the subgrade soils supporting overlying or adjacent structures and to preserve the pipe bearing soil.
- F. Pre-drain the soils prior to final excavation, and maintain the lowered groundwater level until construction has been completed to such an extent that all elements of the BMP facilities will not be floated or otherwise damaged.
- G. Surround well points and other dewatering units with suitable filter sand to prevent fines from being removed by pumping.
- H. Water pumped from excavations shall be disposed of in an approved area so that backflow, pollution, or public nuisance will not occur.

3.4 COFFERDAMS

- A. Design, construct, maintain, and remove cofferdams where necessary for the dewatering, control, and diversion of water to keep excavations free of water.
- B. Design and construct cofferdams to withstand all imposed loads to prevent injury to persons and property. Construct cofferdams of sufficient height to prevent flooding and of such dimensions to give sufficient clearance for construction and inspection.
- C. Remove cofferdams, including all sheeting and bracing, after the completion or permanent construction.

3.4 COFFERDAMS

- A. If required, dewater the excavations and trenches using an efficient drainage wellpoint system to drain the soil and prevent saturated soil from flowing into the excavated area.
- B. Use well points designed for dewatering work.
- C. Use pumping units designed to be used with wellpoints, capable of maintaining high vacuums, and capable of handling large volumes of air and water at the same time.

3.5 TREATMENT OF PUMPED WATER

- A. The Contractor shall provide the means of removing all sediment from water pumped from the excavation areas. This shall include the use of filter bags, sedimentation basins, check dams, and sedimentation fences or tanks.

3.6 EROSION CONTROL PROVISIONS

- A. The discharge from pumping operations during dewatering operations shall be contained by a device so constructed as to prevent silt from spreading off-site.
- B. Prior to removal of all sediment control devices all retained silt or other materials shall be removed at no additional cost to the Owner.

3.7 TURBIDITY

- A. When there is visible turbidity within the ponds or streams caused by the construction, the polluting activity will cease until adequate controls can be installed to protect the brook. Sufficient operating and stand-by pumps and equipment shall be available to dewater and keep the work areas dry during the construction period. Utility costs, and connections shall be arranged and paid for by the Contractor.

3.8 REMOVAL OF TEMPORARY WORKS

- A. After the temporary works have served their purpose, the Contractor shall remove them or level and grade them to the extend required to present a sightly appearance and to prevent any obstruction of the flow of water or any other interference with the operation of or access to the permanent works.

3.9 ENVIRONMENTAL PERMITS (IF APPLICABLE)

- A. All work under this section shall be done in accordance with all federal, state, and local regulations, laws, and rules which may apply and any individual permits that have been obtained for the project.

END OF SECTION

SECTION 02431
CATCH BASINS, FRAMES & GRATES (NH)

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included:
1. Construct catch basins in conformance with the dimensions, elevations, and locations shown on the Drawings, as specified herein, and/or as directed by the Engineer.
 2. Construct all catch basins throughout the entire project from the same materials.
 3. Furnish and install cast iron catch basin frames and grates on all catch basins unless otherwise shown on the Drawings.
 4. Furnish and install composite hood devices in all catch basins with discharge pipe less than or equal to 18”.

1.2 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies:
1. New Hampshire Department of Transportation Standard Specifications, latest edition.

1.3 SUBMITTALS TO THE ENGINEER

- A. Submit Shop Drawings and manufacturer's literature in conformance with the standard General Conditions of the construction contract.

PART 2 - PRODUCTS

2.1 RISERS, TOPS, FRAMES, GRATES AND MASONRY

- A. Sides of catch basins shall be made of precast concrete barrel sections or cast-in-place concrete.
- B. Catch basin bases shall be precast or cast-in-place concrete.
- C. Precast concrete sections shall conform to the N.H.D.O.T. Standard details.
- D. Concrete masonry units shall conform to the requirements of ASTM C139 with a minimum compressive strength of 3000 pounds per square inch when tested by the method in ASTM C116
- E. Cement mortar shall conform to Section 707 of the N.H.D.O.T. Standard Specifications.
- F. Castings shall be gray iron, Class 30, conforming to AASHTO M105, unless otherwise specified.
- G. Catch basin grates shall be N.H.D.O.T. Standard detail type B in pavement areas and Type C in non-pavement areas unless otherwise shown on the Drawings.

H. Acceptable manufacturers:

1. LeBaron
2. Neenah
3. East Jordan
4. Deeter

2.2 COMPOSITE HOOD DEVICES

- A. Molded High Density Polyethylene (HDPE).
- B. Anti-syphon opening
- C. Multiple piece construction not allowed.
- D. Mounting hardware as needed or provided by manufacturer
- E. Acceptable manufacturer:
 1. Nyloplast Snout Structure

PART 3 - EXECUTION

3.1 PERFORMANCE

- A. Precast Risers and Tops:
 1. Install risers and tops level and plumb.
 2. Construct full mortar joints not more than 1/2" wide, with all exposed joints neatly finished.
 3. Construct masonry to fit neatly and tightly around the pipe.
 4. Set metal frames in a full mortar bed.
 5. Do not permit water to rise over newly made joints until after inspection by the Engineer.
 6. Solidly fill annular spaces around pipes entering the catch basin with non-shrink grout.
 7. When necessary, cut openings carefully to prevent damage to risers and tops. Replace all damaged risers and tops at no additional expense to the Owner.
- B. Adjustment to Grade:
 1. If necessary, adjust the tops of catch basins to grade with brick masonry.
 2. Concrete rings are not acceptable for adjusting to grade.
 3. Temporarily set structures within the limits of pavement at the elevation of the bottom of the binder course or as directed. After the binder course has been compacted, set the structures at their final grade.
- C. Frames and Grates:
 1. Set all frames in a full bed of mortar, true to grade and concentric with the catch basin openings.
 2. Completely fill all voids beneath the bottom flange to make a watertight fit.
 3. Place a ring of mortar at least one inch thick around the outside of the bottom flange, extending to the outer edge of the catch basin all around its circumference.

CATCH BASINS, FRAMES & GRATES (NH)

4. Clean the frame seats before setting the grates in place.
- D. Composite Hood Devices
1. Install Composite Hood Device in structures in accordance with manufacturer's instructions. Use manufacturer supplied hardware and supplement as needed to make a complete installation.
- E. Clean up:
1. Upon completion, clean all structures of silt, debris, and other matter.
 2. Keep all catch basins clean until final acceptance of the work.

END OF SECTION

SECTION 02500
SIDEWALKS AND RAMPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. This Work shall include the furnishing of all labor, skill, supervision, tools, equipment and materials for the construction of concrete sidewalks and ADA compliant handicap ramps.
2. All labor and materials shall conform to Division 608, 203 and 209 of the NHDOT Standard Specifications, latest edition, as amended herein.
3. This Work shall consist of furning and installing a detectable warning surface and accessories on sidewalk ramps at locations shown on the plans, as specified herein, or as ordred including all required surface preparation. Detactable warnings shall measure 24 inches in the direction of travel and extend the full width of th sidewalk ramp and the edge nearest the curbline shall be located 6 to 8 inches from the face of the curbline.

1.2 SUBMITTALS

- A. Shop Drawing / Product literature: Prior to ordering the below listed materials, submit shop drawings or product literature to the Engineer for approval as follows. Do not order materials until Engineers' approval has been obtained. Delivered materials shall closely match the approved samples.

1.3 PRODUCT HANDLING AND STORAGE

- A. Deliver materials in original sealed containers marked with name of manufacturer and identification of contents. Store materials under waterproof covers on planking clear of ground and protect from handling damage, dirt, stain, water and wind.

1.4 STANDARDS

- A. Except as modified by governing codes and by the Contract Documents, comply with applicable provisions and recommendations of the following:
1. Standard Specification: State of New Hampshire, Department of Transportation, Standard Specifications for Highways and Bridges, latest edition
 2. AASHTO: American Association of State Highway and Transportation Officials, latest edition
 3. ASTM: American Society for Testing and Materials, latest edition
 4. ADA: Americans with Disabilities Act, latest edition

PART 2 - PRODUCTS

2.1. MATERIALS

- A. All Concrete shall be Class A, 4,000 psi at 28 days with 5 to 7 percent air entrained. **All concrete shall have poly-fiber reinforcing.** The maximum concrete slump is 5.
- B. Handicap ramps (at street intersections) shall be 6 inches deep, 4,000 psi fiber mix reinforced with 6" x 6" x 10ga welded wire mesh with truncated dome panes.
- C. Detectable Warning Devices:
 - 1. Detectable warning devices shall be gray cast iron conforming to AASHTO M105 and AASHTO M306 as supplied by East Jordon Iron Works, Inc., www.ejiw.com, or Neenah Foundry Company, www.NFCO.com, distributed in NH by Waste, Inc www.wasteinc.com, or approved equal.
 - 2. Color. Cast iron panels shall have no surface coating, and shall be allowed to transition to their natural patina.
 - 3. Detectable Warning Panel Truncated Dome Geometry:
 - a. Detectable warning devices shall be in full compliance with current ADAAG guidelines. (Title 49 DFR Transportation, Part 37.9 Standard for Accessible Transportation Facilities, Appendix A, Section 4.29.2- Detectable Warning on Walking Surfaces).
 - b. In accordance with ADA Regulations for Detectable Warning on Curb Ramps, raised truncated domes shall have a diameter of 0.9", a height of nominal 0.2", and a center to center spacing of nominal 2.35 inches.
 - c. The truncated domes shall be arranged in a grid pattern and shall align properly from panel to panel.
- D. Provide metal or wood templates and forms conforming to profiles, lines and dimensions shown, of substantial design and construction to maintain position and shape when concrete is placed.
- E. Form oil shall be suitable for the type of forms used and conditions of use.
- F. Preformed joint filler shall be non-extruding and resilient preformed expansion joint filler and shall conform to AASHTO M213 requirements for premolded rigid cane fiber board impregnated throughout with asphaltic compound. The Contractor shall provide certification that the asphalt cement content is at least 35% by weight of the filler. All expansion joints shall be a minimum of 1/2" thick. All expansion joint filler to be full depth of slab thickness.
- G. Contractor shall install expansion joints a minimum of twenty feet (25') on center and where concrete pavement abuts all vertical surfaces including, but not limited to, all buildings, steps, walkways, structures, curbs, walls, light poles, etc.

- H. Expansion Joint Handling:
 - 1. Deliver materials in manufacturer's original containers, clearly labeled with manufacturer's name and address and product identification.
 - 2. Store materials in original containers protected from direct contact with the ground and from the elements.
 - 3. Store materials above ground on framework or blocking, and cover with protective waterproof covering. Provide for adequate air circulation throughout material stacks.
- I. Joint sealer for non-color concrete for use at expansion and control joints shall meet Federal Specification TT-S-00230C, Type II, Class A, and shall be a sealing compound, synthetic, rubberbase, single component, chemically curing material. Color(s) of sealant shall be manufacturer's standard color(s) as selected by the Landscape Architect. (Sikaflex-1a by Sika Chemical Corp. (201)-933-8801 or an approved equal).
- J. Expansion joint backer rod shall be round, closed cell polyethylene rod with a diameter 1/8" (3mm) larger than the width of the joint.

PART 3 - EXECUTION

3.01 CONCRETE SIDEWALKS AND CURB RAMPS

- A. Make any necessary corrections to gravel fill placed under Section 02220 Excavation-Earth, herein.
- B. Excavation for new sidewalks shall be at a depth of 12 inches below finish grade. In areas not butting curbing or buildings the excavation shall be 6 inches wider on each side than the finished sidewalk width. At all drive crossings, the depth of excavation shall be increased accordingly. All unsuitable material shall be approved by the Engineer and removed and disposed of offsite at the Contractor's own expense. At no time will unsuitable material be left under sidewalk areas.
- C. All sidewalks shall have a minimum thickness of 4 inches
- D. All Curb ramps for sidewalks and 6 inches for curb ramps.
- E. The ends of sidewalks at driveways shall be ramped at a maximum slope of 1:12.
- F. Placing Concrete:
 - 1. Set forms carefully to alignment and grade, and hold rigidly in place by use of steel or wood stakes. Clean forms thoroughly each time they are used and coat with oil as often as necessary to prevent concrete from adhering.
 - 2. Deposit concrete on the base course in successive batches in such manner as to require as little re-handling as possible and distribute to such depth

that , when consolidated and finished, slab thickness will be obtained at all points.

3. Any portion of a batch of concrete which becomes segregated shall be thoroughly mixed with the main body of the batch during the process of spreading. The operation of deposition and spreading shall be continuous between expansion joints.
4. Do not place concrete on a soft, muddy or frozen base course. Do not permit workmen to walk in the concrete with boots or shoes covered with earth or other foreign substances.
5. Keep welded wire fabric clean and free from rust. Place individual sheet or strips flat and free from distortion. Remove bends or kinks in individual wires before the sheet is laid in the pavement.
6. Place welded wire fabric in sheets or strips at depth shown. Lap sheet six (6") inches and tie firmly together by wire or clips spaced not more than four (4) feet apart.
7. Place lower layer of concrete followed promptly by the welded wire fabric and then place the upper layer of concrete. Remove any portions of the bottom layer of concrete which have been placed more than fifteen minutes without being covered with the top layer and replace with freshly mixed concrete.
8. Consolidate concrete thoroughly by tamping, spading and vibrating to eliminate honey-combing and voids. Spade carefully to avoid dislocation of reinforcing materials, dowels and joint installing devices.

G. Concrete Finishing:

1. Finish surface to grade and cross-section by suitable wood floats. After floating, trowel as required to produce a smooth, dense surface and then finish with a fine hair push broom drawn over the surface transverse to the line of traffic. Before the final finish, the surface of the walks shall be checked and any irregularities of more than one eighth inch (1/8") in one hundred (100) feet shall be eliminated.
2. Control Joints: Divide the surface of walks into rectangular areas by means of control joints. Control joints shall be 5 feet apart and shall be 1/4 of the depth of the sidewalk (up to 1-1/2" deep). Form control joints in the fresh concrete by cutting a groove in the top portion of the slab and finishing all edges using a jointing tool. The complete surface shall be uniform in color and free of surface blemishes and tool marks. All joints shall be straight, even and perpendicular to the sidewalk.
3. Expansion Joints: Provide herein expansion joints a minimum of thirty (25) foot on center and/or as shown on the Drawings and where curbs are adjacent to walks. Provide expansion joints where walks abut steps or other structures.
4. After finishing operations are completed, round joint edges with an edging tool and remove concrete from joint opening.

5. All sidewalk areas shall be thoroughly wetted and compacted prior to pouring of any concrete. All sidewalks and ramps will be kept damp using wet burlap tarps or other approved method for 24 hours after set up. Tarps will be staked down to prevent from being blown off. Curing compounds will be considered by the Engineer as an alternative.
 6. All exposed concrete shall be sealed with an approved Silane-Siloxane coating in accordance with NHDOT Section 534.
 7. Any sidewalks poured that have excessive “popcorning” on top or sides as determined by the Engineer will not be paid for.
- H. Truncated dome detectable warning panels shall be installed as shown on the drawings or in accordance with ADA regulations for detectable warning on curb ramps.
1. Ensure the safety of pedestrians when sidewalks must remain in services.
 2. Panels shall be “wet set” set into new uncured concrete.
 3. Use a combination of available panel widths as manufactured to cover the full sidewalk ramp width to the extent practicable. Field cutting panels is not permitted.
 4. Panels shall be set flush with adjacent concrete and centered side to side within the ramp.
 5. All hardware used in association with the panels shall be stainless steel.

END OF SECTION

SECTION 02540

TEMPORARY EROSION CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Description of Work:

1. Comply with all Federal, State and local regulations pertaining to erosion and sediment control and stormwater management.
2. Prepare a Stormwater Pollution Prevention Plan (SWPPP) for review and approval prior to the start of any construction activities.
3. Submit NOTICE OF INTENT letter to the USEPA for approval. Post the appropriate permit number on site.
4. Provide all labor, equipment, materials and maintain temporary erosion control devices as described in the Plan.
5. Provide such erosion control measures as may be necessary to correct conditions that develop prior to the completion of permanent erosion control devices and/or as required to control erosion that occurs during normal construction operations.
6. Provide such sediment control measures as may be necessary to address conditions created by construction dewatering methods and/or stormwater runoff.
7. After award of the Contract, prior to commencement of construction activities, meet with the Engineer to discuss the Plan and develop a mutual understanding relative to.
8. Conduct all construction in a manner and sequence that causes the least practical disturbance of the physical environment.
9. Stabilize disturbed earth surfaces in the shortest practical time and employ such temporary erosion control devices as may be necessary until such time as adequate soil stabilization has been achieved.

B. Recommended Guides:

1. AASHTO Highway Drainage Guidelines, Volume III, Guidelines for Erosion and Sediment Control in Highway Construction, American Association of State Highway and Transportation Officials, Inc., 444 North Capital St. N.W., Suite 249, Washington, D.C. 20001.
2. Stormwater Management and Erosion and Sediment Control Handbook for Urban and Developing Areas in New Hampshire, New Hampshire Department of Environmental Services, Public Information Office, P.O. Box 95, 6 Hazen Drive, Concord, New Hampshire.

3. Storm Water Phase II Compliance Assistance Guide, Section 5 Small Construction Activity, United State Environmental Protection Agency, Publication No. 833-R-00-003.

PART 2 - PRODUCTS

2.1 Plan

- A. Prior to the start of construction submit the Plan in accordance with the Shop Drawing review process in Section 01340 – Submittals.
- B. Prior to the start of construction submit a Notice of Intent for Storm Water Discharges Associated with CONSTRUCTION ACTIVITY Under a NPDES General Permit.
- C. To assist in Plan preparation, the Engineer will supply the following as available:
 - 1. Specific Reproducible plan sheet and if available, cross sections of the project.
 - 2. Drainage calculations as available.
 - 3. Permits obtained for the project.
 - 4. Geotechnical reports.

2.2 ACCEPTABLE MATERIALS

- A. Baled Hay: At least 14" x 18" x 30" securely tied and staked twice per bale.
- B. Stone Check Dams: Washed ¾ inch crushed septic system stone free of sand and silts.
- C. Sand Bags: Heavy cloth bags of approximately 1 cubic foot capacity filled with sand or gravel.
- D. Mulches:
 - 1. Asphalt emulsion, gravel, crushed stone, loose hay, straw, peat moss, pine straw or needles, sawdust, wood chips, wood excelsior, or wood fiber cellulose.
 - 2. Type and use shall be suitable for the Work.
- E. Mats and Netting:
 - 1. Twisted craft paper, yarn, jute, excelsior, wood fiber mats, glass fiber, and plastic film.
 - 2. Type and use shall be suitable for the Work.
- F. Seed:
 - 1. Standard conservation mix of 100% annual rye grass or field broomgrass.
 - 2. Equivalent seed mixture may be used, as approved by the Engineer, based on its suitability for use is controlling erosion of the various soil types and slopes.
- G. Sod:
 - 1. Grown from seed of adapted varieties to produce high quality sod, free of any serious thatch, weeds, insects, diseases and other pest problems.
 - 2. At least one year old and not older than three years. Cut with 1/2" to 1" layer of soil.
- H. Drains:

TEMPORARY EROSION CONTROL

1. Flexible drains consisting of collapsible neoprene pipe, minimum of 8" in diameter, or an approved equal.
2. Corrugated metal pipe and inlet of a gauge consistent with the loading conditions. A minimum size of 12 inches in diameter or approved equal.

PART 3 - EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

- A. Temporary Stone Checks:
 1. Construct temporary erosion checks in ditches and other locations as needed.
 2. Baled hay and/or sand bags may be used in an arrangement to fit local conditions designated by the Engineer.
 3. Terrace side slopes to retard runoff velocities.
- B. Temporary Berms (When Applicable):
 1. Construct temporary barriers along the toe of embankments.
 2. Construct temporary side drains in intervals as needed.
- C. Temporary Slope Drains: Shall be collapsible pipe with corrugated metal pipe inlet with a crescent shaped barrier placed at each slope drain.
- D. Debris Basin:
 1. A barrier or dam constructed across waterway or other suitable location to form a silt or sediment basin.
 2. Capacity shall be equal to the volume of sediment expected to be trapped at the site during the planned use for life of the structure or, if the periodic removal of debris would be practical, the capacity shall be proportionally reduced.

3.2 PERFORMANCE

- A. Install erosion control devices as described in the Plan.
 1. Apply seed for temporary cover at a rate of 40 lbs. per acre.
 2. Apply hay or straw at a rate of 2 tons per acre.
 3. Hydroseed all temporarily seeded areas.
- B. Protection:
 1. Protect streams and channels from fuel, lubricants and other pollutants.
 2. Locate storage of materials in shop yards where erosion and sediment hazards are slight.

3.3 REMOVAL AND DISPOSAL

- A. General: When permanent soil stabilization has been achieved, remove all temporary materials and devices that are unsightly.

TEMPORARY EROSION CONTROL

- B. Reuse: Materials and devices of suitable type and conditions may be reused at other onsite locations. Materials and devices, determined by the Engineer to be unsuitable for reuse, shall become the Contractor's property and shall be disposed of in a manner and location approved by the Owner.
- C. Onsite Disposal when Applicable: The locations and methods of onsite disposal are subject to the Owner's approval. Onsite disposal that results in unsightly conditions, precludes proper maintenance and is detrimental to the physical environment will not be permitted.

END OF SECTION

SECTION 02551

BITUMINOUS CONCRETE PAVING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included:
1. Furnish all plant, labor, equipment and materials required to install subgrades and bituminous concrete pavement courses as shown on the Drawings and as specified herein.
 2. Hand method shall include only the paving of raised islands, slopes, cattle passes, areas between rails at railroad crossings, existing sidewalks, drives, drive aprons, curb patch between granite curb and pavement, and paving of 50 tons or less added after the completion of paving operations.
 3. Machine method shall include all paving not classified as hand method.

1.2 QUALITY ASSURANCE

- A. Materials: Use only materials furnished by a bulk bituminous concrete producer regularly engaged in the production of hot mixed, hot laid bituminous concrete.
- B. Equipment: Provide, maintain and operate pavers, dump trucks, tandem, 3-wheel and pneumatic tired rollers well suited to the mixtures being placed. Provide, maintain and operate hand equipment as required. When applicable, provide, maintain and operate trimming equipment and materials.
- C. Requirements of Regulatory Agencies: New Hampshire Department of Transportation Standard Specifications, latest edition, & current Special Provisions herein abbreviated NHDOT.
- D. NHDOT "Measurement" and "Payment" paragraphs shall not apply.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Materials shall conform to Division 700 Materials; Section 702, Bituminous Materials and Section 703, Aggregates of the NHDOT Standard Specifications, latest edition, as amended herein.
- B. Aggregate subbase courses shall be in accordance with Division 300 Base Courses; Section 304, Sand, Gravel and Crushed Gravel Base Courses of the NHDOT Standard Specifications, latest edition.
- C. Hot Bituminous Pavement
- a. All Hot Bituminous Pavement Job Mixes require shop drawing approval.
 - b. Base course and Wearing course of bituminous pavement shall be as shown on the Drawings and shall conform to Division 400, Section 401, Plant Mix Pavements - General of the NHDOT Standard Specifications, latest edition.

- c. The following requirements pertain to machine method and hand method pavement mixes, not sidewalk mixes.
 - i. Liquid asphalt cement binder shall have a Performance Grade (PG) of PG 64-28 for all standard bituminous pavements and PG 76-28 for all high strength bituminous pavements.
 - ii. All 3/8" nominal aggregate Hot Bituminous Pavement Job Mixes shall conform to **75 Gyrat**ion superpave mix design criteria. All 1/2" and 3/4" nominal aggregate Hot Bituminous Pavement Job Mixes shall conform to **50 Gyrat**ion superpave mix design criteria.
 - iii. **Minimum Binder Content** to be 6.0% for 3/8" mix designs; 5.9% for 1/2" mix designs; and 5.1% for 3/4" mix designs. All pavement mixes shall have a maximum **Total Reused Binder (TRB)** content of 0.5% and meet all the volumetric mix design criteria.
 - iv. Hot Bituminous Pavement to be placed under NHDOT Section 401 "**Method Requirements**" (not "QC/QA").
 - v. Pavement Joint Adhesive (Item 403.6) shall be applied to longitudinal joints in accordance with NHDOT Section 401.
 - vi. The **CONTRACTOR is required to repair any pavement defects** (rutting, cracking, aggregate separation, delamination, etc.) that occur in placed pavement within the 1-year correction period following the date of Substantial Completion at no cost to the OWNER. Suitable repair methods and materials (such as routing and crack sealing or cutting and patching) to be reviewed and approved by OWNER and ENGINEER prior to installation.
 - vii. Asphalt emulsion for tack coat shall be applied between all layers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Methods of construction shall be in accordance with Division 400, Pavements, Section 403, Hot Bituminous Paving of the NHDOT Standard Specifications, latest edition, as modified herein.
- B. Prior to placing of any mix, a pre-paving conference shall be held with the Owner, Contractor, and Engineer to discuss the proposed paving schedule, source of mix, type and amount of equipment to be used, sequence of paving pattern, rate of mix supply, traffic control, and general continuity of the operation. Special attention shall be made to the paving pattern sequence to minimize cold joints.
- C. Place permanent pavement only when the underlying surface is dry, when the atmospheric temperature in the shade is above 40 degrees F, and when the weather is not foggy or rainy, provided however, that the Engineer may permit in case of sudden rain, the placing of the mixture then in transit from the plant, if laid at the proper temperature and if the roadbed is free from pools of water.
- D. Such permission shall in no way relax the requirements for quality of the pavement and smoothness of surface.

- E. Do not lay material upon frozen base course or when wind conditions are such that rapid cooling will prevent satisfactory compaction.
- F. Sweeping. Existing pavement or previously laid courses shall be thoroughly dry and free from all dust, dirt, and loose material. Sweeping with a power broom, supplemented by hand brooming, may be necessary.
- G. Tack coat. Surfaces of any pavement course shall have a tack coat of emulsified asphalt applied in accordance with NHDOT Standards.
- H. Drainage and utility structures within the limits of the pavement shall be set and raised. Contact surfaces of the drainage and utility castings as ordered shall be painted with a thin coating of suitable bituminous material.

END OF SECTION

SECTION 02552-1POROUS PAVEMENT & POROUS MEDIA BEDPART 1 - GENERAL1.1 DESCRIPTION

A. Work Included:

1. Furnish and place porous media bed on a previously prepared subgrade or course as shown on the Plans or as ordered.
2. Installation of porous bituminous pavement courses within the area shown on the Plans and as directed by the Engineer.
3. The work of this Section includes subgrade preparation, installation of porous asphalt mix (mix) design, production, and installation. Porous asphalt pavement refers to the compacted mix of modified asphalt binder and aggregate.
4. Alternative specifications for mix, such as Open Graded Friction Courses (OGFC) from Federal Agencies or state Departments of Transportation (DOT), may be used if approved by the Engineer. The primary requirements for the specifications of the mix are performance grade (PG) asphalt binder, binder content, binder draindown, aggregate gradation, air void content, and retained tensile strength (TSR).
5. Technical specification was developed in accordance with the University of New Hampshire Stormwater Center (UNHSC) Design Specifications for Porous Asphalt Pavement and Beds.
6. The porous asphalt pavement specified herein is modified after the National Asphalt Pavement Association (NAPA) specification outlined in Design, Construction, and Maintenance *Guide for Porous Asphalt Pavements, Information Series 131* (2003) and *Design, Construction, and Maintenance of Open-Graded Friction Courses, Information Series 115* (2002).

1.2 SUBMITTALS

A. Porous Media Bed:

1. Gradations and required material properties (including required hydraulic conductivity testing) for all porous media gravel and stone materials.
2. Product literature and manufactures certifications for the sub-drain pipe.

B. Porous Pavement:

1. Binder PGAB certification.
2. Pavement mix designs.

1.3 QUALITY CONTROL AND QUALITY ASSURANCE (QC/QA)

- A. Use appropriate equipment and adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the

POROUS PAVEMENT & POROUS MEDIA BED

specified requirements and the methods needed for proper performance of the work in this section.

- B. Codes and Standards - All materials, methods of construction, and workmanship shall conform to applicable requirements of AASHTO, ASTM Standards, NHDOT Standard Specifications for Road and Bridge Construction (or similar state DOT) specifications, latest revised (including supplements and updates), or other standards as specified.
- C. QC/QA requirements for mix production are discussed in the Materials Section, and for construction of the porous media beds and paving, in the Execution Section.

PART 2 - PRODUCTS

2.1 POROUS MEDIA BED

The Porous Media Bed is located below the porous asphalt and consists of a stone course material as specified in Table 1 and a sub-drain.

- A. Material for the stone course shall meet the following:
 - 1. Maximum Wash Loss of 0.5%
 - 2. Minimum Durability Index of 35
 - 3. Maximum Abrasion Loss of 10% for 100 revolutions, and maximum of 50% for 500 revolutions.
 - 4. Material for the stone course shall have the AASHTO No. 57 and AASHTO No. 3 gradations, respectively, as specified in **Table 1**. If the AASHTO No. 3 gradation cannot be met, AASHTO No. 5 is acceptable with approval of the Engineer.

Table 1: Gradations of choker, filter, and reservoir course materials.

US Standard Sieve Size (Inches/mm)	Percent Passing (%)
	(AASHTO No. 57)
6/150	-
2½/63	-
2 /50	-
1½/37.5	100
1/25	95 - 100
¾/19	-
½/12.5	25 - 60
3/8/9.5	-
#4/4.75	0 - 10
#8/2.36	0 - 5
#200	-

POROUS PAVEMENT & POROUS MEDIA BED

Sub-drain: The Porous Media Bed contains a perforated sub-drain pipe. The sub-drain pipe shall either be CPDT or CPE of the size and type specified on the Plans.

2.2 POROUS PAVEMENT ASPHALT MIX

- A. Mix materials consist of performance grade asphalt binder (PGAB), coarse and fine aggregates, and optional additives such as polymer modified asphalt (PMA), fibers, or other select additives. Materials shall meet the requirements of the NAPA's Design, Construction, and Maintenance of Open-Graded Friction Courses, Information Series 115 (2002) and Design, Construction, and Maintenance Guide for Porous Asphalt Pavements, Information Series 131, except where noted otherwise below or approved in writing by the Engineer.
- B. Polymer Modified PGAB The asphalt binder for the wearing course shall be a polymer and/or fiber modified performance grade asphalt binder (PGAB) used in the production of Superpave Hot Mix Asphalt (HMA) mixtures. The asphalt binder shall be PG 76 -28. The PGAB polymer modifiers are to be either styrene butadiene rubber (SBR). The dosage of fiber additives shall be added at 1.5% by total mixture volume. Fibers are a simple addition either manually for a batch plant or automated for larger plants. The binder shall meet the requirements of AASHTO M320.
- C. The PGAB may be pre-blended or post-blended. The pre-blended binder can be blended at the source or at a terminal. For post-blended addition, the modifier can either be in-line blended or injected into the pugmill at the Plant.
- D. PG 64-28 with 5 pounds of fibers per ton of asphalt mix shall be used for the binder course.
- E. Anti-Stripping Mix Additives The mix shall be tested for moisture susceptibility and asphalt stripping from the aggregate by AASHTO T283, or improved updated method. If the retained tensile strength (TSR) < 80% upon testing, a heat stable additive shall be furnished to improve the anti-stripping properties of the asphalt binder. Test with one freeze-thaw cycle (rather than five recommended in NAPA IS 115). The amount and type of additive (e.g. fatty amines or hydrated lime) to be used shall be based on the manufacturer's recommendations, the mix design test results, and shall be approved by the Engineer.
- F. Silicone shall be added to the binder at the rate of 1.5 mL/m³ (1 oz. per 5000 gal).
- G. Fibers may be added per manufacturer and NAPA IS 115 recommendation if the draindown requirement cannot be met (<0.3% via ASTM D6390) provided that the air void content requirement is met (>18%, or >16% as tested with CoreLok device).
- H. Additives should be added per the relevant DOT specification and NAPA IS 115.

POROUS PAVEMENT & POROUS MEDIA BED

- I. Coarse aggregate: The coarse aggregate shall be that part of the aggregate retained on the No. 8 sieve; it shall consist of clean, tough, durable fragments of crushed stone, or crushed gravel of uniform quality throughout. Coarse aggregate shall be crushed stone or crushed gravel and shall have a percentage of wear as determined by AASHTO T96 of not more than 40 percent. In the mixture, at least 75 percent, by mass (weight), of the material coarser than the 4.75 mm (No. 4) sieve shall have at least two fractured faces, and 90 percent shall have one or more fractured faces (ASTM D5821). Coarse aggregate shall be free from clay balls, organic matter, deleterious substances, and not more than 8.0% of flat or elongated pieces (>3:1) as specified in ASTM D4791.
- J. Fine Aggregate: The fine aggregate shall be that part of the aggregate mixture passing the No. 8 sieve and shall consist of sand, screenings, or combination thereof with uniform quality throughout. Fine aggregate shall consist of durable particles, free from injurious foreign matter. Screenings shall be of the same or similar materials as specified for coarse aggregate. The plasticity index of that part of the fine aggregate passing the No. 40 sieve shall be not more than 6 when tested in accordance with AASHTO T90. Fine aggregate from the total mixture shall meet plasticity requirements.
- K. Recycled Asphalt (RAP) Recycled asphalt can be used to supplement, or in place of, fine aggregate. RAP should be a ½" minus or properly managed product with known asphalt content in quantities not to exceed more than 10% by weight.
- L. Porous Asphalt Mix Design Procedures: The Contractor shall submit a mix design at least 10 working days prior to the beginning of production. The Contractor shall make available samples of coarse aggregate, fine aggregate, RAP, fibers and a sample of the PGAB that will be used in the design of the mixture. A certificate of analysis (COA) of the PGAB will be submitted with the mix design. The COA will be certified by a laboratory meeting the requirements of AASHTO R18. The Laboratory will be certified by the state DOT, regional equivalent (e.g. NETTCP), and/or qualified under ASTM D3666. Technicians will be certified by the regional certification agency (e.g. NETTCP) in the discipline of HMA Plant Technician.
- M. The mixture will be designed according to the NAPA IS 131, with the exception of testing for air void content. Bulk specific gravity (SG) used in air void content calculations shall not be determined and results will not be accepted using AASHTO T166 (saturated surface dry), since it is not intended for open graded specimens (>10% AV). Bulk SG shall be calculated using AASHTO T275 (paraffin wax) or ASTM D6752 (automatic vacuum sealing, e.g. CoreLok). Air void content shall be calculated from the bulk SG and maximum theoretical SG (AASHTO T209) using ASTM D3203.

POROUS PAVEMENT & POROUS MEDIA BED

- N. The materials shall be combined and graded to meet the composition limits by mass (weight) as shown in Table 2.
- O. Porous Asphalt Mix Production
1. Mixing Plants. Mixing plants shall meet the requirements of hot mix asphalt plants as specified in the state DOT or regional equivalent unless otherwise approved by the Engineer (e.g. *Section 401- Plant Mix Pavements – General for Quality Assurance specifications* in the *Standard Specifications for Road and Bridge Construction – State of New Hampshire DOT*, 2016, or latest revised edition and including supplemental specifications and updates).

Table 2: Porous Asphalt Mix Design Criteria

Sieve Size (inch/mm)	Percent Passing (%)
0.75/19	100
0.50/12.5	85-100
0.375/9.5	55-75
No.4/4.75	10-25
No.8/2.36	5-12
No.200/0.075 (#200)	2-4
Binder Content (AASHTO T164)	5.8 - 6.5%
Air Void Content (ASTM D6752)	16.0-22.0%
Draindown (ASTM D6390)*	≤ 0.3 %
Retained Tensile Strength (AASHTO 283)**	≥ 80 %
Cantabro abrasion test on unaged samples	≤ 20%
Cantabro abrasion test on 7 day aged samples	≤ 30%

* Either method is acceptable

**Cellulose, mineral, or polyester fibers may be used to reduce draindown.

***If the TSR (retained tensile strength) values fall below 80% when tested per NAPA IS 131 (with a single freeze thaw cycle rather than 5), then in Step 4, the contractor shall employ an antistrip additive, such as hydrated lime (ASTM C977) or a fatty amine, to raise the TSR value above 80%.

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2. Preparation of Asphalt Binder. The asphalt material shall be heated to the temperature specified in the state DOT specification (if using a DOT spec for the mix) in a manner that will avoid local overheating. A continuous supply of asphalt material shall be furnished to the mixer at a uniform temperature.
3. Preparation of Aggregates. The aggregate for the mixture shall be dried and heated at the mixing plant before being placed in the mixer. Flames used for drying and heating shall be properly adjusted to avoid damaging the aggregate and depositing soot or unburned fuel on the aggregate.
4. Mineral filler, if required to meet the grading requirements, shall be added in a manner approved by the Engineer after the aggregates have passed through the dryer.
5. The above preparation of aggregates does not apply for drum-mix plants.
6. Mixing. The dried aggregate shall be combined in the mixer in the amount of each fraction of aggregate required to meet the job-mix formula and thoroughly mixed prior to adding the asphalt material.
7. The dried aggregates shall be combined with the asphalt material in such a manner as to produce a mixture that when discharged from the pugmill is at a target temperature in the range that corresponds to a recommended range supplied by the PGAB supplier.
8. The asphalt material shall be measured or gauged and introduced into the mixer in the quantity determined by the Engineer for the particular material being used and at the temperature specified in the relevant specification.
9. After the required quantity of aggregate and asphalt material has been introduced into the mixer, the materials shall be mixed until a complete and uniform coating of the particles and a thorough distribution of the asphalt material throughout the aggregate is secured and there is no residual moisture in the coated aggregate.
10. All plants shall have a positive means of eliminating oversized and foreign material from being incorporated into the mixer.
11. QC During Production. The Contractor shall provide process control and/or QC test results to the Engineer or the Engineer's designee. The QC plan may be altered at the discretion of the Engineer and based on feasible testing as suggested by the asphalt producer. Certain QC testing requirements during production may not be feasible for small projects in which limited asphalt is generated. Some testing methods cannot be completed during the time needed during small batch production. The feasibility should be assessed with the Engineer and producer.
12. The mixing plant shall employ a Quality Control Technician (QCT). The QCT will perform QC testing and will be certified in the discipline of HMA Plant Technician by the relevant certifying agency (e.g. NETTCP in New England). The Contractor shall sample, test and evaluate the mix in accordance with the methods and minimum frequencies in Table 3 and the Post-Blended SBR Binder Quality Control Plan (if applicable).

Table 3: QC/QA testing requirements during production.

Test	Min. Frequency	Test Method
Temperature in truck at plant	6 times per day	
Gradation	Greater of either (a) 1 per 500 tons, (b) 2 per day, or (c) 3 per job	AASHTO T30
Binder Content	Greater of either (a) 1 per 500 tons, (b) 2 per day, or (c) 3 per job	AASHTO T164
Air Void Content	Greater of either (a) 1 per 500 tons, (b) 2 per day, or (c) 3 per job	ASTM D6752
Binder Draindown	Greater of either (a) 1 per 500 tons, (b) 1 per day, or (c) 1 per job	ASTM D6390

13. Testing Tolerances During Production. Testing of the QC requirements shall be within the limits set in Table 4. The paving mixture produced should not vary from the design criteria for aggregate gradation and binder content by more than the tolerances in Table 4

Table 4: QC/QA testing tolerances during production.

Sieve Size (inch/mm)	Percent Passing
0.75/19	-
0.5/12.5	± 6.0
0.375/9.5	± 6.0
0.187/4.75	± 5.0
0.093/2.36	± 4.0
0.0029/0.075	± 2.0
% PGAB	± 0.3

14. Plant Shutdown and Rejection of Mix. Should the porous asphalt mix not meet the tolerances specified in this section upon repeat testing, the Engineer may reject further loads of mix. Mix that is loaded into trucks during the time that the plant is changing operations to comply with a failed test shall not be accepted, and should be recycled at the plant.

PART 3 - EXECUTION

3.1 PRE-PAVING PREPARATION

- A. Prior to placing of any mix, a pre-paving conference shall be held with the Owner, Contractor, and Engineer to discuss the proposed paving schedule, source of mix, type and amount of equipment to be used, sequence of paving pattern, rate of mix supply, traffic control, and general continuity of the operation. Special attention shall be made to the paving pattern sequence to minimize cold joints.

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- B. Place permanent pavement only when the underlying surface is dry, when the atmospheric temperature in the shade is above 50 degrees F, and when the weather is not foggy or rainy, provided however, that the Engineer may permit in case of sudden rain, the placing of the mixture then in transit from the plant, if laid at the proper temperature and if the roadbed is free from pools of water.
- C. Such permission shall in no way relax the requirements for quality of the pavement and smoothness of surface.
- D. Do not lay material upon frozen base course or when wind conditions are such that rapid cooling will prevent satisfactory compaction.
- E. Sweeping. Existing pavement or previously laid courses shall be thoroughly dry and free from all dust, dirt, and loose material. Sweeping with a power broom, supplemented by hand brooming, may be necessary.
- F. Drainage and utility structures within the limits of the pavement shall be set and raised. Contact surfaces of the drainage and utility castings as ordered shall be painted with a thin coating of suitable bituminous material.

3.2 GRADE CONTROL

- A. Establish and maintain required lines and elevations. The Engineer shall be notified for review and approval of final stake lines for the work before construction work is to begin. Finished surfaces shall be true to grade and even, free of roller marks, and free of puddle-forming low spots. All areas must drain freely. Excavation elevations should be within +/- 0.1 ft (+/- 3 cm).
- B. If, in the opinion of the Engineer, based upon reports of the testing service and inspection, the quality of the work is below the standards which have been specified, additional work and testing will be required until satisfactory results are obtained.

3.3 SUBGRADE PREPARATION

- A. Where erosion of the native material subgrade has caused accumulation of fine materials and/or surface ponding at the base of the excavation, this material shall be removed with light equipment and the underlying soils scarified to a minimum depth of 6 inches (15 cm) with a York rake or equivalent and light tractor.
- B. Bring subgrade of stone porous media bed to line, grade, and elevations indicated. Fill and lightly regrade any areas damaged by erosion, ponding, or traffic compaction before the placing of the stone. the slope of the bottom of excavation parallels that of the road surface.

3.4 POROUS MEDIA BED INSTALLATION

- A. Upon completion of subgrade work, the Engineer shall be notified and shall inspect at his/her discretion before proceeding with the porous media bed installation.
- B. Install stone course (see Materials section) aggregate evenly over surface of filter course bed, sufficient to allow placement of pavement, and notify Engineer for approval. Choker base course thickness shall be sufficient to allow for even placement of the porous asphalt

but no less than 4-inches in depth.

3.5 QC/QA REQUIREMENTS FOR POROUS MEDIA BED CONSTRUCTION

QC/QA activities are summarized in Table 5.

Table 5: QC/QA requirements for porous media bed construction.

Activity	Schedule
Contractor to notify engineer for approval	24 hours in advance of start of work
Contractor to employ soil inspector acceptable to engineer	NA
Contractor to employ staking and layout control inspector acceptable to engineer	NA
Contractor to employ site grading inspector acceptable to engineer	NA
Contractor to employ pavement work inspector acceptable to the engineer	NA
Contractor to notify engineer for approval	after subgrade preparation, before construction of porous media bed
Contractor to notify engineer for approval	after filter course placement, before placement of choker course and pavement to verify proper compaction of filter course by ASTM D3385

- A. In cases where a porous asphalt system was constructed and the asphalt needs to be replaced, it is recommended to mill the older asphalt and to resurface on the choker course rather than to use a tackifier and pave over the older asphalt. While there is little documented experience with partial milling and resurfacing it has been done with success for porous asphalt pavements. Attention to cleaning milled surface is critical.
- B. Mill older asphalt down to specified depth or to choker course
- C. Restore the infiltration capacity with low angle pressure washing or air to a vacuum (for example the 15" vacuum attachment hose of a Tymco regenerative air vac)
- D. Level and compact choker course

3.6 POROUS ASPHALT PAVEMENT INSTALLATION

- A. The mixing plant, hauling and placing equipment, and construction methods shall be in conformance with NAPA IS 131 and applicable sections of the state DOT's specification for asphalt mixes.
- B. The use of surge bins shall not be permitted.
- C. Hauling Equipment The open graded mix shall be transported in clean vehicles with tight, smooth dump beds that have been sprayed with a non-petroleum release agent or soap solution to prevent the mixture from adhering to the dump bodies. Mineral filler, fine

POROUS PAVEMENT & POROUS MEDIA BED

aggregate, slag dust, etc. shall not be used to dust truck beds. The open graded mix shall be covered during transportation with a suitable material of such size sufficient to protect the mix from the weather and also minimize mix cooling and the prevention of lumps. When necessary, to ensure the delivery of material at the specified temperature, truck bodies shall be insulated, and covers shall be securely fastened. Long hauls, particularly those in excess of 25 miles (40 km), may result in separation of the mix and its rejection.

- D. Placing Equipment The paver shall be a self-propelled unit with an activated screed or strike-off assembly, capable of being heated if necessary and capable of spreading and finishing the mixture without segregation for the widths and thicknesses required. In general, track pavers have proved superior for Porous Asphalt placement. The screed shall be adjustable to provide the desired cross-sectional shape. The finished surface shall be of uniform texture and evenness and shall not show any indication of tearing, shoving, or pulling of the mixture. The machine shall, at all times, be in good mechanical condition and shall be operated by competent personnel.

Pavers shall be equipped with the necessary attachments, designed to operate electronically, for controlling the grade of the finished surface.

The adjustments and attachments of the paver will be checked and approved by the Engineer before placement of asphalt material.

- E. Rollers shall be in good mechanical condition, operated by competent personnel, capable of reversing without backlash, and operated at speeds slow enough to avoid displacement of the asphalt mixture. The mass (weight) of the rollers shall be sufficient to compact the mixture to the required density without crushing of the aggregate. Rollers shall be equipped with tanks and sprinkling bars for wetting the rolls.

Rollers shall be two-axle tandem rollers with a gross mass (weight) of not less than 7 metric tons (8 tons) and not more than 10 metric tons (12 tons) and shall be capable of providing a minimum compactive effort of 44 kN/m (250 pounds per inch) of width of the drive roll. All rolls shall be at least 1.1 m (42 inches) in diameter.

A rubber tired roller is not required on the open graded asphalt friction course surface.

- F. Conditioning of Existing Surface Contact surfaces such as curbing, gutters, and manholes shall be painted with a thin, uniform coat of Type RS-1, or equivalent emulsified asphalt immediately before the asphalt mixture is placed against them.
- G. Temperature Requirements The temperature of the asphalt mixture, at the time of discharge from the haul vehicle and at the paver, shall be between 135-163°C (275 to 325°F), within 6 °C (10 °F) of the compaction temperature for the approved mix design.
- H. Spreading and Finishing The Porous Asphalt should be placed in two lifts: 1.5” wearing course and 2” base. The base course must be kept clear from dust and moisture, and minimizing traffic on the first layer. Great care must be taken to insure that the porous asphalt layers join completely. The wearing course lift must be paved over the base course as soon as **possible (maximum of one week after base course is paved – the base course shall not be left exposed over the winter)**; however, the surface temperature of the base

lift must be less than 100 °F before paving the next lift.

The asphalt mixture shall be spread and finished with the specified equipment. The mixture shall be struck off in a uniform layer to the full width required and of such depth that each course, when compacted, has the required thickness and conforms to the grade and elevation specified. Pavers shall be used to distribute the mixture over the entire width or over such partial width as practical. On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture shall be spread and raked by hand tools.

No material shall be produced so late in the day as to prohibit the completion of spreading and compaction of the mixture during daylight hours, unless night paving has been approved and established for the project.

No traffic will be permitted on material placed until the material has been thoroughly compacted and has been permitted to cool to below 38 °C (100 °F). The use of water to cool the pavement is not permitted. The Engineer reserves the right to require that all work adjacent to the pavement, such as guardrail, cleanup, and turf establishment, is completed prior to placing the wearing course when this work could cause damage to the pavement. On projects where traffic is to be maintained, the Contractor shall schedule daily pavement operations so that at the end of each working day all travel lanes of the roadway on which work is being performed are paved to the same limits.

- I. Compaction immediately after the asphalt mixture has been spread, struck off, and surface irregularities adjusted, it shall be thoroughly and uniformly compacted by rolling. The compaction objective is 16% - 19% in place void content (Corelock).

Breakdown rolling shall occur when the mix temperature is between 135-163°C (275 to 325°F). This is typically achieved with 1-2 passes with a 7.5 – 10 ton vibratory roller.

Finish rolling shall occur when the mix temperature is between 66-93°C (150 to 200°F). This is typically achieved with a 1-ton roller with no vibratory compaction. Finish rolling is largely aesthetic and done for a smooth finished surface. Care should be taken so as to not continually roll the same location for instance back and forth to a water source.

The cessation temperature occurs at approximately 79°C (175°F), at which point the mix becomes resistant to compaction. If compaction has not been performed at temperatures greater than the cessation temperature, the pavement will not achieve adequate durability. The temperatures referenced here are guidelines and have been used in the field to oversee successful porous asphalt installations.

The surface shall be rolled when the mixture is in the proper condition and when the rolling does not cause undue displacement, cracking, or shoving.

Rollers or oscillating vibratory rollers, ranging from 7.5 – 10 tons, shall be used for breakdown compaction. The number, mass (weight), and type of rollers furnished shall be sufficient to obtain the required compaction while the mixture is in a workable condition. Generally, one breakdown roller will be needed for each paver used in the

spreading operation.

To prevent adhesion of the mixture to the rollers, rollers shall be kept moist with water or water mixed with very small quantities of detergent or other approved material. Excess liquid will not be permitted.

Along forms, curbs, headers, walls, and other places not accessible to the rollers, the mixture shall be thoroughly compacted with hot or lightly oiled hand tampers, smoothing irons or with mechanical tampers. On depressed areas, either a trench roller or cleated compression strips may be used under the roller to transmit compression to the depressed area.

Other combinations of rollers and/or methods of compacting may be used if approved in writing by the Engineer, provided the compaction requirements are met.

The speed of the roller shall be slow and uniform to avoid displacement of the mixture, and the roller should be kept in as continuous operation as practical. Finish rolling shall continue below the threshold temperature until all roller marks and ridges have been eliminated.

Rollers will not be stopped or parked on the freshly placed porous asphalt.

It shall be the responsibility of the Contractor to conduct whatever process control the Contractor deems necessary. Acceptance testing will be conducted by the Engineer using cores provided by the Contractor.

Any mixture that becomes loose and broken, mixed with dirt, or is in any way defective shall be removed and replaced with fresh hot mixture. The mixture shall be compacted to conform to the surrounding area. Any area showing an excess or deficiency of binder shall be removed and replaced. These replacements shall be at the Contractor's expense.

If the Engineer determines that unsatisfactory compaction or surface distortion is being obtained or damage to highway components and/or adjacent property is occurring using vibratory compaction equipment, the Contractor shall immediately cease using this equipment and proceed with the work in accordance with the sixth paragraph of this subsection.

- J. Joints between old and new pavements or between successive day's work shall be made to ensure a thorough and continuous bond between the old and new mixtures. Whenever the spreading process is interrupted long enough for the mixture to attain its initial stability, the paver shall be removed from the mat and a joint constructed.

Butt joints shall be formed by cutting the pavement in a vertical plane at right angles to the centerline, at locations approved by the Engineer. The Engineer will determine locations by using a straightedge at least 3 m (10 feet) long. The butt joint shall be thoroughly coated with Type RS-1 or equivalent emulsified asphalt just prior to depositing the pavement mixture when pavement resumes.

Longitudinal joints that have become cold shall be coated with joint adhesive (NHDOT 403.6) before the adjacent mat is placed. If directed by the Engineer, joints shall be cut

back to a clean vertical edge prior to applying the adhesive.

The longitudinal joint between the porous pavement and the standard pavement shall have a joint adhesive (NHDOT 403.6) applied before paving the adjacent mat.

- K. Surface Tolerances The surface will be tested by the Engineer using a straightedge at least 3 m (10 feet) in length at selected locations parallel with the centerline. Any variations exceeding 9.5 mm (3/8 inch) between any two contact points shall be satisfactorily eliminated. A straightedge at least 3 m (10 feet) in length may be used on a vertical curve. The straightedges shall be provided by the Contractor.

Work shall be done expertly throughout, without staining or injury to other work. Transition to adjacent impervious asphalt pavement shall be merged neatly with flush, clean line. Finished pavement shall be even, without pockets, and graded to elevations shown on drawing.

- L. Repair of Damaged Pavement Any existing pavement on or adjacent to the site that has been damaged as a result of construction work shall be repaired to the satisfaction

- M. Striping Paint

1. Vacuum and clean surface to eliminate loose material and dust
2. Paint 4-inch wide (10 cm) parking striping and traffic lane striping in accordance with plan layouts. Apply paint with mechanical equipment to produce uniform straight edges. Apply in two coats at manufacturer's recommended rates. Provide clear, sharp lines using white traffic paint. Paint should conform with Federal Specification TT-P-85.
3. Color for Handicapped Markings: Blue

3.7 QC/QA for Paving Operations (optional as part of an installation contract)

- A. The full permeability of the pavement surface shall be tested by application of clean water at the rate of at least 5 gpm (23 lpm) over the surface, using a hose or other distribution devise. Water used for the test shall be clean, free of suspended solids and deleterious liquids and will be provided at no extra cost to the Owner. All applied water shall infiltrate directly without large puddle formation or surface runoff, and shall be observed by the Engineer.
- B. Testing and Inspection Employ at Contractor's expense an inspection firm acceptable to the Engineer to perform soil inspection services, staking and layout control, and testing and inspection of site grading and pavement work. Inspection and list of tests shall be reviewed and approved in writing by the Engineer prior to starting construction. All test reports must be signed by a licensed Engineer.
- C. Test in-place base and surface course for compliance with requirements for thickness and surface smoothness. Repair or remove and replace unacceptable work as directed by the Engineer.

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- D. Surface Smoothness Test finished surface for smoothness using a 3 m (10 foot) straightedge applied parallel with and at right angles to the centerline of the paved area. Surface will not be accepted if gaps or ridges exceed 9.5mm (3/8 inch).
- E. Porous pavement beds shall not be used for equipment or materials storage during construction, and under no circumstances shall vehicles be allowed to deposit soil on paved porous surfaces.
- F. QC/QA requirements during paving are summarized in Table 1.

Table 1: QC/QA requirements during paving.

Activity	Schedule/Frequency	Tolerance
Inspect truck beds for pooling (draindown)	every truck	NA
Take temp of asphalt in truck	every truck	> 135°C (275°F)
Take temp of PA mix in the paver	each pull	within 6°C (10°F) of the recommended compaction temp
Consult with engineer to determine locations of butt joints	As needed	NA
Test surface smoothness and positive drainage with a 10' straightedge	after compaction	9.5 mm (3/8")
Consult with engineer to mark core locations	after compaction	NA
House test with at least 5 gpm water	after compaction	immediate infiltration, no puddling

END OF SECTION

SECTION 02555
REMOVAL & REPLACEMENT OF PAVING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included:
 - 1. Remove bituminous asphaltic and/or Portland cement pavement, and replace pavement, subgrade, base courses and surface courses.
 - 2. Do not remove or disturb pavement exceeding 1500 linear feet of roadway, at any given time, without prior approval. The Contractor shall sequence work to minimize impact to pavement and pavement repairs, to the extent that is possible.
- B. Work Not Included:
 - 1. Removal and replacement of paving for the convenience of the Contractor will not be eligible for payment.

1.2 QUALITY ASSURANCE

- A. Materials: Use only materials furnished by a bulk bituminous concrete producer regularly engaged in the production of hot mixed, hot laid bituminous concrete.
- B. Equipment: Provide, maintain and operate pavers, dump trucks, tandem, 3-wheel and pneumatic tired rollers well suited to the mixtures being placed. Provide, maintain and operate hand equipment as required. When applicable, provide, maintain and operate trimming equipment and materials.
- C. Requirements of Regulatory Agencies:
 - 1 New Hampshire Department of Transportation Standard Specifications, latest edition, herein abbreviated N.H.D.O.T.
 - 2. N.H.D.O.T. "Measurement" and "Payment" paragraphs shall not apply.
- D. Joint Make-Up:
 - 1. General:
 - a. Exercise extreme care in the removal of pavement so that pavement will not be unnecessarily disturbed or destroyed. Mechanically cut pavement to be removed to a straight line, unless otherwise directed by the Engineer.
 - 2. Pavement Removal:
 - a. Payment limits for pavement removal shall be as shown on the Payment Limits detail on the Drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Subgrade courses shall be in accordance with Division 300 "Bases"; Section 304, "Sand, Gravel and Crushed Gravel Base Courses" of the N.H.D.O.T. Standard Specifications, latest edition.
- B. Materials shall conform to Division 700, "Material Details"; Section 703, "Aggregates" of the N.H.D.O.T. Standard Specification, latest edition.
- C. Base course of bituminous pavement shall be as shown on the Drawings and shall conform to Division 400, Section 401 "Plant Mix Pavements - General" of the N.H.D.O.T. Standard Specifications, latest edition.
- D. Wearing course of bituminous pavement shall be as shown on the Drawings and shall conform to Division 400, Section 401 "Plant Mix Pavements - General" of the N.H.D.O.T. Standard Specifications, latest edition.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Methods of construction shall be in accordance with Division 400, Pavements; Section 403, Hot Bituminous Pavement of the N.H.D.O.T. Standard Specifications, latest edition. See Drawings for payment limits.
- B. Place the permanent pavement only when the underlying surface is dry, when the atmospheric temperature in the shade is above 40 degrees F, and when the weather is not foggy or rainy, provided however, that the Engineer may permit in case of sudden rain, the placing of the mixture then in transit from the plant, if laid at the proper temperature and if the roadbed is free from pools of water.
- C. Such permission shall in no way relax the requirements for quality of the pavement and smoothness of surface.
- D. Do not lay material upon a frozen base course or when wind conditions are such that rapid cooling will prevent satisfactory compaction.
- E. Temporary Pavement Repairs
 - 1. Temporary pavement repairs shall be made only where deemed necessary by the Engineer, to provide safe unimpeded traffic circulation through the project area and when permanent repairs cannot be made expediency.
 - 2. Temporary pavement (width and depth) shall be as shown or where directed.
- F. Permanent Pavement Repairs - Final Patch at Trench
 - 1. After suitable exposure, the pavement shall be mechanically cut on either side of the temporary pavement repair.

REMOVAL & REPLACEMENT OF PAVING

2. The temporary pavement and the existing undisturbed pavement shall be removed to the limits shown on the Drawings.
3. The existing pavement shall be replaced with new pavement, to the depth specified, unless directed otherwise. The final patch shall meet the cut edge exactly.

G. Full Width Permanent Pavement Overlay

1. When ordered by the Engineer, Contractor shall furnish a full width overlay from curb to curb or edge of traveled way to edge of traveled way as shown on the Drawings.
 - a. Remove all temporary, damaged or cracked pavements, and replace with permanent pavement.
 - b. Mechanically grind the existing pavement on each end of the roadway receiving an overlay or final wearing course.
 - c. All driveways shall be mechanically ground (cold planed) or saw cut prior to installation of pavement overlays. Feathering will not be acceptable.
 - d. The full width permanent pavement overlay shall consist of hot bituminous concrete wearing course over the existing pavement and trench repair base course.
 - e. Contractor shall be responsible for raising all utility covers and shimming.

H. Maintaining Permanently Placed Surfaces

1. Maintain permanently placed surfaces under this Contract until expiration of the guarantee period. Damaged or cracked pavement shall be replaced by the Contractor at their own cost.
2. Should an area that the Contractor has permanently paved settle:
 - a. Remove the entire pavement in the area.
 - b. Add the necessary subgrade material as specified and shown on the Drawings to the depth of the applicable pavement course.
 - c. Replace the base course as specified
 - d. Replace the surface course as specified.
 - e. Do not feather edges, except where shown on the Drawings.

END OF SECTION

SECTION 02558

FINE GRADING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. This work shall consist of the final grading necessary to make the subgrade, under the surface course, the roadway outside the surface course, and other locations by the Engineer conform to the lines shown on the plans.

B. Work Specified Elsewhere. The following is a list of Sections that note work related to this Section. The list is provided for the Contractor's convenience and is not intended to relieve Contractor of requirements noted in Sections that are not listed below.

1. Section 02551 - Bituminous Concrete Paving

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

- 3.1 The surface of each course of material shall be fine graded to conform to the typical section of the plans prior to placing the succeeding course.
- 3.2 Shoulders, slopes, and ditches shall be shaped with suitable machinery supplemented by hand labor to reasonably smooth surfaces that are in keeping with the character of the adjacent terrain and shall merge into the adjacent terrain without any noticeable break. Culverts and waterways shall be cleared of all obstructions. Rubbish, brush, loose rock, boulders, and all other debris from the construction work shall be removed and disposed of as required by the Engineer.
- 3.2 To be acceptable, the entire roadway must present a uniformly finished appearance at the completion of the work.

END OF SECTION

SECTION 02560
GRANITE CURBING (NHDOT)

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included:
1. Work shall consist of constructing new or resetting existing curbing as shown on the Drawings or as ordered.

1.2 DELIVERY, STORAGE AND HANDLINGS

- A. The Contractor shall inspect curbing upon delivery. Any damaged, chipped or defective curbing shall not be accepted.
- B. The Contractor shall exercise care during storage and handling of curbing. Broken curb not meeting the dimensions shown on the Drawings shall not be considered for payment.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Curb shall be new granite, hard, durable, reasonably uniform in appearance and free of seams. Solid quartz or feldspar veins will not be cause for rejection.
- B. Surfaces of granite shall meet the following requirements:

<u>Type</u>	<u>Surface</u>	<u>Minimum Requirements</u>
Straight or Curved	Top	5" wide or as otherwise shown, sawn true plane. Front and back arris lines pitched straight and parallel.
	Front Face (Exposed)	Right angle to top, approximately true plane. No drill holes showing in top 10".
	Back Face (Not Exposed)	Plane parallel with front face. Straight split to 1 1/2" below exposed surface. No larger than 1/4" segment of drill holes showing in arris lines.
	Bottom	Approximately parallel to top. Minimum width: 3".
	Ends (Exposed portion)	Square with planes of top and face.
	Joints (Exposed)	Optimum width: 1".
	Joints (Concealed)	To break back no more than 4". Lengths of stones 3' to 10' with 50% of sections to be 5' or greater, or as indicated.
	Length of Stones	3' to 10' with 50% of sections to be 5' or greater, or as indicated

1. For curbing on curves with a radius of less than 15 feet, radius curbing shall be used.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Construction requirements shall be in accordance with Division 600, Section 609 (Curbs) of N.H.D.O.T. Standard Specifications for Road and Bridge Construction, latest edition.
- B. Excavation for curbing shall be made to the required depth and the base upon which the curb will be set shall be compacted to a firm even surface.
- C. The front top arris line shall conform to the line and grade specified.
- D. Joints shall be pointed with mortar and finished with a jointer.
- E. Concrete Class A in accordance with NHDOT section 520 shall be used to bed the curb and on the roadway side of the curb. The concrete shall be left a ½" lower than the top binder course of pavement.
- F. Curbing to be salvaged and reset shall be carefully removed and stored. The Contractor shall replace any curbing damaged or lost as a result of his failure to remove or store curbing correctly.
- G. The Contractor shall backfill curbing immediately after the curb is set.

END OF SECTION

SECTION 02601
MANHOLES, COVERS AND FRAMES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included: Furnish and install manholes, cast iron frames and covers in conformance with the dimensions, elevations, and locations shown on the Drawings and as specified herein.
- B. Test manholes upon installation, prior to paving.

1.2 QUALITY ASSURANCE

- A. Construct all manholes in conformance with the New Hampshire Department of Environmental Services - Water Division- Standards of Design and Construction for Sewerage and Wastewater Treatment Facilities.
- B. Construct all manholes of a quality to withstand loads of 8 tons (H-20 loading) without failure for a period of time in excess of 25 years.
- C. Construct all manholes of a quality to prevent leakage in excess of 1 gallon per day per vertical foot of manhole.
- D. Construct all manholes throughout the entire project from the same materials unless otherwise shown on the Drawings.
- E. All castings shall be at least Class 30 conforming to ASTM Standard Specifications for Gray Iron Casting, Designation A40.
- F. All essential details of design shall be as shown on the Drawings.
- G. Frames and covers shall be New Hampshire Standard.
- H. Masonry: See specification Section 04201.
- I. Waterproofing: Shall be with a product with demonstrated five (5) years successful use in similar applications.

1.3 SUBMITTALS TO THE ENGINEER

- A. Submit shop drawings in accordance with the General Conditions of the Construction Contract.
- B. A description of all methods of jointing.
- C. All Certificates of Compliance.
- D. Provide Fabrication Schedule that shows:
 - a. Orientation and elevation of opening.
 - b. Section dimensions and assembly order.

1.4 SUPPLEMENTAL INFORMATION

- A. For work performed in the City of Portsmouth, New Hampshire the Contractor shall provide certification that all frames and covers were manufactured in the United States.

PART 2 - PRODUCTS

2.1 PRECAST MANHOLE SECTIONS

- A. General
1. Risers and tops shall be precast reinforced concrete, or cast-in-place reinforced concrete.
 2. The wall thickness shall not be less than 5 inches for 48 inch inside diameter structures.
 3. Manhole bases shall be monolithic to a point 6 inches above the crown of the incoming pipe and shall be constructed of reinforced concrete.
 4. Use concrete that conforms to the requirements of Class A concrete in Section 520 of the N.H.D.O.T. Standard Specifications for manhole bases and cast-in-place manholes.
 5. Use reinforcing steel for cast-in-place concrete that conforms to the requirements of the N.H.D.O.T. Standard Specifications for Billet-Steel Bars or Welded Steel Wire Fabric.
 6. Construct pipe to manhole joints that are approved by the New Hampshire Department of Environmental Services – Water Division. In general, use approved non-shrinking mortar or elastomeric or mastic like sealants to ensure these joints are watertight.
 7. Do not install manhole steps unless shown on the Drawings.
 8. All sewer manhole covers shall be 30 inches in diameter unless shown otherwise on the Drawings and have the letter "S" or the word "SEWER" in 3-inch letters cast into the top surface.
 9. All drain manhole covers shall be 30 inches in diameter unless shown otherwise on the Drawings and have the letter "D" or the word "DRAIN" in 3-inch letters cast into the top surface.
 10. All castings shall be of good quality, strong, tough, even-grained cast iron, smooth, free from scale, lumps, blisters, sandholes, and defects of every nature which would render them unfit for the service for which they are intended.
 11. Contact surfaces of covers and frame seats shall be machined at the foundry before shipment to prevent rocking of covers in any orientation.
 12. All castings shall be thoroughly cleaned and subject to a careful hammer inspection.
 13. Prior to being shipped from the foundry, castings shall be sandblasted.
 14. Repair all coatings that have been damaged in transit or handling to the satisfaction of the Engineer.

B. Openings:

1. Provide openings in the risers to receive pipes entering the manhole.
2. Make openings at the manufacturing plant.
3. Size: To provide a uniform annular space between the outside wall of pipe and riser.
4. Location: To permit setting of the entering pipes at the correct elevations.
5. Openings shall have a flexible watertight union between pipe and the manhole base.
 - a. Cast into the manhole base and sized to the type of pipe being used.
 - b. Type of flexible joint being used shall be approved by the Engineer. Install materials according to the Manufacturer's instructions.
 1. Lock Joint Flexible Manhole Sleeve made by Interpace Corporation.
 2. Kor N Seal made by National Pollution Control System, Inc.
 3. Press Wedge II made by Press-Seal Gasket Corporation.
 4. A-Lok Manhole Pipe Seal made by A-Lok Corporation.
 5. Or equivalent.

C. Joints:

1. Joint gaskets between precast concrete sections shall be sealed with a double row of an elastomeric or mastic-like sealant to ensure these joints are watertight. For cold weather applications, use adhesive with joint sealant as recommended by manufacturer.

Acceptable Materials:

 - a. Kent-Seal No. 2
 - b. Ram-Nek
 - c. Or equivalent.
2. Joints between precast sections shall conform to related standards and manufacturer's instructions.
3. All manholes greater than 6 ft. diameter and all manholes used as wet wells, valve pits and other dry-pit type structures shall be installed with exterior joint collars. The joint collar shall be installed according to the manufacturer's instructions. Acceptable materials:
 - a. MacWrap exterior joint sealer as manufactured by Mar-Mac Manufacturing Company.
 - b. Or equivalent.

D. Waterproofing:

1. The exterior surface of all manholes shall be given two coats of bituminous waterproofing material.
2. The coating shall be applied after the manholes have cured adequately and can be applied by brush or spray in accordance with the manufacturer's written instruction.
3. Sufficient time shall be allowed between coats to permit sufficient drying so that the application of the second coat has no effect on the first coat.

2.2 FRAMES AND COVERS

A. Standard Units:

1. Shall be "New Hampshire Standard".
2. Made of cast iron conforming to ASTM A48-76, Class 30 minimum.
3. Have machined bearing surfaces to prevent rocking.
4. Castings shall be smooth with no sharp edges.
5. Constructed to support an HS-20 wheel loading.
6. Dimensions and Style shall conform to the Drawings; Standard castings differing in non-essential details are subject to approval by the Engineer:
 - a. Covers - solid 3-inch letters diamond pattern.
 - b. Frame - 30-inch diameter clear opening, with flange bracing ribs.
7. Minimum weight of frame and cover shall be 430 lbs.
8. Acceptable Manufacturers:
 - a. LeBaron
 - b. Neenah
 - c. East Jordan
 - d. Deeter

B. Hinged Manhole Covers

1. Hinged manhole covers shall be manufactured by PAMREX or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Manhole Bases:

1. Place bases on a 6-inch layer of compacted bedding consisting of crushed stone and/or natural stone graded to the following specifications:
 - a. 100 percent passing a 1-inch screen.
 - b. 90 to 100 percent passing a 3/4-inch screen.

- c. 20 to 55 percent passing a 3/8-inch screen.
 - d. 0 to 10 percent passing a number 4 sieve.
 - e. 0 to 5 percent passing a number 8 sieve.
 - f. Equivalent to Standard Stone Size Number 67, Section 703 of N.H.D.O.T. Standard Specifications.
- 2. Properly dewater the excavation while placing the bedding material and placing the structure or concrete.
- 3. Use waterstops at the horizontal joint of cast-in-place manholes.
- B. Construct inlet and outlet stubs as shown on the Drawings.
- C. Invert Channels:
 - 1. Construct smooth and semicircular in shape conforming to the inside of the adjacent sewer section.
 - 2. Make changes in direction of flow with smooth curves having a radius as large as permitted by the size of the manhole.
 - 3. Stop the pipes at the inside face of the manhole where changes of direction occur.
 - 4. Form invert channels as shown on the Drawings.
 - 5. Slope the floor of the manhole outside the flow channel as shown on the Drawings or as directed by the Engineer.
- D. Precast Risers and Tops:
 - 1. Use the appropriate combinations of risers and top lengths.
 - 2. Seal joints with an approved type mastic as shown on the Drawings.
 - 3. Test the manhole as soon as practical after installation.
 - 4. Perform jointing in accordance with the manufacturer's recommendations and as approved by the Engineer.
 - 5. Install risers and tops level and plumb.
 - 6. Do not permit water to rise over newly made joints until after inspection by the Engineer.
 - 7. Make all joints watertight.
 - 8. Solidly fill annular spaces around pipes entering the manholes with non-shrink mortar or as otherwise shown on the Drawings.
 - 9. When necessary, core openings carefully to prevent damage to risers and tops. Replace all damaged risers and tops at no additional cost to the Owner.
 - 10. Cutting opening shall not be allowed without the expressed written permission of the Engineer.

- E. Cast-In-Place Manholes:
 - 1. Place a special plastic waterstop in the joint between the base and the sides of all manholes.
 - 2. Obtain the Engineer's approval of the type of waterstop and the installation.
 - 3. Cast all pipes entering the manholes in accordance with pipe manufacture recommendations.
- F. Drop Manholes:
 - 1. No free drop shall be permitted at the pipe inlet. Drops must be less than 6 inches or greater than 24 inches.
 - 2. Where the vertical distance between inlet and outlet pipe inverts exceeds 24 inches, construct a drop manhole as shown on the Drawings.
- G. Adjustment to Grade: If necessary, adjust tops of manholes to grade, a maximum of 12 inches, with brick masonry.
- H. Set manhole frames with the tops conforming accurately to the grade of the pavement or finished ground surface or as shown on the drawings.
- I. Set frames concentric with the top of the masonry and in a full bed of mortar so that the space between the top of the manhole masonry and the bottom flange at the frame shall be completely filled and made watertight.
- J. Place a thick ring of mortar extending to the outer edge of the masonry all around and on the top of the bottom flange.
- K. Finish the mortar so that it will be smooth and have a slight slope to shed water away from the frame.
- L. When the work on each manhole is complete, clean the frame seat and set the cover in place.

3.2 LEAKAGE TESTS

- A. General:
 - 1. Perform vacuum tests on all manholes.
 - 2. The Engineer shall observe tests.
 - 3. Repairs to manholes found to leak by any test method shall be performed both inside and outside the structure by a method approved by the Engineer.
- B. Preparation:
 - 1. After manholes have been assembled in place, fill and point all lifting holes.
 - 2. Test all manholes with pipes and or stubs installed. Testing with through pipes to be removed and replaces is not acceptable.
 - 3. Manholes in which the pipe to manhole connection is disassembled after testing shall be retested at the Contractors expense.

MANHOLES, COVERS AND FRAMES

4. Make the tests prior to placing the shelves and inverts and before filling and pointing the horizontal joints below the 6-foot depth line.
 5. Suitably plug all pipes and other openings into the manholes.
- C. Test Procedure: Vacuum
1. Use only an approved testing machine.
 - a. National Pollution Control, Inc.
 - b. Or equal.
 2. Securely brace all plugs.
 3. Check cone section to insure good seal with Test Machine Bladder.
 4. Bring test vacuum to 10 in. Hg gauge.
 - a. Time:
 - Manholes 0'-10' - 2 minutes
 - Manholes 10'-15' - 2.5 minutes
 - Manholes 15'-25' - 3 minutes
 - b. Allowable leakage is 1" Hg or less per times given.
 - c. If pressure drop exceeds 1" Hg in the required time, the manhole shall be repaired and retested.
 - d. If the manhole fails after being repaired, the manhole shall be "Water Exfiltration Tested" according to the criteria of the specification.
 5. When a leak is identified, repair the area from both inside and out by a method approved by the Engineer. Methods to be considered include parging with hydraulic cement and pressure application of polyurethane grout.
- D. Backfilling:
1. Manhole testing shall be conducted before backfilling around the manhole. However, if the Contractor elects to backfill prior to testing, for any reason, it shall be at Contractor's own risk and it shall be incumbent upon the Contractor to determine the reason for any failure of the test.
 2. 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 during the test is a result of leaks through the joints or through the concrete.
- E. All repairs to manholes shall be performed to the exterior of the structure.
- F. Accident Prevention: Following the satisfactory completion of the leakage test, place the frame and cover on the top, or provide other means of preventing accidental entry by unauthorized persons, children, animals, etc., until ready to make final adjustment to grade.

END OF SECTION

SECTION 02610
PIPE & PIPE FITTINGS - GENERAL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included: Furnish, install, support and test pipe and pipe fittings of the type(s) and size(s) and in the location(s) shown on the Drawings and as specified herein.

1.2 SUBMITTALS TO THE ENGINEER

- A. Submit shop drawings in accordance with the General Conditions of the Construction Contract.
- B. If requested by the Engineer, submit manufacturer's "Certification of Conformance" that pipe and pipe fittings meet or exceed the requirements of these Specifications.
- C. Submit other documents as specified in the appropriate Sections of this Division.

1.3 DELIVERY, STORAGE AND HANDLING

- A. Exercise care during loading, transporting, unloading, and handling to prevent damage of any nature to interior and exterior surfaces of pipe and fittings.
- B. Do not drop pipe and fittings.
- C. Store materials on the project site in enclosures or under protective coverings in accordance with manufacturer's recommendations and as directed by the Engineer.
- D. Assure that materials are kept clean and dry.
- E. Do not store materials directly on the ground.
- F. Follow manufacturer's specific instructions, recommendations and requirements.
- G. Store in a manner to protect items with epoxy shop coatings from exposure to UV light which can cause chalking of the epoxy. Length of acceptable exposure prior to providing UV protective measures shall be in accordance with coating manufacturer's recommendations. This includes protection from UV light after installation while awaiting covering or filling of tanks. Or prior to topcoating aliphatic polyester polyurethane for items scheduled to be topcoated.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Marking Tape
 - 1. Shall be coded in accordance with the NPWA Standards.
 - 2. Shall be indelibly marked indicating the type of utility it is placed over.
 - 3. Shall be three (3) inches wide Terra Tape Sentry Line 1350 (Detachable) by Reef Industries, Houston, TX, or approved equal.
- B. Pipe Lubricant or glue
 - 1. Use only lubricants or glues suitable for the type of pipe and application.

2. For potable water pipe use only lubricants or glues clearly marked “For Use with Potable Water”.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Provide all labor and equipment necessary to assist the Engineer to inspect pipe, fittings, gaskets, and other materials.
 1. This shall include all air quality testing equipment, harnesses and manlifts necessary to comply with the appropriate OSHA regulation.
 2. The Engineer shall comply with the Contractor’s regulations and policies regarding below grade or confined space entry.
- B. Carefully inspect all materials at the time of delivery and just prior to installation.
- C. Carefully inspect all pipe and fittings for:
 1. Defects and damage.
 2. Deviations beyond allowable tolerances for joint dimensions.
 3. Removal of debris and foreign matter.
- D. Examine areas and structures to receive piping for:
 1. Defects, such as weak structural components that adversely affect the execution and quality of work.
 2. Deviations beyond allowable tolerances for pipe clearances.
- E. All materials and methods not meeting the requirements of these Specifications shall be rejected.
- F. Immediately remove all rejected materials from the project site.
- G. Start work only when conditions are corrected to the satisfaction of the Engineer.

3.2 INSTALLATION

- A. General:
 1. Install all pipe and fittings in strict accordance with the manufacturer's instructions and recommendations and as instructed by the Engineer.
 2. Install all pipes and fittings in accordance with the lines and grades shown on the Drawings and as required for a complete installation.
 3. Install adapters, approved by the Engineer, when connecting pipes constructed from different materials.
 4. When applicable, support all piping not being installed in trenches in accordance with the "Pipe Hangers & Supports" Section of these Specifications.
- B. Installation and Trenches:
 1. Firmly support the pipe and fittings on bedding material as shown on the Drawings and as specified in the appropriate Sections of these Specifications.

PIPE & PIPE FITTINGS – GENERAL

- a. Where, in the opinion of the Engineers, the subgrade material is unsuitable to support the pipe, over-excavate the unsuitable material and replace the same with suitable gravel or granular borrow.
 - b. If the subgrade material encountered consists of saturated clays or silts, the Engineer may direct the installation of the bedding material and pipe inside a construction fabric wrap as shown on the Drawings.
2. Do not permanently support the pipe or fittings on saddles, blocking stones, or any material which does not provide firm and uniform bearing along the outside length of the pipe.
 3. Thoroughly compact the material under the pipe to obtain a substantial unyielding bed shaped to fully support the pipe.
 4. Excavate suitable holes for the joints so that only the barrel of the pipe receives bearing pressure from the supporting material after placement.
 5. Lay each pipe length so it forms a close joint with the adjoining length and bring inverts to the required grade.
 6. Set the pipe true to line and grade. Use a transit for line. Use a laser beam aligner for grade.
 7. Do not drive the pipe down to grade by striking it with a shovel handle, timber, rammer or any other unyielding object.
 8. Make all pipe joints watertight and no sand, silt, clay or soil of any description entering the pipeline at the joints.
 9. Immediately after making a joint, fill the holes for the joint with bedding material, and compact.
 10. When each pipe length has been properly set, place and compact enough of the bedding material between the pipe and the sides of the trench to hold the pipe in correct alignment.
 11. After filling the sides of the trench, place and lightly tamp bedding material to complete the bedding as shown on the Drawings.
 12. Take all necessary precautions to prevent flotation of the pipe in the trench.
 13. Where there is evidence of water or soil entering the pipeline, repair the defects to the satisfaction of the Engineer.
- C. Temporary Plugs:
1. When pipe installation work in trenches is not in progress, close open ends of the pipe with temporary watertight plugs.
 2. If water is in the trench when work is resumed, do not remove plugs until all danger of water entering the pipe is eliminated.
 3. Do not use the pipe lines as conductors for trench drainage during construction.
- D. Protection of Water Supplies:
1. There shall be no physical connection between a public or private potable water supply system and a sewer.
 2. Sewer shall be a minimum of ten feet horizontally unless shown otherwise on the drawings.

PIPE & PIPE FITTINGS – GENERAL

3. Whenever sewers must cross water mains, the sewer shall be constructed as follows (unless shown otherwise on the Drawings):
 - a. Sewer pipe shall be class 52 ductile iron or PVC pressure rated pipe (DR-25 min. or SDR-32.5 min.) for a minimum distance of 9 feet each side of the crossing.
 - b. Joints shall be mechanical type water pressure rated with zero leakage when tested at 25 pounds per square inch for gravity sewers and 1-1/2 times working pressure for force mains, and joints shall not be located within 9 feet of the crossing.
 - c. Vertical separation of sewer and water main shall not be less than 18".
 - d. A minimum of 18" of separation from the bottom of the water main to the top of the sewer line shall be maintained at all crossings. The water line grade shall be adjusted where necessary to provide the required vertical separation. Sewer pipe joints shall not be located within 9 feet of the water main crossing and the sewer joints shall be tested with zero leakage at 25 pounds per square inch for gravity sewers and 1-½ times working pressure for force mains.

3.3 CLEANING AND TESTING

A. Cleaning and Testing Piping - General:

1. Thoroughly clean all piping prior to testing. Remove all dirt, dust, oil, grease and other foreign material. Exercise care while cleaning to avoid damage to linings and coatings.
2. When the installation is complete, test all pipelines, including service laterals, in the presence of the Engineer and the plumbing or building inspector in accordance with the requirements of the local and state plumbing codes and the appropriate Sections of these Specifications, at no additional cost to the Owner.
3. Equipment: Supply all labor, equipment, materials, gages, and pumps required to conduct the tests.
4. Retesting: Perform all retesting required due to failure at no additional cost to the Owner and to the complete satisfaction of the Engineer.

B. Outside Potable Water Piping:

1. Pressure Test:
 - a. Perform testing in accordance with Section 5 of AWWA Standard C600.
 - b. Pressure and leakage tests are required and shall be run concurrently.
2. Chlorination of Pipelines:
 - a. Chlorinate all new potable water lines in accordance with the procedure outlined in AWWA C651 and AWWA C600, latest revisions.
 - b. Prior to chlorination, the pipeline shall be flushed to remove all sediment and discolored water from the main.
 - c. Locate chlorination and sampling points as approved by the Engineer.
 - d. Use a dosage which will produce not less than 10.0 ppm chlorine residual after a contact period of not less than 24 hours.

PIPE & PIPE FITTINGS – GENERAL

- e. During the chlorination period, exercise care to prevent the contamination of water in existing water mains.
 - f. After chlorination, flush the piping with clean potable water until there is only background chlorine residual.
 - g. Chlorinated effluent shall be dechlorinated prior to release to surface waters.
 - h. Segments of pipes at tie-in locations that cannot be chlorinated by the above noted procedure shall be swabbed down with a solution of chlorine prior to their installation.
 - i. A written certificate of the leakage test, pressure test, and disinfection results must be submitted to the Owner, Engineer, and City of Portsmouth Department of Public Works to the main being considered for acceptance.
3. Bacteriological Testing:
- a. Test all new potable water lines for total Coliform bacteria at no additional cost to the Owner. The Contractor shall coordinate all testing with the City. Bacteriological testing services of new water mains will be completed by the City of Portsmouth Water Department and reimbursed by the Contractor. The Contractor shall remain responsible for coordination and sampling in advance.
 - b. The length of pipe to be tested and the time of the test shall be as approved by the Engineer.
 - c. The Engineer will observe the taking of samples.
 - d. Have all samples tested by a laboratory approved by the State and submit test results to the Engineer.
 - e. Any segment of a potable water line shall be considered unsuitable for service if a Coliform bacteria count is obtained from that sample.
 - f. Re-disinfect all segments of piping considered unsuitable and retest. Continue to disinfect and test until no Coliform bacteria are present.
 - g. Place piping into service when it has been successfully tested for pressure, leakage and total Coliform bacteria.
4. Services:
- a. After a new main has been energized and the new service has been completed, it shall be the responsibility of the Contractor to confirm with the property owner that all water systems in the building are working properly. This will include removing any air from the water service and confirmation with the property owner that interior plumbing is functioning properly.
- C. Building Interior Water Lines (When Applicable):
- 1. Clean and test in accordance with the "Plumbing General" Section in these Specifications.

D. Sewer Lines:

1. Outside Sewer Lines: Test with a low pressure air test, a visual inspection, and for PVC or other flexible piping, test with a deflectometer after suitable settling time has elapsed. Refer to Section 02651 – Final Sewer Testing for additional requirements.
2. Building Interior Sewer System: Clean and test in accordance with the "Plumbing General" Section in these Specifications.

E. All Other Piping Systems:

1. Pressure Test:
 - a. Perform a pressure test for all other piping systems at 1-1/2 times maximum system pressure, or at the maximum working pressure of the piping system, or at a pressure indicated in the appropriate Sections of this Specification.
 - b. Tests shall be hydrostatic water, or air pressure as specified or as approved by the Engineer.
2. Cleaning: Perform all specialized cleaning as specified or required by system.

END OF SECTION

SECTION 02611
DUCTILE IRON PIPE & FITTINGS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included: Furnish and install ductile iron pipe and ductile iron fittings of the type(s) and size(s) in the location(s) shown on the Drawings and as specified herein.

1.2 QUALITY ASSURANCE

- A. Standards:
1. Cement-mortar lining for water: ANSI A21.4/AWWA C104.
 2. Rubber gasket joints: ANSI A21.11/AWWA C111.
 3. Ductile iron pipe thickness: ANSI A21.50/AWWA C150.
 4. Ductile iron pipe, centrifugally cast: ANSI A21.51/AWWA C151.
 5. Threaded flanges: ANSI A21.15/AWWA C115.
 6. Ductile iron fittings: ANSI 21.53/AWWA C153.
 7. Pipe flanges and fittings: ANSI B16-1, ANSI A-21.12.
 8. Bolts: COR-TEN ASTM A588.
 9. Polyethylene encasement: ANSI/A21.5/AWWA C105

1.3 SUBMITTALS TO THE ENGINEER

- A. Submit shop drawings in accordance with the General Conditions of the Construction Contract.
- B. If requested by the Engineer, submit manufacturer's "Certification of Conformance" that pipe and fittings meet or exceed the requirements of these Specifications.
- C. If joint restraints are to be used in place of thrust blocks, submit restraint calculations for review by the Engineer. Restraint calculation shall be in accordance with DIPRA and AWWA standards.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Exercise extra care when handling pipe and fittings.
- B. Exercise extra care when handling cement lined pipe and fittings because damage to the lining will render it unfit for use.
- C. Protect the spherical spigot ends and the plain ends of all pipe during shipment by wood lagging securely fastened in place.

1.5 INSPECTION

- A. Provide all labor necessary for the Engineer to inspect pipe, fittings, gaskets, and other materials.
- B. Carefully inspect all materials at the time of delivery and just prior to installation.
- C. Carefully inspect all pipe and fittings for:
 - 1. Defects and damage.
 - 2. Deviations beyond allowable tolerances for joint dimensions.
 - 3. Removal of debris and foreign matter.
- D. Examine areas and structures to receive piping for:
 - 1. Defects, such as weak structural components that adversely affect the execution and quality of work.
 - 2. Deviations beyond allowable tolerances for pipe clearances.
- E. All materials and methods not meeting the requirements of the Contract Documents will be rejected.
- F. Immediately remove all rejected materials from the project site.
- G. Start work only when conditions are corrected to the satisfaction of the Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Pipe:
 - 1. All pipes shall conform to the latest AWWA specification C151. Unless otherwise shown on the Drawings, the minimum thickness of ductile iron pipe shall be:
 - a. All ductile iron pipe shall be Class 52, double cement lined.
 - b. Pipe with flanges: Class 53 (formerly Class 3).
 - c. All ductile iron pipe shall have cement lining of double thickness.
 - 2. Pipe for use with sleeve type couplings shall have plain ends (without bells or beads) cast or machined at right angles to the axis.
 - 3. Pipe for use with split type couplings shall have ends with cast or machined shoulders or grooves that meet the requirements of the manufacturer of the couplings.
 - 4. Factory applied bituminous coatings, as approved by the Engineer, shall be furnished for all underground piping.
 - 5. Each ductile iron pipe shall have conspicuously marked on the exterior the pressure, class, and weight of the pipe.
 - 6. All ductile iron pipe furnished to the project shall be one uniform length, either 18 feet or 20 feet.
- B. Joints (as shown on the Drawings, specified and applicable):
 - 1. General: All joints shall be the same pressure class as the pipe unless otherwise shown on the Drawings.

2. Flanged:
 - a. Provide specially drilled flanges when required for connection to existing piping or special equipment.
 - b. Flanges shall be long-hub screwed tightly on pipe by machine at the foundry prior to facing and drilling.
 - c. Gaskets:
 - (1) Ring type of rubber with cloth insertion.
 - (2) Thickness of gaskets 12 inches in diameter and smaller: 1/16 inch.
 - (3) Thickness of gaskets larger than 12 inches in diameter: 3/32 inch.
 - d. Fasteners:
 - (1) Make joints with bolt, stubs with a nut on each end, or one tapped flanged with a stud and nut.
 - (2) The number and size of bolts shall meet the requirements of the same American National Standard as the flanges.
 - (3) Nuts, bolts and studs shall be Grade B meeting the requirements of ASTM A307.
 - (4) After jointing, coat entire joint with bituminous material compatible with pipe coating.
 - e. When applicable, provide and install flange clamps as shown on the Drawings.
 - f. Uniflange type connection shall be positively restrained by use of threaded rods (2) or other approved restraint device.
3. Push-on and Mechanical Joint:
 - a. The plain ends of push-on pipes shall be factory machined to a true circle and chamfered to facilitate fitting the gasket.
 - b. Provide gaskets manufactured from a composition material suitable for exposure to the liquid to be contained within the pipe.
4. Grooved split ring couplings, sleeve couplings, flexible joints and couplings:
As specified and shown on the Drawings.
5. Joint Restraint:
 - a. Provide both Mega-lug type joint restraint and thrust blocks as indicated on drawings details.
 - b. Types of joint restraint:
 - (1) Mechanical joint ductile iron pipe shall have “Mega-lug Type” restrained ductile iron glands and thrust blocks of sufficient size in accordance with DIPRA and AWWA standards for thrust restraint.
 - (2) Pipe and fittings with approved lugs or hooks cast integrally for use with socket pipe clamps, tie rods, or bridles. Bridles and tie rods shall be a minimum of 3/4 inch diameter except where they

replace flange bolts of a smaller size, in which case they shall be fitted with a nut on each side of the pair of flanges. The clamps, tie rods, and bridles shall be coated with an approved bituminous paint after assembly or, if necessary, prior to assembly.

- (3) Other types of bracing as shown on the Drawings.

C. Standard Fittings:

1. All joints shall conform to the latest AWWA specification C-153.
2. Class 350, Ductile Iron, Cement Lined except as shown on the Drawings or as specified.
3. Joints the same as the pipe with which they are used or as shown on the Drawings.
4. Provide fittings with standard bases where shown on the Drawings.
5. Provide retainer glands on all fittings.
6. Outside surface coated to specifications applicable to pipe.

D. Non-Standard Fittings:

1. Fittings having non-standard dimensions shall be subject to the Engineer's approval.
2. Non-standard fittings shall have the same diameter and thickness as standard fittings and shall meet the specification requirements for standard fittings.
3. The laying lengths and types of joints shall be determined by the particular piping to which they connect.
4. Flanged fittings not meeting the requirements of ANSI A21.10 (i.e., laterals or reducing elbows) shall meet the requirements of ANSI B16.1 in Class 125.

E. Polyethylene encasement shall be 8 mil thick.

F. Tapping Sleeves for Water Main Connections

Shells: 304 stainless steel MIG welded, fully passivated

1. Lugs: 304 stainless steel
2. Bolts, Nuts, and Washers: Teflon coated, NC rolled threads, plastic lubricating washer
3. Gaskets: Virgin SBR compounded for water service
4. Flange: Ductile Iron meeting ASTM 536-80, Grade 65-45-12 welded to neck, coated gasket glued

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Install all pipe and fittings in strict accordance with the manufacturer's instructions and recommendations.
2. Install all pipes and fittings in accordance with the lines and grades shown on the Drawings and as required for a complete installation.
3. Install adapters, approved by the Engineer, when connecting pipes constructed from different materials.

B. Installation in Trenches:

1. Firmly support the pipe and fittings on bedding material as shown on the Drawings and as specified in the appropriate Sections of these Specifications.
2. Do not permanently support the pipe or fittings on saddles, blocking stones, or any material which does not provide firm and uniform bearing along the outside length of the pipe.
3. Thoroughly compact the material under the pipe to obtain a substantial unyielding bed shaped to fully support the pipe.
4. Excavate suitable holes for the joints so that only the barrel of the pipe receives bearing pressure from the supporting material after placement.
5. When cutting of pipe is required, the Contractor shall make a square cut in the pipe using an approved cutting tool that will not damage the pipe lining. After the cut has been made, the Contractor shall grind a bevel around the pipe with a hand-held mechanical grinder.
6. Lay each pipe length so it forms a close joint with the adjoining length and bring the inverts up to the required grade.
7. Set the pipe true to line and grade. Use a transit and level or a laser beam aligner as appropriate to the pipe application.
8. Do not drive the pipe down to grade by striking it with a shovel handle, timber, rammer, or any other unyielding object.
9. Make all pipe joints watertight with no visible leakage and no sand, silt, clay or soil of any description entering the pipeline at the joints.
10. Install two brass wedges between the new pipe and the preceding pipe bell.
11. Immediately after making a joint, fill the holes for the joints with bedding material and compact.
12. When each pipe length has been properly set, place and compact enough of the bedding material between the pipe and the sides of the trench to hold the pipe in correct alignment.
13. After filling the sides of the trench, place and lightly tamp bedding material to complete the bedding as shown on the Drawings.
14. Take all necessary precautions to prevent flotation of the pipe in the trench.

15. Where there is evidence of water or soil entering the pipeline, repair the defects.
- C. Temporary Plugs:
 1. When pipe installation work in trenches is not in progress, close the open ends of the pipe with temporary watertight plugs.
 2. If water is in the trench when work is resumed, do not remove plugs until all danger of water entering the pipe is eliminated.
 3. Do not use the pipelines as conductors for trench drainage during construction.
- D. Assembling Joints:
 1. Push-on Joints:
 - a. Insert the gasket into the groove of the bell.
 - b. Uniformly apply a thin film of special lubricant over the inner surface of the gasket that will contact the spigot end of the pipe.
 - c. Insert the chamfered end of the plain pipe into the gasket and push until it seats against the bottom of the socket.
 - d. Where electromagnetic type pipe locators are used or as directed, insert serrated brass wedges at all joints to assure continuity. Use two wedges per joint for 2" through 12" diameter pipe and four wedges for pipes greater than 12" diameter. Each wedge shall be driven into the opening between the plain end and the bell end. Wedges may be omitted with use of Field Lok 350™ gaskets.
 2. Bolted Joints:
 - a. Remove rust preventive coatings from machined surfaces prior to assembly.
 - b. Thoroughly clean and carefully smooth all burrs and other defects from pipe ends, sockets, sleeves, housings and gaskets.
 3. Flanged Joints:
 - a. Insert the nuts and bolts (or studs), finger tighten, and progressively tighten diametrically opposite bolts uniformly around the flange to the proper tension.
 - b. Execute care when tightening joints to prevent undue strain upon valves, pumps, and other equipment.
 4. Mechanical Joints:
 - a. Thoroughly clean, with a wire brush, surfaces that will be in contact with the gaskets.
 - b. Lubricate the gasket, bell, and spigot.
 - c. Slip the gland and gasket, in that order, over the spigot and insert the spigot into the bell until properly seated.
 - d. Evenly seat the gasket in the bell at all points, center the spigot, and firmly press the gland against the gasket.

- e. Insert the bolts, install the nuts finger tight, and progressively tighten diametrically opposite nuts uniformly around the joint to the proper tension with a torque wrench.
 - f. The correct range of torque (as indicated by a torque wrench) and the length of wrench (if not a torque wrench) shall not exceed:
 - (1) Range of Torque: 60-90 Ft.-lbs.
 - (2) Length of Wrench: 10 inches.
 - g. If effective joint sealing is not attained at the maximum torque specified above, disassemble, thoroughly clean, and reassemble the joint. Do not overstress the bolts to tighten a leaking joint.
5. Bell and Spigot Joints:
- a. Thoroughly clean the bell and spigots and remove excess tar and other obstructions.
 - b. Apply a liberal coat of manufacturer supplied lubricant to both the gasket and the spigot end. Lubricant shall be appropriate for the pipe application.
 - c. Insert the spigot firmly into place and hold securely until the joint has been properly completed.
- E. Fabrication:
- 1. Tapped Connections:
 - a. Make all tapped connections where shown on the Drawings or where directed by the Engineer.
 - b. Make all connections watertight and of adequate strength to prevent pullout.
 - c. Drill and tap normal to the longitudinal axis of the pipe.
 - d. The maximum sizes of taps in pipes and fittings without busses shall not exceed the sizes listed in the appendix of ANSI A21.51 based on 3 full threads for cast iron and 2 full threads for ductile iron.
 - 2. Cutting:
 - a. Perform all cutting with machines having rolling wheel cutters or knives designed to cut cast or ductile iron. Do not use a hammer and chisel to cut pipe.
 - b. After cutting, examine all cut ends for possible cracks.
 - c. Carefully chamfer all cut ends to be used with push-on joints to prevent damage to gaskets when pipe is installed.
- F. Polyethylene encasement shall be installed in agreement with ANSI/AWWA C105/A21.5 and per manufacturers recommendations. Tube end shall be overlapped and secured with adhesive tape or plastic string. Repair any rips or defects prior to backfilling.
- G. Pipe Deflection:
- 1. Push-on and Mechanical Joints:

- a. The maximum permissible deflection of alignment at joints, in inches for 18 foot lengths:

<u>Size of Pipe</u>	<u>Push-On</u>	<u>Mechanical</u>
6	19	27
8	19	20
10	19	20
12	11	20
14	11	13.5
16	11	13.5
18	11	11
20	11	11
24	11	9

- b. The maximum permissible deflection for other lengths shall be in proportion of such lengths to 18 feet.
2. Flexible Joints: The maximum deflection in any direction shall not exceed the manufacturer's instructions and recommendations.
- H. Testing to be performed in accordance with the appropriate section of Section 02610 Pipe and Pipe Fittings – General.

END OF SECTION

HIGH DENSITY POLYETHYLENE (HDPE) PIPE AND FITTINGS

SECTION 02619HIGH DENSITY POLYETHYLENE (HDPE) PIPE AND FITTINGS

PART 1 GENERAL

1.01 SERVICE AND TYPE REQUIREMENTS

- A. High-density polyethylene (HDPE) will be allowed for use as potable water pipe.
- B. Except as otherwise specified or authorized, high density polyethylene pipe and fittings shall be of the type, grade, schedule, or pressure rating indicated on the Plans and as approved by the Engineer for its service function.

1.02 QUALITY ASSURANCE

- A. Provide all required manufacturer's certifications and test results in accordance with Section 01340 prior to delivery of the pipe on site.
- B. Provide all test results of the HDPE piping system prior to substantial completion of the Project.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Performance Pipe
- B. ISCO pipe
- C. Approved equal

2.02 MATERIALS

- A. WATER PIPE:
 - 1. Water pipe shall be high-density polyethylene (HDPE) DR-9 pressure class 250 pipe, color striped blue, and in conformance with requirements of AWWA C906 Standard for Polyethylene Pressure Pipe and Fittings for water distribution.
 - 2. HDPE pipe and fittings shall be made from resin meeting requirements of Plastic Pipe Institute (PPI) as **PE 4710** high density polyethylene meeting ASTM D3350 cell classification 445574C (formerly PE 3408 meeting 345464C per ASTM D3350-02). The material shall be listed and approved for potable water in accordance with NSF/ANSI 61. Materials shall meet ASTM D1248 Type III, Class C, Category 5, Grade P34 per ASTM D1248.

HIGH DENSITY POLYETHYLENE (HDPE) PIPE AND FITTINGS

3. Piping shall be manufactured in accordance with ASTM F 714. Provide manufacturer's certification that the piping has been tested in accordance with ASTM D 2837.

B. FITTINGS:

1. Butt fusion molded and fabricated fittings shall be pressure rated to match the system piping to which they are fused, and manufactured in accordance with ASTM D 3261.
2. Electro fusion couplings, adapters and fittings shall be designation DR 9 or better and shall be installed according to the manufacturer's instructions.
3. Provide factory fabricated dual containment fittings from the same manufacturer as the pipe materials.
4. Fittings shall have the same or higher pressure rating as the pipe.
5. The Drawings do not show all the fittings required and the Contractor shall provide all fittings required to complete the work, including electrofusion couplings.
6. Mechanical joint adapters shall be required for installation of mechanical joint valves, hydrants and metallic fittings. Mechanical joint adapters shall have same or higher rating, material designation and standards equivalent to HDPE pipe. Mechanical joint adapters shall have a stainless steel gland ring, gasket and attachment bolts and nuts. Mechanical joint adapters shall be equipped with stainless steel pipe stiffener insert or be one-piece, molded PE adapters with stainless steel retaining ring. Mechanical joint adapters shall be installed according to manufacturer's instructions.
7. Mechanical joints shall require SBR rubber gaskets.
8. At fittings and interfaces with difference pipe materials, mechanical joint restraint mechanism (Tie rod and clamp) shall be required in conjunction with concrete anchoring and thrust blocking. Mechanical joint restraint mechanism shall have epoxy coating or approved equivalent. Hardware shall be coated with blue fluorocarbon coating, 304 stainless steel or approved equivalent.
9. Mechanical joint restraint mechanism shall require pipe stiffener of sufficient length to support full bearing length of restrainer and prevent toe-in of pipe end. Pipe stiffener shall be made of T-304 stainless steel, 8 inches long, with reinforcing wedge. Pipe stiffener shall match DR designation of pipe on which it is to be used, and shall be installed according to manufacturer's instructions.

HIGH DENSITY POLYETHYLENE (HDPE) PIPE AND FITTINGS

10. For connecting HDPE pipe to ductile iron pipe or PVC pipe, connection shall be made by an adapter kit which includes HDPE bell mechanical joint fitting with stainless steel reinforcing collar, C-110 heavy body ductile iron gland ring, gasket and extra length T-bolts. Installation shall be made with mechanical joint restraining mechanism for ductile iron or PVC pipe. Adapter kit shall be installed according to manufacturer's instructions.

C. TRACER WIRE:

1. Tracer wire shall be designed specifically for detecting buried utilities. Tracer wire for open cut installation shall be minimum of 12 AWG copper wire, solid, coated with a blue colored minimum 30 mil high molecular weight polyethylene insulation (HDPE or LDPE).
2. Termination box shall be cathode protection test box. Termination box shall be 4 feet long, have shaft size of 4 inches inside diameter, body made of ABS plastic flared at bottom, with cast iron rim and flush fit drop-turn locking lid with words "WATER TEST" cast on top of lid. Non-conductive terminal board designed for minimum of two stainless steel terminal connections shall be attached to inside of lid.
3. If termination box is to be installed in paved area, termination box shall be installed within 7 inch diameter valve box. Valve box shall be minimum 4 feet long cast iron, screw type with arched base, with word "WATER" cast on top of lid.

PART 3 EXECUTION

3.01 PIPING DELIVERY AND STORAGE

- A. Piping delivered on site shall be clean, new, and bear the manufacturer's identification and SDR designation. Piping shall be unloaded and stored on site on pallets in accordance with the manufacturer's recommendations.
- B. Piping damaged en route to the site or during the unloading will be rejected and shall be removed from the site and replaced with new piping meeting specification.

3.02 INSTALLATION OF PIPING

A. GENERAL:

1. Lay out piping as shown on the Plans. Any deviation from the layout shown must be approved by the Engineer.

HIGH DENSITY POLYETHYLENE (HDPE) PIPE AND FITTINGS

2. Piping shall be cut from measurements taken at the site and not from the Plans. All necessary provisions shall be taken in laying out piping to provide for expansion and contraction.

B. INSPECTION OF PIPING:

1. Carefully inspect all pipe and fittings before installation, removing all dirt. The pipe should be installed with the markings up for visual inspection and verification.
2. All pipe shall have smooth exterior and interior surfaces, be first quality, be free from cracks, blisters, and other imperfections, and be true to shape or form throughout each length. Piping judged by the Engineer to be unacceptable shall be removed from the site and new undamaged pipe shall be provided at no extra cost to the Owner.
3. The interior of the pipeline shall be kept free from all dirt, joint material, and other foreign materials as the work progresses. Tight fitting stoppers or bulkheads shall be securely placed at the ends and any other openings of the pipe when work is stopped temporarily, or at the end of the days work to prevent dirt or trash from entering the pipe.

C. PIPE JOINTING:

1. Pipe joints and fittings shall be butt fused at 440°F or 500°F and shall be socket or sidewall fused at 500°F. Fusing shall be performed using manufacturer approved equipment and shall be in accordance with the manufacturer's recommendations. When shown on the Plans, piping shall be joined using the stainless steel repair clamps equivalent Dresser Style 364 with Viton or equivalent.
2. Flanged connections shall be completed with fabricated flange adapters and, convoluted stainless steel back-up rings on installations below ground, and epoxy coated carbon steel backup rings shall be used above grade. Use Viton full face gaskets or approved equal. All fasteners shall be Type 18-8 or Type 304 stainless steel below grade, and zinc plated steel above grade. Hot dipped galvanized fasteners are not permitted.
3. Protect below grade bolts and flanges by covering with 6-mil thick polyethylene wrap. Duct tape wrap to HDPE pipe.
4. Electrofusion couplings, where used, shall be installed per manufacturer's recommendations. The outside diameter of the HDPE pipe and face shall be prepared in accordance with the manufacturers recommendations prior to installing the coupler.

HIGH DENSITY POLYETHYLENE (HDPE) PIPE AND FITTINGS

D. CARRIER PIPE/FITTING SUPPORT SPACERS PLACEMENT

1. Support spacers shall be secured at a minimum of 4-foot intervals to align pipe for fusion welding adjacent to fittings and bends.

3.03 PIPE EMBEDMENT AND BACKFILL

- A. The HDPE pipe and fittings shall be installed in full compliance with the manufacturer's recommendations.
- B. The pipe shall be embedded with bedding, haunching, and initial backfill materials that provide stable and permanent support to the pipe. These materials shall be as shown on the Plans.
- C. Care should be taken to ensure that the haunching of the pipe is performed without disturbing the pipe. Initial backfill shall be placed in 6-inch layers and hand tamped to assure compaction.

3.04 TRACER WIRE INSTALLATION

- A. Tracer wire shall be installed along and above all HDPE water pipe. Tracer wire shall be installed in such manner as to enable its detection with electronic locating equipment. Tracer wire secured to water pipe with tape or plastic straps at 8 feet maximum intervals and at pipe bends. Tracer wire shall not be spiraled or otherwise wrapped around water pipe. At water service saddles, tracer wire shall be placed over and across water service saddle and water pipe. At valves, tracer wire shall be placed along the side of the water pipe so that the installation of a valve box will not damage the wire.
- B. Tracer wire shall begin and terminate at all connections to existing metallic water pipes wherever possible. Tracer wire connections to existing metallic pipes shall be made with thermite weld. Thermite weld shall be completely sealed with a brush applied coats of an approved bitumastic coating specifically manufactured for underground use.
- C. Route of tracer wire shall extend continuously along HDPE water pipe, and shall be terminated at tracer wire termination box located near hydrant. Termination box shall be installed flush with finished grade and approximately 3 feet away from any given hydrant. Tracer wire shall extend up termination box and be connected to terminal board. Length of tracer wire extending up termination box shall be such that minimum of 3 feet of tracer wire can be coiled up and left tucked inside termination box.
- D. Number of splices made on tracer wire shall be kept to a minimum. Splices shall be made using an approved waterproof connector. Where polyethylene (PE) water services are installed with PVC/PVCO/HDPE water pipe, tracer wire for PE water

HIGH DENSITY POLYETHYLENE (HDPE) PIPE AND FITTINGS

service shall be spliced to tracer wire for PVC/PVCO/HDPE water main pipe, using an approved splice connector that slips over the main tracer wire without cutting it.

- E. For directional drilling method of installing water main, Contractor shall attach tracer wire securely at beginning of pipe making sure wire will not become detached from pipe during drilling operation.
- F. After installation of tracer wire on mains and services has been completed, the Contractor shall test the tracer wire for electrical continuity. Upon successful completion of system test and submission of certification form to the Engineer, tracer wire system shall be checked for functionality by a representative of the Public Works Department. Deficiencies in the tracer wire system shall be repaired by Contractor at no additional cost to the Owner, and the tracer wire system shall be retested by Contractor.

3.05 CLEANING & TESTING

- A. Cleaning, disinfection, and pressure testing shall be done as specified in Section 02610 for potable water mains.

END OF SECTION

CORRUGATED POLYETHYLENE (CPE) PIPE & FITTINGS

SECTION 02625CORRUGATED POLYETHYLENE (CPE) PIPE & FITTINGSPART 1 - GENERAL1.1 DESCRIPTION

- A. Work Included: Furnish, install, anchor, support and test pipe and pipe fittings of the types and sizes in the locations shown on the Drawings and/or as directed by the Engineer.

1.2 QUALITY ASSURANCE

- A. Pipe shall be high density polyethylene (HDPE) conforming to the following standard referenced specifications:
 - 1. AASHTO M294
 - 2. ASTM: D1248 Polyethylene Extrusion Materials for Wire and Cable.
 - 3. ASTM D3350 Polyethylene Plastic Pipes and Fittings.
- B. Pipe and fittings shall be provided by a single manufacturer, and a certificate of compliance will be submitted to the Engineer for approval.

PART 2 - PRODUCTS2.1 MATERIALS

- A. General
 - 1. The prescribed sizes of pipes are nominal inside diameters. Pipes shall be of the size and length shown on the plans.
- B. Smooth Interior Corrugated Polyethylene Pipe
 - 1. The product supplied under this specification shall be high density polyethylene corrugated exterior/smooth interior pipe. 12 - to 36 - inch diameters shall conform to AASHTO M294 Type S. Forty-two and 48 - inch diameters shall have minimum pipe stiffness of 20 and 17 psi, respectively, at 5% deflection; and shall meet all other requirements of AASHTO M294.
 - 2. Material shall meet ASTM D1248 Type III, Category 4, Grade P33, Class C; or ASTM D3350 Cell Classification 324420C.
 - 3. Pipe shall be heavy duty corrugated polyethylene (PE) tubing, type SP.
 - 4. Perforated CPE perforated pipe shall have Class 2 perforations. The water inlet area shall be a minimum of 2.0 square inch per linear foot.

CORRUGATED POLYETHYLENE (CPE) PIPE & FITTINGS

C. Coupling Bands and Fittings

1. Coupling bands shall cover at least one full corrugation on each section of pipe. When gasketed coupling bands are required, the gasket shall be made of closed-cell synthetic expanded rubber meeting the requirements of ASTM D1056, Type 2. Gaskets shall be installed on the coupling band by the pipe manufacturer. All coupling bands shall meet or exceed the soil-tightness requirement of the AASHTO Standard Specification for Highway Bridges, section 23, paragraph 23.3.1.5.4(e).
2. Furnish fittings of approved equal to the pipe and having connection configurations identical to that of the pipe.
3. Pipe fittings shall conform to AASHTO M294.

D. Acceptable Manufacturers:

1. Hancor, Inc., Findlay Ohio
2. Advanced Drainage Systems, Columbus Ohio
3. Or equal.

PART 3 - EXECUTION3.1 TRANSPORTING, HANDLING AND STORING PIPE

A. Transporting

1. Care shall be taken during the transportation of the pipe in trucks and trailers so that it is not damaged from cuts and kinks.

B. Handling

1. The handling and lifting of pipe lengths and fittings shall be such as to avoid damage and shall be done by means of ropes, fabric or rubber protected slings and straps.
2. The pipe shall not be lifted by means of metal slings, chains, cables or hooks inserted into the pipe ends. Slings shall be positioned to prevent excessive flexing of the pipe lengths to avoid kinking or damage to the pipe.
3. The pipe lengths shall not be dragged from the transportation media or allowed to fall onto unprepared or rocky ground.
4. The handling of the joined pipeline shall be done in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects.
5. Sections of the pipes where cuts and gouges of the pipe wall are apparent shall be removed and the ends of the pipeline rejoined.

C. Storing

1. The stacking of the polyethylene pipe shall be limited to such a height as to not cause excessive deformation of the bottom layers of pipes under anticipated temperature conditions.
2. The surface where the pipe shall be stored shall be level and free of foreign objects which could damage the pipe.

CORRUGATED POLYETHYLENE (CPE) PIPE & FITTINGS

3. Where necessary due to ground conditions, the pipe shall be stored on wooden sleepers of sufficient bearing and spacing.
4. Pipe coils shall be laid flat on their flat side and not stacked.

3.2 INSTALLATION

- A. Installation shall be in accordance with manufacturer's recommendations and as shown on the drawings.
- B. Prior to backfilling, exercise extra care to maintain water level in open excavation below the pipe invert to avoid flotation of pipe already set to line and grade.
- C. Flared end sections shall be fully supported.
- D. Stones larger than 3 inches in diameter shall not contact the pipe, fittings or appurtenances.
- E. The polyethylene pipe shall be lifted and lowered into the trench with proper equipment and in such a manner to ensure that the pipe is not damaged or twisted.
- F. The pipe and fittings shall be laid with the perforations face down on the trench bottom.

3.3 INSPECTION AND CLEANING

- A. Inspect all drain pipes in the presence of the Owner and the Engineer. All pipes not demonstrating uniform slope and alignment shall be replaced at no additional cost to the Owner.

END OF SECTION

SECTION 02626
COPPER SERVICE PIPE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included: Furnish and install copper service pipe of the type and size and in the locations shown on the Drawings and as specified herein.

1.2 QUALITY ASSURANCE

- A. Seamless copper water tube, ASTM B88.

1.3 SUBMITTALS

- A. Submit manufacturer's literature, test reports, and certificates in accordance with the General Conditions and Section 01340 - Submittals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Type K, soft annealed, 3/4" (minimum) through 1".
- B. Type K, hard tempered, 1-1/4 inches and larger.
- C. All pipe shall have the manufacturer's trademark and type stamped on the pipe.

PART 3 - EXECUTION

- A. Install pipe from the new corporation stop to the new curb stop and connect to the existing service pipe.
- B. A "goose-neck" shall be placed in the pipe at the corporation stop as shown on the drawings.
- C. Place sand below, adjacent to, and above the pipe as shown on the drawings.
- D. Jointing:
 - 1. Compression Joint
 - a. Ream or file the pipe to remove burrs.
 - b. Slip compression nut over pipe and slide pipe into corporation.
 - c. Tighten compression nut.
 - d. Inspect for cracks, splits or other damages and replace if necessary.
 - 2. Adapters: Use as required to connect to existing services.
- E. Bending Pipe:
 - 1. Bend pipe with suitable tools and provide smooth bend free of any cracks or buckles.
- E. Testing:
 - 1. Services shall be installed after the water main has been successfully tested for leakage and bacteria.

END OF SECTION

SECTION 02630
COUPLINGS, CONNECTORS, CAPS & PLUGS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included: Furnish and install couplings and connectors of the type(s) and size(s) in the location(s) shown on the Drawings and as specified herein.
- B. Related Work Specified Elsewhere: "Pipe & Pipe Fittings - General" is specified in this Division.

1.2 QUALITY ASSURANCE

- A. Minimum pressure rating equal to that of the pipeline in which they are to be installed.
- B. Couplings and connectors, other than those specified herein, are subject to the Engineer's approval.
- C. Cap and plug shop drawing submissions must be accompanied by a manufacturer's written certification that the cap or plug will effectively and permanently seal the inactivated or abandoned utility.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All couplings and Connectors:
 - 1. Gasket Materials: Composition suitable for exposure to the liquids to be contained within the pipes.
 - 2. Diameters to properly fit the specific types of pipes on which couplings and connectors are to be installed.
- B. Sleeve Type Couplings (When Applicable):
 - 1. Exposed Couplings (When Applicable):
 - a. Steel middle ring,
 - b. Two steel follower rings,
 - c. Two wedge-section gaskets,
 - d. Sufficient steel bolts to properly compress the gaskets,
 - e. Acceptable Manufacturers:
 - (1) Dresser Manufacturing Co. - Style 38,
 - (2) Smith-Blair Inc. - Style 411,
 - (3) Or approved equal.
 - 2. Buried Couplings (When Applicable):
 - a. Cast or ductile iron middle rings with pipe stops removed,
 - b. Two malleable iron follower rings with ribbed construction,
 - c. Two wedge-section gaskets,

COUPLINGS, CONNECTORS, CAPS & PLUGS

- d. Sufficient galvanized steel bolts to properly compress the gaskets,
- e. Acceptable Manufacturers:
 - (1) Dresser Manufacturing Co.
 - (2) Smith-Blair Inc. - Style 411,
 - (3) Or approved equal.
- C. Split Type Couplings (When Applicable):
 - 1. Constructed from malleable or ductile iron.
 - 2. For use with grooved or shouldered end pipe with minimum wall thickness as required so as not to weaken pipe.
 - 3. Cast in two sections for 3/4 inch through 14 inch pipe sizes, four segments for 15 inch through 24 inch pipe sizes, and six segments for pipe sizes over 24 inch.
 - 4. Coating: Enamel.
 - 5. Bolts: Carbon steel.
 - 6. Acceptable Manufacturers:
 - a. Victaulic Company of America, Style 77,
 - b. Gustin-Bacon Co.,
 - c. Or approved equal.
- D. Flanged Adapters (When Applicable):
 - 1. For joining plain end or grooved end pipe to flanged pipes and fittings.
 - 2. Adapters shall conform in size and bolt hole placement to ANSI standards for steel and/or cast iron flanges 125 or 150 pound standard unless otherwise required for connections.
 - 3. Exposed Sleeve Type:
 - a. Constructed from steel.
 - b. Coating: Enamel.
 - c. Bolts: Carbon steel.
 - d. Acceptable Manufacturers:
 - (1) Dresser Manufacturing Co. - Style 128 for cast iron, ductile iron and steel pipes with diameters of 2 inches through 96 inches.
 - (2) Or approved equal.
 - 4. Buried Sleeve Type:
 - a. Constructed from cast iron.
 - b. Bolts: Galvanized steel.
 - c. Acceptable Manufacturers:
 - (1) Dresser Manufacturing Co. - Style 127 locking type for cast iron, ductile iron, asbestos cement and steel pipes with diameters of 3 inches through 12 inches.
 - (2) Or approved equal.
 - 5. Split Type:
 - a. Constructed from malleable or ductile iron.
 - b. For use with grooved or shouldered end pipe.
 - c. Coating: Enamel.

COUPLINGS, CONNECTORS, CAPS & PLUGS

- d. Acceptable Manufacturers:
 - (1) Victaulic Company of America - Style 741 for pipe diameters of 2 inches through 12 inches,
 - (2) Victaulic Company of America - Style 742 for pipe diameters of 14 inches through 16 inches,
 - (3) Or approved equal.
- E. Flexible Joints:
 - 1. Expansion Joints:
 - a. Materials shall be capable of withstanding the temperature, pressure and type of material in the pipeline.
 - b. Shall be the filled arch type that will prevent sediment build up for all sludge, sewage, and other lines with similar service.
 - c. Supplied with control rods to restrict elongation and compression.
 - d. Metal retaining rings shall be split and beveled galvanized steel for placement against the flange of the expansion joint.
 - 2. Deflection Joints:
 - a. Joints designed to permit a nominal maximum deflection of 15 degrees in all directions from the axis of the adjacent pipe length, will prevent pulling apart, and will remain watertight at any angle of deflection under 15 degrees.
 - b. Material to be manufactured from a composition material suitable for exposure to the liquid, pressure and temperature to be contained within the pipe.
 - c. Supplied with control rods as required.
- F. Caps and Plugs
 - 1. Cap and plug material shall be as indicated on the Drawings and shall be adaptable to the inactive or abandoned utility to be capped or plugged.

PART 3 - EXECUTION3.1 INSTALLATION

- A. Sleeve Type Couplings (When Applicable):
 - 1. Thoroughly clean pipe ends for a distance of 8 inches from the ends prior to installing couplings, and use soapy water as a gasket lubricant.
 - 2. Slip a follower ring and gasket (in that order) over each pipe and place the middle ring centered over the joint.
 - 3. Insert the other pipe length into the middle ring the proper distance.
 - 4. Press the gaskets and followers evenly and firmly into the middle ring flares.
 - 5. Insert the bolts, finger tighten and progressively tighten diametrically opposite bolts uniformly around the flange to the torque recommended by the manufacturer.
- B. Split Type Flange Adapters (When Applicable): Install in the same manner as Split Type Couplings.

COUPLINGS, CONNECTORS, CAPS & PLUGS

- C. Buried Couplings, Adapters and Connectors (When Applicable): Thoroughly coat all exterior surfaces, including nuts and bolts, after assembly and inspection by the Engineer with a heavy-bodied bituminous mastic as approved by the Engineer.
- D. Install thrust rods, supports and other provisions to properly support pipe weight and axial equipment loads.
- E. Install caps and plugs in accordance with manufacturer's recommendations to ensure a permanent seal of the inactive or abandoned utility.

END OF SECTION

SECTION 02641
RESILIENT-SEATED GATE VALVES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included: Furnish and install gate valves of the type(s) and size(s) and in the location(s) shown on the Drawings and as specified herein.

1.2 QUALITY ASSURANCE

- A. All gate valves of the same type and style shall be manufactured by one manufacturer.
- B. Meet or exceed AWWA 509 Resilient-Seated Gate Valves for Water and Sewerage Systems or AWWA C515 Reduced Wall Resilient Seated Gate Valves for Water Supply Service.
- C. Acceptable Manufacturers shall be specified by the local authority in their standards. If local standards do not exist, the following manufacturers shall be acceptable:
 - 1. Mueller
 - 2. Dresser
 - 3. Darling
 - 4. Clow
 - 5. Smith
 - 6. Or Equivalent

1.3 VALVE LOCATION AND USE

- A. As shown on the Drawings.
- B. Accessories: As shown and required for proper operation.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Waterworks type NRS valves (AWWA C509 or AWWA C515), with mechanical joints and all accessories including retainer gland.
 - 1. Iron body bronze mounted (IBBM), coated inside and out with fusion bonded epoxy (AWWA C550).
 - 2. Non rising stem (NRS).
 - 3. Resilient seat gate.
 - 4. End Connections: As shown on the Drawings and as required for pipe.
 - 5. Working pressure:
 - a. All sizes: 200 psi water.
 - b. Unless otherwise shown on the Drawings.
 - 6. Stem Sealing:
 - a. Rust-proofed bolting.
 - b. "O" ring design.

RESILIENT-SEATED GATE VALVES

- c. Capable of replacing under pressure with valve open.
- 7. Buried Valves:
 - a. Gate box required.
 - b. Sufficient quantity of tee-handle valve wrenches for operating valves of various depths.
 - c. 2 inch square operating nut, securely fastened to shaft.
- 8. Valve operation: Open by turning right-clockwise.
- 9. Arrow showing direction of opening plainly cast on valve bonnet.

PART 3 - EXECUTION3.1 INSTALLATION

- A. Buried Valves:
 - 1. Stem vertical
 - 2. Box vertical and centered over operating nut.
 - 3. Thrust blocks installed as shown on the Drawings.
 - 4. Gate box supported during backfilling and maintained.
 - 5. Gate box shall not transmit shock load or stress to valve.

END OF SECTION

SECTION 02642
CORPORATION STOPS

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. Work Included: Furnish and install corporation stops of the type(s) and size(s) and in the location(s) shown on the Drawings and as specified herein.
- B. Work Specified Elsewhere. This Section is not a stand-alone Section. Other requirements which relate to this Section are noted elsewhere in these documents. The Contractor and all Subcontractors are required to review this entire document along with the Drawings in an effort to identify all requirements.

1.2 REFERENCE STANDARDS

- A. ANSI/AWWA C800.

1.3 SUBMITTALS

- A. Submit manufacturer's literature, test reports, and certificates in accordance with the General Conditions and Section 01340 - Submittals.

1.4 DELIVERY, STORAGE & HANDLING

- A. Store to prevent damage and in accordance with manufacturer's instructions.

PART 2 -- PRODUCTS

2.1 MATERIALS

- A. Ball valve-type corporation with 300 psi rating.
- B. Shall conform to ANSI/AWWA C800, latest revision.
- C. Constructed of brass. Brass alloys not listed in ANSI/AWWA C800 Paragraph 4.1.2 are not approved.
- D. Shall be "lead free" as defined in the Safe Drinking Water Act, amended January 4, 2011. Specifically, fittings shall contain not more than a weighted average of 0.25% lead when used with respect to their wetted surfaces.
- E. Outlet shall have a compression pack joint (CPPJ) for Copper Tubing Size (CTS) O.D.
- F. Stainless steel insert stiffeners shall be used where CTS plastic tubing is specified
- G. Inlet shall have AWWA (cc) Tapered Pipe Threads.
- H. Acceptable Manufacturers:
 - 1. Mueller
 - 2. A. Y. McDonald
 - 3. Or equivalent

2.2 SUBSTITUTIONS

- A. Products of equal or better quality, function and performance may be proposed for substitution by following the procedures in Section 01630 – Substitution and Product Options.

PART 3 -- EXECUTION

3.1 INSTALLATION

- A. Install at locations shown on the Drawings and as specified in accordance with manufacturer's instructions.
- B. Service saddles shall be required for all service connections.
- C. Spiral-wrap completely the thread area with Teflon tape prior to insertion.
- D. Install corporation stops at the 2 and 10 o'clock positions on the pipe.
- E. A minimum of one and a maximum of three threads of the installed corporation stop must be showing outside the water main. Care shall be taken not to over-tighten the stops.
- F. Check and adjust all corporation stops for smooth operation.

3.2 TESTING

- A. All corporation stops must be installed prior to leakage testing of the water main.

END OF SECTION

SECTION 02644
HYDRANT ASSEMBLIES

PART 1 - GENERAL

1.1. DESCRIPTION

- A. Work Included: Furnish and install hydrant assemblies of the type(s) and size(s) and in the location(s) shown on the Drawings and as specified herein.
- B. Hydrant Assemblies consist of:
 - 1. Tee or anchor tee, according to Owner's Standards.
 - 2. Hydrant tee.
 - 3. 6 inch gate valve and valve box.
 - 4. 6 inch hydrant branch piping.
 - 5. Hydrant.
 - 6. Thrust blocking and retainer glands.

1.2 QUALITY ASSURANCE

- A. Hydrants shall conform to AWWA C502 and all hydrants shall be from one manufacturer.
- B. Hydrants shall comply with Factory Mutual Research Corporation and Underwriters' Laboratories UL246 Standard.
- C. Gate valves shall conform to AWWA C500.
- D. Acceptable Manufacturer:
 - 1. Kennedy Model K-81A or as approved by the City of Portsmouth Water Department.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Fire Hydrants:
 - 1. Dry barrel type with a 5-1/4 inch minimum valve opening.
 - 2. Two (2) 2-1/2 inch hose connections and one (1) 4-1/2 inch pumper connection.
 - a. 2-1/2 inch outlets: 60 degree V threads, 7-1/2 threads to the inch, external threads 3-1/16 inches, O.D. National Standard threads.
 - b. 4-1/2 inch outlet: 4 threads to the inch, external threads 5-3/4 inches, O.D. National Standard threads.
 - 3. 200 pounds working pressure and 400 pounds hydrostatic test pressure.
 - 4. Working parts shall be bronze and open RIGHT (clockwise). Operating nut shall open by turning to the RIGHT and be five-sided, 1 1/2 inch point to flat.
 - 5. Designed with standpipe breaking ring or breakable sections.

6. Supply one (1) collision repair kit for every twenty-five (25) hydrants installed.
7. Caps shall be attached to hydrant body by chains.
- B. Gate Valves: Waterworks type non-rising stem AWWA valve as specified in Section 02646-Valve Boxes.
- C. Valve Boxes:
 1. Cast or ductile iron, with the word "WATER" cast in covers.
 2. Be of such length as required without full extensions. Minimum lap 12 inches.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install hydrants as shown in the details and using manufacturer's written instructions.
- B. No hydrant assembly shall be backfilled until approved by the Engineer.
- C. Provide thrust blocks as shown.
- D. Provide barrel extensions as required for hydrant to be installed at proper grade at no additional cost to the Owner.
- E. Plug all drain openings with brass plugs.
- F. Provide finish paint on all exposed surfaces. Color must meet Owner's requirements.

3.2 CLEANING

- A. Clean all hydrants of concrete, etc. and repaint (Portsmouth standard) as necessary to the satisfaction of the Engineer and Owner.

END OF SECTION

SECTION 02646
VALVE BOXES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included: Furnish and install valve boxes of the type(s) and size(s) and in the location(s) shown on the Drawings and as specified herein.

1.2 QUALITY ASSURANCE

- A. All valve boxes shall be manufactured by one manufacturer.
- B. Qualifications of Manufacturer: Products to have been proven reliable in similar installations over a reasonable number of years.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. For valves 10 inches and smaller the valve box shall be cast iron, slip type two-piece integral base, with a top flange, 5-1/4 inch shaft.
- B. For valves 12 inches and larger the valve box shall be cast iron, slip type, three piece (separate base), with a top flange, 5-1/4 inch shaft.
- C. Cast or ductile iron, with the word "WATER" cast in covers.
- D. Acceptable Manufacturers:
 - 1. Mueller Co.
 - 2. Central Foundry Co.
 - 3. Clow.
 - 4. Or equivalent.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Installation as shown on the Drawings and/or as specified herein:
 - 1. When installation is complete, no pressure shall be exerted by valve box on the water main or on the valve.
 - 2. Be of such length as required without full extension. Minimum lap 12 inches.
 - 3. Install so cover is exactly level to 1/4 inch lower than pavement.

END OF SECTION

SECTION 02651
FINAL SEWER TESTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. All sewers, manholes, and appurtenant work, in order to be eligible for approval by the Engineer, shall be subjected to tests that will determine the degree of watertightness and horizontal and vertical alignment.
2. Final sewer testing work includes the performance of testing and inspecting each and every length of sewer pipe, pipe joints and each item of appurtenant construction.
3. Perform testing at a time approved by the Engineer, which may be during the construction operations, after completion of a substantial and convenient section of the work, or after the completion of all pipe laying operations.
4. Provide all labor, pumps, pipes, connections, gages, measuring devices and all other necessary apparatus to conduct tests.

PART 2 - PRODUCTS

(NOT PART OF THIS SECTION)

PART 3 - EXECUTION

3.1 PERFORMANCE

A. General:

1. Thoroughly clean all sewer lines to be tested, in a manner and to the extent acceptable to the Engineer, prior to initiating test procedures.
2. Perform all tests and inspections only under the direct observation of the Engineer and the plumbing or building inspector and in accordance with the requirements of the local and State plumbing codes.
3. Prior to construction, inform the Engineer of the planned sewer testing pattern.
4. Remedial Work:
 - a. Perform all work necessary to correct deficiencies discovered as a result of testing and/or inspections.
 - b. Completely retest all portions of the original construction on which remedial work has been performed.
 - c. Perform all remedial work and retesting in a manner and at a time approved by the Engineer at no additional cost to the Owner.

B. Line Acceptance Tests (Gravity sewers):

1. Test all gravity sewer lines for leakage by conducting a low pressure air test conforming to ASTM F1417 or Uni-B-6. Conduct all tests after the tees or saddles and service connections have been installed to the limit indicated on the Contract Drawings. Conduct all tests after backfilling the sewer line trenches and prior to any paving.
2. Equipment:
 - a. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected.
 - b. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.
 - c. All air used shall pass through a single central panel.
 - d. Connect 3 individual hoses:
 - (1) From the control panel to the pneumatic plugs for inflation,
 - (2) From the control panel to the sealed sewer line for introducing the low pressure air.
 - (3) From the sealed sewer line to the control panel for continually monitoring the air pressure rise in the sealed line.
 - e. All bypass pumping equipment needed to maintain main line flows for the entire test procedure.
3. Groundwater Conditions:
 - a. In areas where groundwater exists, and at the time of installing the sewer line, install a 1/2 inch diameter capped pipe nipple, approximately 10 inches long, through the manhole wall on top of one of the sewer lines entering the manhole.
 - b. Immediately prior to performing the line acceptance test, determine the height of groundwater by removing the groundwater test pipe cap, blowing air through the pipe nipple into the ground to clear it, and then connecting a clear plastic tube to the nipple.
 - c. Hold the tube vertically and measure the height in feet. Divide this height by 2.3 to establish the pounds of groundwater pressure to be added to the air pressure test readings. (Example: Height of water is 11-1/2 feet, added groundwater pressure is 5 psig, minimum air pressure is 3.5 psig; therefore, the total minimum acceptable pressure is 8.5 psig.)
4. Testing Pneumatic Plugs:
 - a. Seal test all pneumatic plugs prior to using them in the actual test.
 - b. Lay one length of pipe on the ground and seal both ends with the pneumatic plugs to be tested.
 - c. Pressurize the sealed pipe to 5 psig.
 - d. The pneumatic plugs are acceptable if they remain in place without bracing.

5. Testing Sewer Pipeline:

- a. After the sewer pipe has been cleaned and the pneumatic plugs checked, place the plugs in the sewer line at each manhole and inflate them.
- b. Introduce low pressure air into the sealed sewer pipeline until the air pressure reaches 4 psig greater than the average groundwater pressure.
- c. Allow a minimum of 2 minutes for the air pressure to stabilize to a minimum of 3.5 psig greater than the groundwater pressure.
- d. After the stabilization period, disconnect the air hose from the control panel to the air supply.
- e. The pipeline will be acceptable if the pressure decrease is not greater than 1/2 psig in the time stated in the following table.

TABLE 1

Pipe Diameter (inches)	Minimum Time (min)	Length for Min. Time (feet)	Time for Longer Lengths* (sec)
4	1:53	597	.190L
6	2:50	398	.427L
8	3:47	298	.760L
10	4:43	239	1.187L
12	5:50	199	1.709L
15	7:05	156	2.671L
18	8:30	133	3.846L
21	9:55	114	5.235L
24	11:20	99	6.837L
27	12:45	88	8.653L
30	14:10	80	10.683L
33	15:35	72	12.926L
36	17:00	66	15.384L

*Applies to pipe runs greater than those listed in column 3.
L = Actual length of pipe being tested.

6. Test Results:

- a. If the installation fails the low pressure air test, determine the source of leakage.
- b. Replace all defective materials and/or workmanship and repeat low pressure test at no additional cost to the Owner.
- c. Repairs shall only be made with prior approval of the Engineer in accordance with a method acceptable to the Engineer.

- C. Alignment Tests (Gravity Sewers):
1. Perform tests for the correctness of horizontal and vertical alignment on each and every length of gravity sewer pipeline between manholes.
 2. Beam a source of light, acceptable to the Engineer, through the pipe line and directly observe the light in the manhole at the opposite end of each test section.
- D. Deflection Tests:
1. Deflection test all PVC pipe.
 2. Perform test by using a deflectometer.
 3. Maximum deflection: 5 percent.
 4. Testing limits and test gauge diameter for plastic pipe:
 - a. Acceptance limit for deflection tests of installed flexible sewer pipe, listed in Table 2 shall be 5% of average inside diameter. A test shall be conducted after a minimum of thirty days following installation.

TABLE 2 - PVC Materials

D 3034	Solid Wall	4" - 15"
F 679	Solid Wall	18" - 36"
F 794	Ribbed Wall	18" - 48"
F 949	Corrugated	4" - 8"

- b. The deflection gauge diameter (G) for this test shall be determined by the following formula:

$$G = 0.95 D \text{ inches (nominal)}$$

where D is the average inside diameter given in the applicable ASTM standard. In the cases where inside diameters are not given they shall be determined by the following formula:

$$D = D' - 2(1.06 t) \text{ inches}$$

Where: t = the minimum solid wall thickness
 D' = the average outside diameter

- c. All PVC pipe is to be gauged and the results are to be recorded and the owner is to be provided written results.
- d. Limits of installed deflection for other flexible pipe materials shall not exceed the above for PVC.

- E. Force Main Test:
1. Pressure Test:
 - a. Perform testing in accordance with Section 5 of AWWA Standard C600, latest edition, at a pressure equal to 150 psi of the design operating total dynamic head.

- b. The section of pipe to be tested shall be filled with water of approved quality, and all air shall be expelled from the pipe. If blowoffs are not available at high points for releasing air the Contractor shall make the necessary excavations, backfilling and taps at such points and shall plug said holes after completion of the test.
 - c. The section under test shall be maintained full of water for a period of 24 hours prior to the combined pressure and leakage test being applied. Perform a pressure test for all other piping systems at 1-1/2 times maximum system pressure, or at the maximum working pressure of the piping system, or at a pressure indicated in the appropriate Sections of this Specification.
 - d. While maintaining this pressure, the Contractor shall make a leakage test by metering the flow of water into the pipe. If the average leakage during a two-hour period on buried pipelines exceeds a rate of 10 gallons per inch of diameter per 24 hours per mile of pipeline the section shall be considered as having failed the test. All pipes within structures and chambers and all flanged joints shall be no visible leakage.
 - e. If the section fails to pass the pressure and leakage test, the Contractor shall do everything necessary to locate, uncover, and repair or replace the defective pipe, fitting, or joint, all at his own expense and without extension of time for completion of the work. Additional tests and repairs shall be made until the section passes the specified test.
 - f. Tests shall be hydrostatic.
2. Connection to Work by Others
- a. If work involves connection of pipe lines to pipes or structures provided by others, pressure test pipe lines prior to making the connection.
 - b. After successfully passing the pipe line pressure test, make the necessary connections to the work by others, and pressure test the connection.
 - c. The connection shall be pressurized to the pipe line test pressure, for a minimum of 4 hours. The connection shall have no visible leakage.
 - d. Correct any leakage at no cost to the Owner and retest until connection passes.
3. Cleaning: Perform all specialized cleaning as specified or required by system

END OF SECTION

SECTION 02790
SYNTHETIC GRASS INFILL SYSTEM

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide all labor, materials, equipment and tools necessary for the complete installation of Synthetic Grass Infill System over a graded stone base as outlined in these specifications and in strict accordance with the manufacturer's written specifications with a specially formulated resilient infill of rounded sand and ambiently recycled rubber.
1. Excavation and placement of graded stone sub-base.
 2. A drainage system consisting of a flat drains and collector piping.
 3. A synthetic grass system with 2.25" to 2.5" long 100% polyethylene fibers, tufted on a 3/8" -3/4" tufting machine. A minimum of 10,800 denier monofilament yarn, and 10,000 denier low friction parallel slit film yarn specifically designed to reduce abrasion in AB tufting configuration if 3/8" gauge or a combination of minimum 5000 denier slit film and minimum 7200 denier monofilament in single needle stitching, with a fiber weight of not less than 46 ounces per square yard. The turf shall be of dual fiber construction with multi-structured monofilament and slit-film fibers tufted together in same needle stitching if 1/2" or 3/4" gauge, or AB tufting configuration if 3/8" gauge. The system shall include a single, dimensionally stable, two or three-component backing, and have a minimum of 20 ounces of urethane secondary backing per square yard and a total weight of 74 ounces per square yard. The finished product shall also include perforations (1/4" holes on 4" centers) to ensure maximum drainage. Systems that are tufted on larger than 3/4" gauge tufting machines, are not perforated or include any type of nylon fiber "thatch zone" shall not be acceptable.
- B. A resilient infill system, consisting of a course, rounded, uniformly sized silica sand and graded ambient SBR crumb rubber. (Minimum total weight of 7 lbs. per square foot with a 50/50 sand and rubber ratio – No Exceptions). Infill shall be installed to a minimum height of 2.0 inches providing no more than 1/2 inch exposed fiber.
- C. All turf systems should be considered "PFAS/PFOS free" according to REACH and PROP 65. Turf systems should be non-detect (ND) for 30 PFAS compounds tested via EPA Method 537 Modified and have a statement from the vendor that the turf does not contain and is not manufactured with PFAS/PFOA.

1. Or an Engineer approved equivalent.
- D. Alternate - Provide all labor, materials, equipment and tools necessary for the complete installation of Synthetic Grass Infill System over a graded stone base as outlined in these specifications and in strict accordance with the manufacturer's written specifications with a specially formulated resilient infill of rounded sand and ambiently recycled rubber.
1. Excavation and placement of graded stone sub-base.
 2. A drainage system consisting of a pre-fabricated Geocellular interlocking system and collector piping.
 3. A synthetic grass system with 1.75" long 100% polyethylene fibers, tufted on a 3/8" -3/4" tufting machine. A minimum of 10,800 denier monofilament yarn, and 10,000 denier low friction parallel slit film yarn specifically designed to reduce abrasion in AB tufting configuration if 3/8" gauge or a combination of minimum 5000 denier slit film and minimum 7200 denier monofilament in single needle stitching, with a fiber weight of not less than 46 ounces per square yard. The turf shall be of dual fiber construction with multi-structured monofilament and slit-film fibers tufted together in same needle stitching if 1/2" or 3/4" gauge, or AB tufting configuration if 3/8" gauge. The system shall include a single, dimensionally stable, two or three-component backing, and have a minimum of 20 ounces of urethane secondary backing per square yard and a total weight of 74 ounces per square yard. The finished product shall also include perforations (1/4" holes on 4" centers) to ensure maximum drainage. Systems that are tufted on larger than 3/4" gauge tufting machines, are not perforated or include any type of nylon fiber "thatch zone" shall not be acceptable. **(Alternate)**
 4. A resilient infill system, consisting of Envirofill (Minimum total weight of 7 lbs. per square foot) Infill shall be installed to a minimum height of 1 1/4 inches providing no more than 1/2 inch exposed fiber. **(Alternate)**
 5. A resilient infill system, consisting of Safeshell. (Minimum total weight of 1.5 lbs. per square foot) and raw rounded sand (Minimum total weight 5.0 lbs. per square foot) Infill shall be installed to a minimum height of 1 1/4 inches providing no more than 1/2 inch exposed fiber. **(Alternate)**
 6. The installation and operating performance of an athletic field synthetic base underlayment material needed for a synthetic turf field. Primary system requirements for insuring optimum safety of the playing surface (impact attenuation/surface playability) and high capacity subsurface drainage of the installed playing field. **(Alternate)**

7. All turf systems should be considered “PFAS/PFOS free” according to REACH and PROP 65. Turf systems should be non-detect (ND) for 30 PFAS compounds tested via EPA Method 537 Modified and have a statement from the vendor that the turf does not contain and is not manufactured with PFAS/PFOA.
8. Or an Engineer approved equivalent.

E. APPROVED MANUFACTURERS

1. Fieldturf
2. Sprinturf
3. Shaw Sports Turf
4. Act Global

1.02 QUALIFICATIONS AND SUBMITTALS

- A. Prospective Bidders and / or installers of the turf shall be required to comply with the following:
 1. The successful turf contractor must employ a Certified Sports Field Builder by the American Sports Builders Association (ASBA) who will be present at the site regularly throughout the project to supervise and inspect all phases, including subgrade verification of the synthetic turf field
 2. Contractor shall note, the successful turf contractor must be a member of the Synthetic Turf Council (STC), Sports Turf Managers Association (STMA), or American Sports Builders Association (ASBA). This requirement may be waived by the Owner should the successful bidder be able to prove they are competent and meet all other qualifications and bid submittal requirements as specified. The proof of qualifications is on the contractor.
 3. The turf contractor and / or the turf manufacturer must be experienced in the manufacture and installation of this specific type of sand and rubber infill and/or alternative synthetic grass system, for at least five (5) years and provide references of ten (10) specific installations in the last five (5) years.
 4. The turf manufacturer shall have a minimum of ten (10) installations in New England.
 5. The turf manufacturer shall have a minimum of Ten (10) game and/or practice fields installed for football or soccer.

6. The turf contractor and/or turf manufacturer must provide in-house competent workmen skilled in this specific type of synthetic grass installation with a minimum of 10 fields installed. The designated supervisory personnel on the project must be certified in writing by the turf manufacturer as competent in the installation of this material, including the gluing of seams and the proper installation of the infill mixture. The manufacturer shall have a representative on site to certify the installation and warranty compliance.
 7. All designs, marking, layouts, materials shall conform to current National Federation of High School (NFHS) rules and other standards that may be applicable to this type of synthetic grass installation unless there is a specific exception identified. Submit a full color rendering/drawing indicating all field markings for final approval prior to placing turf order. Failure to do so shall be at the contractors risk and cost.
- F. All bidders of the turf contract must submit to the Engineer the following information:
1. The Contractor shall submit to the Engineer, prior to the bid, a 1' x 1' minimum sample of the exact synthetic turf and infill system that is specified for this project. A sample of the Resilient Performance Base material shall also be submitted.
 2. The turf contractor / manufacturer shall submit with the bid, a sample copy of the material warranty demonstrating compliance with the warranty requirements.
 3. The turf contractor shall provide evidence - direct from the turf manufacturer corporate headquarters- that the installer is certified by the manufacturer to install this type of synthetic grass installation.
 4. Certified copies of independent (third-party) laboratory reports on ASTM tests as follows:
 - a. Pile Height, Face or Pile Weight & Total Fabric Weight, ASTM D418 or D5848
 - b. Primary & Secondary Backing Weights, ASTM D418 and D5848
 - c. Tuft Bind, ASTM D1335
 - d. Grab Tear Strength, ASTM D1682 or D5034
 - e. Infill Materials, ASTM F3188-16
 - f. Carpet backing and fibers, EPA Method 537Modified
 5. List of Ten (10) similar existing installations that have been installed in New England including, Owner representative and telephone number(s).

6. The Turf Contractor and Turf Manufacturer (if different from the company) shall provide evidence that their turf system does not violate any other manufacturer's patents, patents allowed or patents pending. Evidence shall be in the form of a written document stating such and signed by the Turf Manufacturers Corporate Headquarters.
 7. The Turf Contractor and Turf Manufacturer (if different from the company) shall provide a sample copy of insured, non-pro-rated warranty and NON-CANCELABLE warranty insurance policy with a policy minimum claim limits of at least \$350,000 and annual aggregate limit of at least \$10,000,000 in order to fully cover the full replacement of the turf system in the event of total failure.
 8. Letter stating the products anticipated lifespan.
 9. A letter and specifications sheet certifying that the products in this section meet or exceed specified requirements including certification from the turf manufacturer that lead or lead chromate, or PFAS/PFOS are not used in the manufacturing of the specified system. Including test results from the time the material leaves the plant indicating such.
 10. Warranty must cover full 100% of replacement value of total square footage installed. Minimum \$10.00 per square foot.
- G. The General Contractor / Site Contractor shall be defined as the contractor who is responsible for the construction of the site components related to and located beneath the turf product, inclusive of but not limited to all cuts and fills as needed to establish an approved subgrade, the dynamic stone drainage system, flat drain system, and the perimeter collection system. The turf supplier / installer is a subcontractor to the general contractor. The General Contractor / Site Contractor shall have installed a minimum of five (5) Turf Fields in the last three (3) years and shall provide documentation and contact information for such.

1.03SHOCK ATTENUATION EVALUATION:

- A. Near the completion of the turf, hire an independent testing laboratory to perform ten (10) in place G max tests in compliance with ASTM F1936 and F355. If any test results exceed 125, modify the infill material ratios as necessary to achieve satisfactory results. Perform additional testing to verify the results as required by the Owner's Representative.
- B. Guarantee: During the eight (8) year guarantee period, the G max rating shall remain less than 165. The Contractor shall contract with an independent testing laboratory to perform three (3) in place G max tests each on site during the first,

third, fifth, seventh and eighth years. If any test results meet or exceed 165, modify the infill material ratios as necessary to achieve satisfactory results. Perform additional testing to verify the results as required by the Architect. If the G max rating exceeds 165 after three attempts to repair the high rating, replace the field within 90 calendar days at no cost to the Owner.

1.04 PRE-INSTALLATION MEETING:

A. Convene One (1) Week After Bid Opening:

1. An interview shall take place at a time and date to be determined by the Engineer at the district office or other location determined by the Engineer and Owner. Present at this meeting shall be the Engineer, Owner's Representative(s), the Project Manager and Site Superintendent for the Prime Contractor and the Project Manager and Project Foreman for the Turf Installer. The purpose of this meeting will be to review turf product and installation means and methods, to interview and ascertain the experience and competence of the Turf Installer, as well as, the onsite Project Foreman for this project and to review the project schedule. The basis of choosing this particular product shall be in part due to the results of this interview process. Contractor shall submit all required submittals before this meeting.

B. Convene One (1) Week Prior to Stone Blanket Completion:

1. A second meeting shall take place at a location, time and date to be determined by the Engineer. Present at this meeting shall be the Engineer, Owner's Representative(s), and the Project Manager for the Site Contractor. The purpose of this meeting shall be to review and confirm schedule. (with particular attention on the turf installation) and to confirm that the turf product has been ordered by way of notarized copies of the original confirmed Purchase Order and guaranteed delivery date.

1.04 DELIVERY, STORAGE, AND INSTALLATION

A. Convene Deliver products to project site in wrapped condition.

B. Store products under cover and elevated above grade to limit any on site contamination of the material.

C. Protect all products and installation area from vandalism, theft, other construction, etc.

1.05 WARRANTIES

A. The Turf Manufacturer shall provide a Warranty to the Owner that covers defects

in materials and workmanship of the turf for a period of eight (8) years from the date of Substantial Completion. The turf manufacturer must verify that their onsite representative has inspected the installation and that the work conforms to the manufacturer's requirements. The turf fabric shall not lose more than an average 2% per year. The manufacturer shall guarantee the availability of replacement material for the synthetic turf system installed for the life of the warranty.

- B. The Manufacturer's Warranty shall include general wear and damage caused from UV degradation. The warranty shall specifically exclude vandalism, and acts of God beyond the control of the Owner or the manufacturer.
- C. The Turf Manufacturer's Warranty must be supported by an insurance policy of the full eight (8) year period.
- D. The Turf Contractor shall provide a Warranty to the Owner that covers defects in the installation workmanship, and further warrant that the installation was done in accordance with both the Manufactures' recommendations and any written directives of the Manufacturer's onsite representative.
- E. The synthetic grass turf must maintain an ASTM F355 and ASTM F1936 G-max between 125-165 for the life of the Warranty. Refer to 1.3, B.
- F. Any repairs or service to the field requested by the Owner or Owner's representative shall be addressed within 14 days from the date of written notification.
- G. The Turf Manufacturer shall be 100% responsible for and warranty all products installed as part of his system inclusive of the fibers whether the fibers are manufactured by the turf company or by others.

1.06 MAINTENANCE SERVICE

- A. The Turf Contractor will train the Owner's facility maintenance staff in the use of the specified maintenance attachments and equipment to routinely groom and sweep the field. Equipment shall be in good working condition.

1.07 ADA HANDICAP ACCESSIBLE

- A. Synthetic turf system shall be approved as ADA compliant as determined by Test-Method ASTM 1951-99.
- B. Proof of passing must be submitted for approval.

PART 2. PRODUCTS

2.01 BASE STONE AND DRAINAGE SYSTEM

Sieves	Base Stone-Type 1	Base Stone-Type 2	Finishing Stone
3"			
2"	100		
1 ½"	90-100		
1"	75-100	100	
¾"	65-95	90-100	
½"	55-85	80-100	100
⅜"	40-75	70-100	85-100
¼"	25-65	60-90	75-100
US#4	15-60	50-85	60-90
US#8	0-40	30-65	35-75
US#16	0-20	10-50	10-55
US#30	0-10	0-35	0-40
US#60	0-8	0-15	0-15
US#100	0-6	0-8	0-8
US#200	0-5	0-2	0-2

A. PLEASE NOTE THAT THE BASE STONE AND DRAINAGE STONE SYSTEM IS A SPECIAL MANUFACTURED PRODUCT AND ANY DEVIATION FROM THIS MATERIAL SHALL REQUIRE WRITTEN APPROVAL FROM THE TURF MANUFACTURER'S CORPORATE HEADQUARTERS. THE BASE STONE AND FINISHING STONE PRODUCT IS A 100% CLEANED WASHED QUARRY STONE MIXTURE. GRAVEL AND SAND MIX MATERIAL SHALL NOT BE ALLOWED (NO EXCEPTIONS)

B. RESTRICTIONS:

1. To ensure structural stability:
 - a. $D_{60}/D_{10} > 5$ and $1 < \frac{D_{30}^2}{D_{10}} < 3$
 - b. D_{10} D_{60} Fragmentation must be 100%.
2. To ensure separation of both stones:
 - a. D_{85} of finishing stone > 2
 - b. D_{15} of base stone and $3 < \frac{D_{50}^2}{D_{10}} < 6$
 - c. D_{50} of finishing stone
3. To ensure proper drainage:
 - a. Permeability of base stone > 50 in/hr (3.5×10^{-2} cm/sec)
 - b. Permeability of finishing stone > 10 in/hr (7.0×10^{-3} cm/sec)
 - c. Porosity of both stones $> 25\%$ (When stone is saturated and compacted to 95% Proctor.)

C. Perimeter Edge Concrete: Concrete curb (see Contract Drawings).

1. Perimeter Edge Rubber: Flexedge Rubber Baseball Divider Edge as supplied by Sportsedge or approved equal (see Contract Drawings).
2. Base: Model #SEFLEXBDC by:
SportsEdge®
259 Murdock Rd.
Troutman, NC 28166
P: 800-334-6057
info@sportsedge.com
www.sportsedge.com
3. COMPONENTS: Rubber Baseball Divider Curb for synthetic turf, shall be manufactured of 100% recycled rubber, and must meet the following criteria as the minimum standard:
 - a. Baseball Divider Curb:
 - i. 3" High x 5" Wide, 0.75" recess for flexible rubber insert
 - ii. Chamfered inside edge
 - iii. Manufactured of 100% recycled rubber
 - iv. Manufactured of 90% post-consumer content
 - b. Flexible Divider:
 - i. Polymer SBR/BR
 - ii. 2.25" overall height, 1.5" height above rubber curb
 - iii. Woven nylon polyester chord
 - iv. Hardness (Shore A) 60
 - v. UV inhibitors
 - c. Tubing:
 - i. 0.75" x 0.75" square aluminum tubing
 - ii. Interlocking doweled ends

iii. Pre-radiused as required

d. Accessories:

- i. 0.5" x 18" Anchor Pins, Steel w/ welded cap, part # SEFLEXA18
- ii. Bata Seal Adhesive, 11 oz., part # FLEXBST
- iii. UV Top Coat - 4 Liter, part # SEFLEXTC
- iv. 10" spike (nails)

C. Underdrain System

1. ADS AdvanEdge

- a. 1 inch by 12 inch flat drain.
- b. ADS AdvanEdge end connector with 4 inch ADS pipe.
- c. 12-18 inch diameter perforated collector drain pipe.
- d. 6 inch diameter solid wall HDPE cleanout with 8 inch by 8 inch by 8 gauge aluminum plate with synthetic surface glued directly to plate.

2. Approved equivalent.

D. Sub-Base System – Shock Pad (**Alternate**)

1. General Requirements – An impact energy absorbing sub-base drainage system designed specifically for use with synthetic turf is required. The quality of standard, design, and function of the Shock Pad is based on ProPlay-Sport20 manufactured by Schmitz Foam Products or engineer approved equal. The specified material must have physical, drainage and performance properties that meet the following requirements:

- a. Minimum material nominal thickness 0.79 inches or 20mm – material thickness must be within +/- 1.5mm
- b. Tensile strength >38 psi ASTM D 3575 (EN 12230)
- c. Compressive at 25% deflection 12 psi ASTM D 3575
- d. Compressive at 50% deflection 49 psi ASTM D 3575
- e. Water flow rate under 2 in (51 mm) hydraulic head 15 gpm/ft² ASTM D 4491 (EN ISO 11058)
- f. In-plane water flow rate at 0.3 psi (2 kPa) load and 0.005 hydraulic gradient (0.5% slope) 0.05 gpm/ft ASTM D 4716 (EN ISO 12958)
- g. Thermal conductivity [λ 10] 0.03 BTU/h.ft.°F ASTM C 177 (EN 12667)
- h. Surface system must provide maximum average Gmax of 110G's upon initial testing of installed field (ASTM F1936-10)
- i. Surface system must provide maximum average Gmax of field of 135G's during warranty period of artificial turf. (ASTM F1936-10)
- j. Resistance to Chemicals \leq 2 (ASTM F925)
- k. Resistance to Bacteria - no growth (ASTM G22)
- l. Resistance to Fungi – no growth (ASTM G21)

2.02 SYNTHETIC GRASS INFILL SYSTEM MATERIALS

A. Manufacturer: Subject to compliance with all specified requirements,

1. THE CONTRACTOR SHALL PROVIDE WITH HIS BID, IN THE BID FORM, THE SYNTHETIC GRASS INFILL SYSTEM MANUFACTURER AND SYSTEM HIS/HER BID IS BASED ON.

B. The Synthetic Grass Material and resilient infill shall be in strict accordance with the following:

1. The fiber shall be a 7,200 to 12,000 denier 260 micron minimum thickness monofilament, and 5,000-10,000 denier 100 micron minimum thickness parallel slit film 100% polyethylene, low-friction fiber, measuring not less than 2.25-2.5 inches high, as manufactured by Bonar Yarns & Fabrics, Tencate, Field Turf or ITS/Sprinturf. The low friction fiber shall be specifically designed to virtually eliminate abrasion. The fiber shall be a hybrid fiber combo with multi-structured monofilament and slit-film fibers tufted together in same or alternating needle construction per General specification part A-1-c.
2. The tufted fiber weight shall not be less than 46 ounces per square yard. The fiber shall be tufted on a 3/8" to 3/4" tufting machine. Tuft Bind strength shall be greater than 8 lbs. The Breakload shall be a minimum of 18 PSI per ASTM D 2256 and Elongation at Break shall be a minimum of 47% per ASTM D 2256. The overall product weight must not be less than 74 ounces per square yard. The low friction non-abrasive fiber shall be 100% polyethylene, treated with a UV inhibitor. The turf backing shall provide dimensional stability as specified by the manufacturer. Systems that use polyethylene/ polypropylene blended fibers and systems that include any type of nylon fibers are unacceptable.
3. The carpet shall be delivered in 15' wide rolls. The rolls shall be of sufficient length to go from edge of track to edge of track. Head seams will not be acceptable.
4. All field lines, numbers and markings indicated on the plans shall be permanently inlaid.
5. The fiber shall be Field Green/Rye Green in color to simulate natural grass as closely as possible and treated with UV inhibitor, guaranteed a minimum of eight (8) years.

6. The infill system shall consist of a non-compacting mixture of specifically graded, coarse, rounded, uniformly sized silica sand and coarse, ambiently recycled SBR crumb rubber. SBR rubber shall conform to all STC regulation standards for safety. The contractor shall submit to the engineer for approval all SBR product data inclusive of material size and content. Failure to do so shall be at the contractors risk and cost.

- a. Typ. Part. Size Distr. Typ. Part. Size Distr.
 *Mesh (ASTM E-11) *Mesh (ASTM E-11)

8	-----	8	-----
12	0.3%	10	Trace
16	57.8%	12	20%
20	32.6%	16	80%
30	5.1%	20	100%
40	-----	PAN	0%
50	-----		
PAN	0.4%		

- b. Minimum total weight of infill to be 7 lbs./square foot with a 50/50 sand and rubber ratio by weight. (NO EXCEPTIONS)
- c. *Represents the typical mean percentage (%) retained on individual sieves. Sand shall meet the following Particle Size Distribution:

Sieve Size Mesh	Min % Retained	Max % Retained
8	0	0
10	0	0
12	0	0.1
14	0	0.5
16	0	15
20	10	60
30	10	90
40	0	40
50	0	5
60	0	0.5
70	0	0.5
100	0	0.5
pan	0	0.5

Total – 50M <1

- d. Krumbein #must be \geq to 0.4.
- e. API Crush – 50M fines generation at 80 psig: \leq 0.4%.

7. The infill system shall consist of the following: **(Alternate)**

- a. The synthetic turf infill material shall be specifically designed and manufactured for athletic use. It shall be a rounded and highly uniform quartz sand pigmented and sealed with an acrylic polymer and have the following properties:
 - b. The silica sand shall have a Coefficient of Uniformity of ≤ 1.3 .
 - c. 98% of the particles retained on US standard sieves 12 through 20.
 - d. The coated particles shall be smooth to resist mounding and compaction and have an angle of repose of 30° or less.
 - e. The finished product shall be 100% coated, shall repel water, be non-flammable and have $<.001\%$ dust content.
 - f. When placed in the synthetic turf, the system shall have an Abrasion Index of 26 ± 2 .
 - g. Installed homogenously, without any additional infill materials.
 - h. A 16 year product warranty.
 - i. Color: Green
 - j. Product to be Envirofill ® manufactured by USGreentech, L.L.C. or approved equal.
8. The infill system shall consist of the following: **Alternate**
- a. The synthetic turf infill material shall be specifically designed and manufactured for athletic use.
 - b. It shall be a product consisting of organic walnut shells and have the following properties:
 - i. A proprietary blend of Black Walnut shells and English Walnut shells with 98% retained between the 8/20 sieves.
 - ii. Walnuts must be grown in the USA.
 - iii. The finished product shall be non-flammable
 - iv. Dust content must be $<.001\%$.
 - v. The allergen content must be below 2.5ppm as tested by an ISO-certified food grade laboratory.
 - c. Product to be Safeshell ® by USGreentech, L.L.C. or approved equal.

9. Turf Data

- a. Pile Weight: Min. 43 oz/sy for 2.25",
- b. Min. 46 oz/sy for 2.5"
- c. Face Yarn Type: 100% Polyethylene
- d. Yarn Size: Monofilament 7200-12,000 Denier (260 micron minimum thickness) Depending on gauge and tufting
- e. Slit Film: 5,000-10,000 Denier (100 micron minimum thickness) Depending on tufting

- f. Pile Height (Finished): 2.25-2.5" or **(1.75" – Alternate)**
- g. Color: Field Green/Rye Green
- h. Construction: Broadloom Tufted
- i. Stitch Rate: 10/3"
- j. Tufting Gauge: 3/8" to ½"
- k. Primary Backing: Woven and non-woven, fiber reinforced backing (three component system)
- l. Secondary Backing: 20 oz/sy Urethane
- m. Total Product Weight: 73 oz/sy (± 2 oz) Min.
- n. Finished Roll Width: 15'
- o. Finished Roll Length: Up to 220'
- p. Perforation (Outdoors): 3/16" Holes on Staggered 4" (approximate)
- q. Center Permeability: 20" ± Per Hour
- r. Turf contractor shall provide independent study data on permeability requirements
- s. Infill Composition: Rounded, Uniformly-Sized Silica Sand and Ambient SBR Rubber Mixture (50% rubber / 50% sand by weight)
- t. Infill Composition: **Alt.** Rounded, uniformly sand pigmented with acrylic polymer.
- u. Infill Composition: **Alt.** Organic, uniformly sized, Black Walnuts
- v. Field Lines & Markings: Tufted, Inlaid and Painted
- w. An Engineered approved equivalent.

PART 3 INSTALLATION

3.01 Subgrade / Subbase Approvals

- A. Prior to the installation of the Synthetic Grass Infill System, the General/Site Contractor shall provide written certification that all subgrade, subbase, and slopes and elevations are in compliance with the Contract Documents and meets or exceeds all manufacturer's requirements. This certification shall be prepared by an approved Installer. The finished grade of the subbase shall not vary more than 3/16" in ten (10) feet. A laser grader must be used to meet the requirements.
- B. Compaction requirements shall be in conformance with Section 02100 – Site Work and Section 02229 Backfill and Compaction.
- C. The General/Site Contractor shall also **provide an as-built survey of the finished subgrade with spot grades** every 25 feet on center each way for approval.
- D. The General/Site Contractor shall prepare a minimum **25'x25' (twenty five foot by twenty five foot) mock-up of the approved materials for the subbase** in order to evaluate porosity and stability prior to installing material over the entire field. If acceptable the mock-up may become part of the finished field.

3.02 Synthetic Grass Infill System

- A. Verification of Conditions (by Installer): Examine conditions under which synthetic grass surfacing is to be installed in coordination with Installer of materials and components specified in this Section and notify affected Prime Contractors and Architect in writing of any conditions detrimental to proper and timely installation. Do not proceed with installation until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.03 When Installer confirms conditions as acceptable to ensure proper and timely installation and to ensure requirements for applicable warranty or guarantee can be satisfied, submit to Architect written confirmation from applicable Installer. Failure to submit written confirmation and subsequent installation will be assumed to indicate conditions are acceptable to Installer.

3.04 Synthetic Grass Infill System: Provide manufacturer's inspection and certification that surface to receive synthetic turf is ready for installation of synthetic turf system, is perfectly clean in accordance with manufacturer's standards, and will be maintained in acceptable clean condition throughout installation.

- A. Installation: Install in strict accordance with manufacturer's written specifications and recommendations.

3.05 Unless otherwise recommended by turf and base manufacturer, lay turf loosely across field, stretched, and attached to perimeter edge detail with sufficient length to permit full cross-field installation without head or cross-seams. **(Head and cross-seams shall not be permitted)**

3.06 Unless otherwise recommended by the turf and base manufacturer, this shall be a 100% sewn installation. **(Gluing of seams shall not be permitted without authorization and warrantee from the turf manufacturer)**

3.07 Provide Infill material, as specified on site and applied/spread evenly with a large fertilizer type spreader (minimum six (6) foot wide) in strict accordance with manufacturer recommendations. Between each application of infill, the field area shall be brushed with a motorized rotary nylon broom. Minimum infill depth shall be 2.0 inches or 1.25" **(Alternate)** Comply with manufacturer's recommendations regarding environmental requirements for installation such as dryness and absence of moisture. Please note that prior to final approval of the field the Engineer shall perform field infill height measurements and also infill weight tests throughout the field to ensure the proper infill height and weight have been met. The infill weight tests shall include removing a square foot of material and weighing accordingly, in the presence of the turf manufacturer / turf installer, at 8 chosen areas throughout the field of play. Upon completion of the test, the turf manufacturer shall replace the extracted material accordingly. If it is deemed the proper infill weight is not in compliance with the contract documents, the turf manufacturer, at his/her cost, shall import and install

added infill material (in the presence of the Engineer) throughout the field until it has been deemed the infill weight is acceptable.

3.08 Field markings: Apply and install fixed markings as indicated herein and in accordance with the Contract Drawings. White lines shall be the primary color where conflicts with soccer lines occur.

- A. Football: All lines/markings shall be white.
- B. Soccer: All lines/markings shall be yellow.
- C. U12 Soccer: Tick marks/markings shall be inlaid yellow
- D. Boys Lacrosse: Tick marks/markings shall be inlaid blue.
- E. Girls Lacrosse: Tick marks/markings shall be inlaid light blue.
- F. All markings shall be tufted at the factory as much as practicable, other minor markings can be sheared/shaved or cut and glued.

3.09 Provide final cleaning of synthetic grass surfacing installations and maintain area clean and free from debris during installation. Clean surfaces, recesses, enclosures, and similar areas as required leaving area of installation in clean, immaculate condition ready for immediate occupancy and using by Owner.

3.10 Protect installed synthetic grass from subsequent construction operations. Do not permit traffic over unprotected surfacing.

3.11 The turf manufacturer shall provide training for the Owner's facility maintenance staff in use of grooming equipment recommended by the manufacturer.

3.12 Installation of Flexedge Rubber Baseball Divider Curb

- A. Install as recommended by the manufacturer, and as indicated on the drawings. The installing contractor shall ensure that the base is compacted and level to correct elevation.

PART 4 MAINTENANCE AND WARRANTY

4.01 The turf installer and/or the turf manufacturer must provide the following:

- A. The turf manufacturer shall provide a warranty to the Owner that covers defects in materials and workmanship of the turf for a period of eight years from the date of Substantial Completion. The turf manufacturer must verify that their on-site representative has inspected the installation and that the work conforms to the manufacturer's requirements. The polyethylene yarn manufacturer shall provide an eight (8) year "UV stabilization" warranty.
- B. The manufacturer's warranty shall include general wear and damage caused from UV degradation. The warranty shall specifically exclude vandalism, acts of War and acts of God beyond the control of the Owner of the manufacturer.

- C. The turf contractor shall provide a warranty to the owner that covers defects in the installation workmanship, and further warrant the installation was done in accordance with both the manufacturer's recommendations and any written directives of the manufacturer's on site representative.
- D. All turf warranties shall be limited to repair or replacement of the affected areas and shall include all necessary materials, labor, transportation costs, etc. to complete said repairs. All warranties are contingent on the full payment by the Owner of all pertinent invoices.

END OF SECTION

SECTION 02801
RECREATIONAL FIELDS SITE IMPROVEMENTS

PART 1 - GENERAL

- A. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Work Included:
 - 1. The work of this Section consists of all site improvements and related items as indicated on the Drawings and/or as specified herein and includes, but is not limited to, the following:
 - a. Pedestrian light fixture
 - b. Football Goal Post and Pad
 - c. Scoreboard
 - d. Port a John Shade Shelter
 - e. Bike Rack
 - f. Drinking Fountain
 - g. Storage Shed
 - h. Soccer Goal
 - i. Bleachers
- C. Related Sections
 - 1. Division 02100 – SITE WORK
 - 2. Section 03300 – CAST-IN-PLACE CONCRETE
 - 3. Section 02790 - SYNTHETIC GRASS INFILL SYSTEM
- D. Submittals:
 - 1. Contractor shall submit catalog information on site improvements for review by Owner's Representative.

PART 2 - PRODUCTS

- A. Light Fixtures and Accessories
 - 1. Pedestrian Light Fixture:
 - a. Model: Saturn Cutoff LED (SACL) as manufactured by Selux Corporation, www.selux.us, shall comply to University Design Standards or approved equal
 - b. Model: SACL-R5-1-LG4105-35-120. Color: Black

- c. Pole type: Single (1), Model: S35-12-BK, 3 ½” diameter straight steel pole—Round Straight Steel with aluminum die-cast fitter base secured to pole with Allen head set screws or approved equal. Color: Black.

2. Football Goal:

- a. Provide and install football goal posts in the locations shown on the Drawings and per manufacturer’s recommendations. Submit manufacturer’s product data and installation details for approval before ordering materials.
- b. Football goal posts shall be one of the following or Landscape Architect approved equal with Standard Yellow powder coated finish:
 - i. Model # GP-4380PL, “Football Goal Post – 6’ Offset”, as manufactured by SportsField Specialties, P.O. Box 231, 41155 St. Hwy 10, Delhi, NY 13753, (888) 975-3343 and supplied locally by Pioneer Athletics – pioneerathletics.com.
 - ii. Model # FBGP-520/FBP-520 – FBSLV8 “6’-7” Offset Goal Posts” with semi-permanent ground sleeve, as manufactured by Jaypro Sports, www.jaypro.com , supplied locally by Pioneer Athletics – pioneerathletics.com
 - iii. Model # SEF300, “6.5 Ft. Offset Football Goals”, as manufactured by Sports Edge, P.O. Box 837, Troutman, NC, 28166, (800) 334-6057. Ground sleeves Model No. SEF30005.
- c. Football Goal Support Post and Crossbar shall consist of 6 to 6 5/8-inch O.D. Schedule 40 aluminum gooseneck and cross bar, 4” Schedule 40 aluminum uprights, and 6-foot to 6 1/2-foot offset. Uprights to be 20-feet high. Finish to be powder coated white.
- d. Goal post shall be installed with galvanized hardware, set level and square, with ground sleeve embedded in a concrete footing 5’-6” deep by 3’ wide, according to the Detail. Ground sleeves to be galvanized steel.
- e. Top of concrete footing shall be 8” below finish grade. Measurement from finish grade to the top of crossbar shall be 10’-0”.
- f. All nuts and bolts should be firmly tightened and covered with heavy grease. Protect with heavy poly and wrap with tape.
- g. Football Goal Post Pads shall be manufactured by one of the following or Landscape Architect approved equal:
 - i. Model No Model No GP-4590RFULL, “Round Goal Post Pad, Fully Encapsulated”, as manufactured by SportsField Specialties,

P.O. Box 231, 41155 St. Hwy 10, Delhi, NY 13753, (888) 975-3343 and supplied locally by Pioneer Athletics.

ii. Model No PPP-800, “Football Goal Post Pads”, as manufactured by Jaypro Athletics, www.jaypro.com. and supplied locally by Pioneer Athletics.

iii. Model No SEF302, “Goal Post Pads” (entire coverage), as manufactured by Sports Edge, P.O. Box 837, Troutman, NC, 28166, (800) 334-6057.

h. Pads shall be for 6 to 6 1/2-inch O.D. posts, constructed of min. 5-inch thick cylindrical high-density polyurethane foam filler with rear cutout. Heavy coated vinyl cover shall completely enclose foam filler. Vinyl cover shall have full-length Velcro closure flap. Pads to be 6’ high. Color to be maroon with white vinyl lettering spelling “PORTSMOUTH” vertically on each goal post pad. Submit color sample for approval.

3. Scoreboards

- a. Model: Daktronics MS-2002 as manufactured by Daktronics, 274 Fruit St, Mansfield, MA 02048, 508-339-8113, info@scoreboardenterprises.com or approved equal.
- b. Painted Color of Choice – paint front, sides and rear all the same color
- c. Controlled with All Sport MX-1 (App Based Control) – no need for a control console – operated via SmartPhone
- d. 12V Horn Kit
- e. Border Striping
- f. Include stamped engineered drawing for supports and foundations
- g. Five Year Exchange Parts Warranty
- h. Three (3) Year onsite Labor Warranty
- i. 2’ x 16’ Sponsor/Field Name Sign – paint rear same as font

4. Port a John Shade Shelter

- a. Shade Structure shall be Model # PLE-HC2 as manufactured by The Polygon Park Architecture, 420 N. 136th Avenue, Holland, MI 49424, 800-354-7721, www.polygon.com, represented locally by Site Specific, P.O. Box 325, Rochester, MA. Cindy Maak, 1-508-763-0207 or approved equal. Note that new structure installations (as indicated on the drawings) shall be constructed on a cement concrete pad, eleven (11’) feet wide x nineteen (19’) feet in length and six (6”) inches in depth and reinforced with welded wire fabric as directed.
- b. Shade structure shall be furnished with the anchor attachment and concrete footings, such that each column is connected to each concrete footing in

conformance with manufacturer's recommendations. Contractor shall include footing and anchor information as part of the submittal application.

- c. Shade structure shall be furnished with a structural panel understanding seam roof (SPSS) and galvanized frame structure and associated components.
- d. Colors shall be determined through the shop drawing submittal application and approved by the owner and or owner's representative prior to fabrication and installation.
- e. Include stamped engineered drawing for supports and foundations

5. Bike racks

- a. The bike racks shall be "Cycle Sentry" series by Secure Site Design, LLC (www.securesitedesign.com) Model No. BRWS-101, or approved equal to be installed in concrete footings embedded/direct bury. Surface mounting will not be accepted. Receptacles shall be powder coated in standard color to be selected by Owner.

6. Drinking Water Fountain

- A. Fountains shall be Murdock-Super Secur M-43 or approved equal.
- B. Fountain plumbing shall be complete, for connection from the meter/backflow preventer, to drainage connections to drywell and 3/8 inch water service line.
- C. Shall be stainless steel finish.

Execution:

- a. Include all necessary transportation, shipping, handling and installation, per code requirements.
- b. Construct all piping, fittings, and couplings as necessary to extend/reconnect drinking fountain water and drain feeds.
- c. Test all equipment per Section 01450 of these Specifications

7. Storage Shed

- a. There is to be one storage shed purchased and installed on a concrete pad. The shed shall Be the 14 x 30 "Barn Garage B" manufactured by Jamaica Cottage Shop 866-297-3760 or approved equal and will be made of hemlock with 4x4 post and beam wall framing, double pine doors with a pressure treated ramp. Shed shall have a gabled standing seam metal roof. Siding shall be 1" rough sawn pine board and batten siding with rough sawn pine trim. Color as selected by Owner's Representative.

8. Soccer Goal:

- a. Provide and install all soccer goals in the locations shown on the Drawings and per manufacturer's recommendations. Submit manufacturer's product data and installation details for approval before ordering materials.
- b. Soccer goals shall be the following or Landscape Architect approved equal:
 - i. SGP-400 NOVA CLASSIC ROUND, as manufactured by Jaypro Athletics, www.jaypro.com. and supplied locally by Pioneer Athletics.
 - ii. Optional Wheel kit (CSGWK) shall be included.
 - iii. Optional Weighted Anchors (SGA-40) shall be included

9. Bleachers

- a. Shop drawings:
 - i. Layout of bleacher system to include dimensions, details, and finishes of components, accessories, and post foundations.
 - ii. Drawing/s to include engineers stamp certifying the bleacher system is in code compliance with all state regulations and meets manufacturer's structural requirements.
- b. Product data: Manufacturer's catalog cuts indicating material compliance and specified options.
- c. Bleacher systems shall be aluminum bleacher system by the following manufacturers or approved equal:
 - i. Model # NB-1030AVPADA from NRS- National Recreation Systems, PH: 888-568-9064 FAX: 260-482-7449 WWW.BLEACHERS.NET or approved equal.
- d. Bleacher features:
 - i. 10 row x 30' Non-Elevated Bleacher with (4) ADA seats
 - ii. Net seating capacity: 148 + 4 ADA seats
 - iii. Aluminum angle understructure
 - iv. 2 x 10 anodized aluminum seat plank
 - v. Double mill finish aluminum foot plank
 - vi. 1 x 6 riser rows 2 – 9, (2) 1 x 6 top row risers
 - vii. (1) 54" vertical aisle with mid aisle handrail
 - viii. Vertical picket guardrail fencing system
 - ix. 4 ADA seating
- e. Securely attach bleacher to concrete slab with galvanized hardware per manufacturer's instructions.

10. Execution

- a. Light Fixtures and Accessories shall be permanently installed in concrete anchorages unless otherwise indicated by manufacturer specifications. See Section 03 33 00 CAST-IN-PLACE CONCRETE for Bases and Anchorages.
- b. Sports Equipment shall be installed in accordance with the manufacturers requirements.
- c. Any site improvement materials which are constructed of steel and not galvanized or factory coated with a finish system shall be painted in the field in accordance with manufacturers requirements. Colors by Owner's Representative.
- d. All Sports Equipment shall be installed ready for use.

END OF SECTION

SECTION 02820

CHAIN LINK FENCE

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. The Contractor shall provide all labor, materials and appurtenances necessary for the installation of a complete chain link fence systems and shall meet or exceed the standards of the Chain Link Fence Manufacturer's Institute, New York, NY except as otherwise indicated on the Drawings and as herein specified.
- B. The manufacturer shall supply a complete hot dipped galvanized chain link fence system of the height, fabric type, fabric gauge, framework strength, and galvanized coating specifications contained herein. The manufacturer shall supply a total vinyl PVC coated chain link fence system of the height, fabric type, fabric gauge, framework strength, color and coating specifications contained herein. All fence materials unless specifically stated otherwise, shall be extrusion bonded polyvinyl chloride (PVC) coated.
- C. The Contractor shall provide all labor, materials and appurtenances necessary for the installation of a complete safety netting system and shall meet or exceed the standards indicated on the drawings and as herein specified.

1.02 RELATED WORK:

- A. Section 01340, SUBMITTALS
- B. Section 03300, CAST IN PLACE CONCRETE
- C. Section 02100, SITE WORK
- D. Section 03320 MOW CURB

1.03 REFERENCES:

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

American Society for Testing and Materials (ASTM)

ASTM	A53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM	A121	Zinc-Coated (Galvanized) Steel Barbed Wire
ASTM	A392	Zinc Coated Steel Chain Link Fence Fabric

ASTM	A123	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM	A153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM	F567	Installation of Chain Link Fence
ASTM	F626	Fence Fittings
ASTM	F668	Specification for Poly Vinyl Chloride (PVC) - Coated Steel Chain-Link Fence Fabric.
ASTM	F1043	Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework.

Federal Specifications (FS)

FS	RR-F-191	Fencing Wire and Post, Metal (and Gates, Chain-Link Fabric, and Accessories)
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1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

- A. Six sets of manufacturers literature of the materials specified herein shall be submitted to the Engineer for review.
- B. Six sets of shop drawings of the fence and safety netting shall be submitted to the Engineer for review.
- C. Stamped Engineered structural drawings for the safety netting system.

1.05 WARRANTY:

- A. Prior to installation, the fence contractor shall provide the fence manufacturer's notarized certification that all components are fully warranted by the manufacturer for 15 years against rust and corrosion.

PART 2 - PRODUCTS - PVC COATED

2.01 STEEL FRAMEWORK (GENERAL):

- A. All posts, gate frames, braces and horizontal rails shall be Type I round post, hot dipped galvanized with a minimum average coating of 1.8 oz/ft², meeting ASTM F 1083 for Standard Weight Galvanized Pipe and shall be of the sizes and weights given below or other approved equivalent sections of steel having a minimum tensile strength of 50,000 pounds per square inch and a minimum yield strength of 25,000 pounds per square inch.

- B. Minimum cross-section dimensions for line posts of specified shape shall be: either 2-3/8-inch (2.375-inch) outside diameter steel pipe weighing not less than 3.65 pounds per linear foot; or 2.25 by 1.95 by 9/64-inch steel H section weighing not less than 4.10 pounds per linear foot.
- C. Minimum cross-section dimensions for end, corner, and pull posts of specified shape shall be: 2-7/8-in. (2.875-in.) outside diameter steel pipe weighing not less than 5.79 pounds per linear foot; 2-1/2 by 2-1/2-inch square tubes weighing not less than 5.70 pounds per linear foot; or 3-1/2 by 3-1/2-inch rolled-formed sections weighing not less than 8.14 pounds per linear foot.
- D. All tubular and pipe posts shall be capped to prevent precipitation from entering the post, unless a barbed wire extension arm assembly acts as a cap.
- E. Posts, other fence framework, accessories, fittings, and miscellaneous items shall be galvanized and have an extrusion bonded polyvinyl chloride (PVC) coating. The PVC coating on posts shall be a minimum of 10 mils thick. Framework color coating shall match fabric. Galvanized finish shall have not less than the following weight of zinc per square foot:
1. Pipe: 1.8 oz, complying with ASTM A53.
 2. H-sections and square tubing: 2.0 oz, complying with ASTM A123.
 3. Hardware and accessories: Comply with Table I of ASTM A153.
- F. For top railings and top, middle and bottom braces between terminal posts and adjacent line posts, the minimum cross-section dimensions for the specified shall be 1-5/8-inch outside diameter steel pipe weighing not less than 2.26 pounds per linear foot.
- G. Diagonal truss braces between terminal and adjacent line posts and for gauge framework shall not be less than either 3/8-inch diameter steel rod or double No. 9 AWG steel wire stranded together.
- H. Fittings shall be galvanized press steel, malleable or cast steel as specified in ASTM F626 and Federal Specification RR-F-191.
- I. Where posts do not have provisions for weaving fence fabric to posts, tension or stretcher bars for attaching fabric to terminal posts such as end, corner, gauge and pull posts, shall be flat bar with nominal dimensions no less than 3/16 by 3/4-inch for use with fence fabric having mesh larger than 1-inch, of a length equal to full height of the fence fabric, and used with bar bands, bolts and nuts. Bar bands shall be no thinner than No. 11 gauge coated sheet steel. Bolt diameters shall be not less than 3/8-inch for use with bar bands.
- J. 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 ½" wide bands, with a minimum breaking strength of 850 lbs., ½" band capacity ear-loct design buckles to be manufactured with 0.050" thick material, 201/301 series stainless steel.

2.02 CHAIN LINK FENCE FABRIC – PVC COATED:

- A. Vinyl coated fabric shall be supplied with Class 2A (extrusion bonded) vinyl coating. The coating shall be applied over a galvanized steel core wire and be manufactured in accordance with Federal Specifications RR-F-191 and ASTM F668. The PVC coating shall have a final coating thickness of 0.015-0.025-inch and a core wire size diameter of 0.148-inch.
- B. Wire size: The finished wire size shall be 6 gauge.
- C. Height and Mesh Size: The fabric height shall be 4' & 6' feet high with a mesh size of 2-inches.
- D. Selvage: Top edge and bottom edge of the fabric shall be knuckled for 4' fence height and twisted for 6' height.
- E. The tension wires shall either be No. 9 gauge steel-core wire. PVC coating shall conform to ASTM F668 Class 2a or 2b. Also, a 7-strand galvanized steel ½-inch guy wire with PVC coating may be supplied.
- F. The polyvinyl chloride (PVC) coating shall be free of voids, shall be dense and impervious, shall be of a plasticized or epoxy modified, high specific gravity polyvinyl chloride with high resistance to tear and suitable hardness. The PVC coating shall not support combustion and shall withstand an accelerated aging and weathering test a minimum of 2,000 hours at 145 degrees F with ultraviolet and salt spray without cracking or peeling the PVC coating and without corrosion of the base metal. The PVC coating shall withstand a mandrel bending test of ten times the thickness of the base metal at minus 25 degrees F without cracking. The PVC coating shall not separate from the metal or shrink. Color used in PVC coating shall be stabilized so that it will not fade under long exposure to sunlight. Color shall be approved by the Engineer as selected from the manufacturer's standard colors.

2.03 SWING GATES – PVC COATED:

- A. Gate leaf frames shall be amply braced and trussed for rigidity. Truss rods shall be adjustable. Gate leaf framework shall be pipe or other approved suitable cross-section of the size recommended by the fencing manufacturer for the size of gate leaf, but shall be no smaller than 2-inch outside diameter steel pipe weighing not less than 2.72 pounds per linear foot. If bolted or riveted corner fittings are not used, the gate frame shall have the corrosion-resistant finish applied after welding.

- B. Gates, gate posts, fabric and associated hardware shall be thermally coated with PVC, 10 mils thick, to match the fence.
- C. Gate hinges shall be 180 degree, heavy pattern, of adequate strength for the gate size, with large bearing surfaces for clamping or bolting in position, and with hinge action such that the gates may be opened and closed easily.
- D. Gates shall be provided with accessible, suitable latches and provisions for padlocking as indicated on the details.
- E. Double leaf gates shall have center bolts and center stops. Unless indicated otherwise on the drawings, the gates shall have automatic backstops to hold the leaves in open position.
- F. For gate openings, up to and including 12-feet, with double leaf gates, minimum cross-section dimensions for the gate posts of specified shape shall be the same as specified above for end posts.
- G. For gate openings larger than 12 feet, the minimum outside diameter for the gate posts shall be 6-5/8-inches, weighing not less than 18.97 pounds per linear foot.

2.04 SAFETY NETTING

A. Safety Netting

1. Model #TFBSS630P-SG, 6.625" O.D., 6" schedule 40 aluminum straight pole ball stopper system with standard coated black pole finish. Model TFBSS-NET-ULTRACROSS, 4 ply ultra-cross dyneema knotless UHMWPE netting, 1 3/4" square mesh with sewn rope binding on perimeter edges as manufactured by Sportsfield Specialties, Inc., 41155 State Highway 10, PO Box 231, Delhi, NY 13753, 1-888-3343, www.sportsfieldspecialties.com or approved equal from Aluminum Athletic Equipment (AAE) or Sportsedge.
2. Contractor to provide engineered stamped drawings for approval.

2.05 CHAIN LINK SLATTING:

- A. Fence slatting is to be extruded high density virgin polyethylene, containing color pigmentation and U.V. inhibitors to resist the effects of ultraviolet radiation from sunlight and extend the colorfastness of the materials for a minimum of 15 years service without visible degradation as manufactured by the PDS Fence Products, Yakima, WA; or approved equal.
- B. Slats are to be of flat tubular shape with a profile depth of 0.312-inch (5/16-inch) and a wall thickness of .020-inch. The slat width shall be as required for the size of wire mesh being used. The slat height shall be fabricated 3-1/2-inches shorter than the overall fence height specified. Fence slats shall be installed using the self-locking horizontal bottom channel system.

- C. The color of the slats shall be selected by the Engineer from samples submitted by the Contractor prior to the start of the fence installation.
- D. The manufacturer of the slats must provide a 15-year limited warranty against either color fading or breakage of slats and locking channel used under normal climatic extremes.
- E. Install in locations as shown on the Contract documents.

PART 3 - EXECUTION

3.01 FENCE ERECTION:

- 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. Maximum post spacing shall be 10-feet. Post spacing shall be uniform and posts shall be plumb. All end, corner, pull and gate posts must be set in concrete. Line posts may be secured by driven blades.
- C. Concrete post foundations in earth shall be concrete cylinders with a minimum diameter of 18-inches, crowned at grade to shed water, and shall extend not less than 3.5-feet into the ground. Posts shall be set in the full depth of the foundations except for 3-inches of concrete under the posts. If foundation holes are excavated in unsuitable material, the Engineer shall be notified for determination of suitable construction precautions.
- D. If solid rock is encountered without an overburden of soil, poles shall be set into the rock a minimum depth of 12-inches for line posts and 18-inches for terminal posts, such as end, corner, gate and pull posts, and grouted into solid rock with the post hole diameter a minimum of one inch larger than that of the post.
- E. Where solid rock is covered by an overburden of soil or loose rock, the posts shall be set into the rock as specified above. The total pole setting depth shall not exceed the depths required for setting in earth.
- F. Any change in direction of fence line of 30 degrees or more shall be considered as a corner. Pull posts shall be used at all abrupt changes in grade. Maximum area of unbraced fence shall not exceed 1,500 square feet.
- G. Terminal posts such as end, corner, gate and pull posts shall be braced to the adjacent post(s) with horizontal rail braces used as compression members and diagonal truss braces with truss tighteners for tension members, with the lower ends at the terminal post in each panel of fence framework as indicated in detail on drawings.

- H. The top railing shall pass through intermediate or line post tops, form a continuous brace with all splices made by approved couplings, and shall be fastened to terminal posts.
- I. Fabric shall be stretched taut, with the bottom edge following the finished 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.
- J. 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).
- J. The bottom tension wire shall be interlaced in the weave of the fabric, pulled taut and fastened to terminal posts.

3.02 SAFETY NETTING ERECTION:

A. Safety Netting

- (1.) The Contractor shall layout the Safety Netting and place wood stakes as required at post locations and then notify the Owner's Representative that the unit has been laid out. It shall be the Contractor's responsibility to offset the stakes installed by his Engineer and take extreme care not to disturb these stakes before incorporating them into his work. Layout shall include setting of wood stakes at each post location in the field.
- (2.) The Contractor shall excavate for proposed post footings and shall inspect the excavation to ensure that surrounding areas of footing are stable and holding vertically.
- (3.) Pour footings against undisturbed subsoil and onto compacted bottom of void. Set posts plumb and to the proper heights for assembly and place foundations.
- (4.) Allow footings to cure sufficiently prior to assembly of netting, and brace and stay all posts sufficiently until curing is adequate.
- (5.) Under mow curbs, pitch tops of footings one (1) inch away from posts.
- (6.) Backfill and compact in no greater than eight (8) inch layers around footings.

END OF SECTION

SECTION 02930

TREES AND LANDSCAPING

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This Section includes furnishing all labor, materials, equipment, plants, and incidental materials necessary to perform all operations related to the planting of all trees and for all appurtenant work, complete in place, maintained, and accepted, in accordance with the Contract Drawings and Specifications.
- 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 plant materials, as part of the work of this contract.

1.02 RELATED WORK:

- A. Section 02329, LOAM BORROW & TOPSOIL
- B. Section 02290, SEEDING

1.03 SUBMITTALS:

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

- A. Prior to planting, State nursery inspection certificates for all plant materials shall be submitted to the Engineer for review.
- B. Samples and six copies of the manufacturer's product data, as applicable, shall be submitted to the Engineer for review and approval for the following materials:
 - 1. Limestone.
 - 2. Fertilizer.
 - 3. Humus.
 - 4. Organic Compost.
 - 5. Mulch.
 - 6. Guying and Staking Apparatus.

7. Herbicides.

PART 2 - PRODUCTS

2.01 PLANT MATERIALS:

- A. The Contractor shall furnish and plant all plant materials as shown on the plans and in the quantities and sizes listed thereon. No substitutions shall be permitted without the written approval of the Engineer.
- B. Plants larger than those specified in the Plant List may be used if approved by the Engineer. However, use of such oversized plants shall not be considered grounds for any increase in the contract price. If the use of larger plants is approved, the required spread of roots or ball of earth shall be increased in proportion to the size of the plant and plant pits shall be increased as necessary.
- C. All plants shall be certified to have passed all required Federal and State inspection laws requiring ensuring freedom from plant diseases and insect infestations. The Contractor shall obtain clearance from applicable governing agencies, as required by law, before planting any plants delivered from outside the state in which they are to be planted.
- D. All plants shall be nursery-grown under climatic conditions and environmental stresses similar to those in the locality of the project. All plants shall originate from nurseries that are no more than one Hardiness Zone higher (as established by the Arnold Arboretum, Jamaica Plain, MA or the USDA) than where the plant is to be installed. Plants also shall conform to the botanical names and standards of size, culture, and quality for the highest grades and standards as adopted by the American Association of Nurserymen, Inc. in the American Standard for Nursery Stock, ANSI-Z60.1, latest edition. All plants shall be legibly tagged with their proper botanical name.
- E. No heeled-in plants or plants from cold storage shall be used. All plants shall be typical of their species or variety and shall have a normal habit of growth. Plants shall be sound, healthy, and vigorous, well branched and densely foliated when in leaf; shall be free of disease, insects, eggs or larvae; and shall have healthy, well-developed root systems. All parts of the plant shall be moist and shall show active green cambium when cut.
- F. All nursery plants shall be balled and burlapped or container-grown and shall have been acclimatized for at least one growing season. Container-grown stock shall have been grown in a container long enough for the root system to have developed sufficiently to hold its soil together, firm and whole, after removal from the container. No plants shall be loose in the container. Container-grown plants shall have no girdling roots and shall not be in a root-bound condition. Plants shall remain in their container until planted.

- G. Care shall be exercised in digging and preparing field-grown plants for shipment and planting. Balled and burlapped materials shall have solid unbroken balls of earth of sufficient size to encompass all fibrous feeding roots necessary to ensure successful recovery and development of the plants. Balls shall be firmly wrapped in untreated biodegradable burlap and tied securely with wire cages and/or jute twine. Roots or balls of plants shall be adequately protected at all times from sun and drying winds. No plant shall be accepted when the ball of earth surrounding its roots has been badly cracked or broken preparatory to or during planting, or after the burlap, staves, wire cage, rope, or platform in connection with its transplanting have been removed. Soil characteristics (i.e., composition, texture, pH, etc.) of all field-grown plants shall closely match those of the soil where plant materials are to be planted.
- H. The height of the trees, measured from the crown of the roots to the top of the top branch, shall not be less than the minimum size designated in the Plant List in the Drawings. The branching height for deciduous trees installed adjacent to or within walks shall be 7 feet minimum, having been pruned to this height at least 1 year prior to transplanting. Except when a clump is designated, the trunk of each tree shall be a single trunk growing from a single, unmutilated crown of roots. No part of the trunk shall be conspicuously crooked as compared with normal trees of the same variety. The trunk shall be free from sunscald, frost cracks, or wounds resulting from abrasions, fire, or other causes. All pruning cuts shall comply with acceptable horticultural practices. No pruning wounds having a diameter of more than 1½-inches shall be present. Any such wounds must show vigorous bark growth on all edges. Evergreen trees shall be branched to within 1 foot of the ground. No tree that has had its leader cut or die shall be accepted.
- I. Caliper measurements for tree trunks shall be taken 6-inches above ground for trees up to and including 4-inch caliper size and at 12-inches above ground for larger sizes.
- J. Plants shall be delivered only after preparations for planting have been completed. Plants shall be handled and packed in a horticulturally approved manner and all necessary precautions shall be taken to ensure that plants arrive on-site in a healthy vigorous condition. Trucks used for transporting plants shall be equipped with covers to protect plants from windburn, desiccation, and overheating during transport. Plants that have not been thoroughly watered shall not be accepted at the planting site. Any plants delivered to the site in a dry or wilted condition shall be rejected and replaced at no expense to the Owner. All plant materials shall be protected, watered and otherwise maintained prior to, during, and upon delivery to the site.
- M. Plants shall be subject to inspection and approval by the Engineer at the place of growth, or upon delivery, for conformity to specification requirements as to quality, size, variety, and condition. Inspection and selection of plants before digging shall be at the option of the Engineer. The Contractor, or his representative, shall be present, if requested by the Engineer, for inspection of plants at the Nursery. Such approval shall not impair the right of inspection and rejection upon delivery at the site or during the progress of work, for size and condition of balls and roots, disease, insects and latent

defects or injuries. Rejected plants shall be removed immediately from the site. Certificates of inspection of plant materials shall be furnished as may be required by Federal, State and other authorities to accompany shipments.

2.02 LOAM BORROW:

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

2.03 SOIL ADDITIVES AND AMENDMENTS:

A. 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.

B. 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. Fertilizer for tree, shrub and groundcover plantings shall contain all major plant nutrients and minor trace elements essential to sustain plant growth and shall have the following analysis:

Nitrogen (N)	Phosphorous (P)	Potassium (K)
10%	10%	10%

3. As approved by the Engineer, a slow release root contact fertilizer installed at the time of planting, may be used in place of the above, at the discretion of the Contractor.

C. Organic Compost- see specification section 02910- Loam Borrow (Re-Used), or Topsoil (New Import).

2.04 PLANTING MIXTURE:

Planting mix shall consist of 7 parts loam borrow and 1 part organic compost, and humus, thoroughly blended.

2.05 WATER:

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 furnished by the Contractor, at no additional cost to the Owner.

2.06 MULCH:

Mulch shall be fibrous pliable shredded softbark mulch, not exceeding ½-inch in width. It shall be 98 percent organic matter with a pH range between 3.5 and 4.5 and a moisture content not to exceed 35 percent. It shall be free of weeds, weed seeds, debris, and other materials harmful to plant growth and viability. Organic mulch shall be aged no longer than 2 years. Color shall be natural brown.

2.07 MATERIALS FOR STAKING, GUYING, AND WRAPPING:

- A. Tree stakes shall be sound, untreated 2 x 3 (nominal) x 8-foot length Douglas Fir reasonably free of knots. No paint or stain shall be used in conjunction with tree stakes. Tying material shall be flexible braided nylon webbing, ¾-inch wide and have a tensile strength of 900 pounds. Webbing shall be ‘ArborTie’, or approved equal.
- B. Drive anchors and guy wire assemblies shall be suitable for protecting trees and shall be sized in accordance with the manufacturer’s recommendations. No materials shall be used for guying that will girdle, chafe, or otherwise injure trees.

2.08 TREE PAINT:

Tree paint shall not be used.

2.09 ANTI-TRANSPIRANT/ANTI-DESICCANT:

Anti-transpirant or anti-desiccant shall be ‘Wilt-Pruf’, as manufactured by Nursery Specialty Products, Inc., Groton Falls, NY, or approved equal. It shall be delivered in original sealed manufacturer's containers and used in accordance with the manufacturer's instructions.

2.10 HERBICIDES:

- A. No herbicides shall be used on-site without the Contractor notifying and obtaining prior approval of the Engineer.

- B. Herbicides shall be EPA registered and approved for use in public open spaces. All herbicide shall be handled by State licensed applicators only, delivered in the original sealed manufacturer's containers, and used in accordance with the manufacturer's instructions.
- C. Herbicide for post-emergent application shall be glyphosate contact, 'Roundup', as manufactured by Monsanto, Inc., or approved equal.
- D. Herbicide use shall be limited and selective, only to control specific weed infestations that have been identified by the Contractor or the Owner's Representative.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. All plants shall be subject to inspection and approval by the Engineer upon delivery to the site. No materials shall be planted until approval is received.
- B. All work shall be performed by skilled workers with a minimum of 2 years planting experience, in accordance with accepted horticultural/nursery practices, under the full-time supervision of a Certified Nurseryman or Arborist.
- C. All balled and burlapped plants that cannot be planted immediately upon delivery shall be set on the ground and the root balls shall be well protected with soil, wet moss, or other acceptable material. All foliage shall be protected and covered with perforated shade materials.
- D. The planting season for evergreen trees shall extend from the time the soil becomes workable in the spring until new growth appears, and from September 15 until November 30 in the fall. Deciduous trees shall be planted only when dormant, either prior to bud break and/or before leaves appear in the spring, or subsequent to their leaf drop in the fall. Ground covers shall be planted only after the last frost in the spring through mid-May. Planting season periods may be extended if weather and soil conditions permit only with the written approval of the Engineer. Extended or out-of-season planting requirements shall include application of antitranspirant and extra water as needed. Plant guarantee periods shall remain as stated below. Planting shall not be permitted in frozen ground.
- E. All plant locations and outlines for planting beds shall be staked out for review and potential adjustment by the Engineer before any excavation is begun. In the event that rock, underground construction work or obstructions are encountered in any proposed planting pit or bed, the Engineer may select alternate locations. Where locations cannot be changed, the obstruction shall be removed, subject to the Engineer's approval, to a depth of not less than 3 feet below grade and not less than 6-inches below the bottom of the root ball when plant is properly set at the required grade. Removal of boulders or

obstructions greater than 1 cubic yard in size shall be subject to approval and will be paid for by the Owner. No ledge will be removed to create planting pits or beds

- F. All planting pits shall be excavated with sloped walls, wider at the top than at the bottom, and scarified to eliminate glazing. Tree pits shall be at least 2 times greater in diameter than the root ball of earth or root system. Shrub pits shall be at least 1 foot greater than the diameter of the root ball. Planting pits shall not be deeper than the height of the root ball.
- G. When excavation occurs in areas of heavily compacted earth, stones, concrete chunks or other foreign matter, pits shall be dug at least 3 times the width of the rootball. Excavated material from plant pits shall be disposed of as required.
- H. Container plants shall be removed from their growing container before planting. If roots are densely matted, the outer root mass shall be scored, sliced vertically, with a sharp knife to separate roots. All herbaceous plants and groundcovers shall be evenly spaced to produce a uniform effect and staggered in rows at intervals designated on the contract drawings.
- I. Trees shall be set in the center of planting pits, plumb and straight, and at such a level that after settlement the crown of the roots (root flare) will be 1-inch above the surrounding finished grade. Root ball masses shall not be loosened, broken or damaged. When balled and burlapped plants are set, planting mixture shall be compacted around bases of balls to fill all voids. All tying materials, twine and rope shall be cut and removed. Biodegradable burlap shall be laid back or cut away from the top and sides of the ball. If a wire basket is present, the basket shall be cut away and removed from the top and sides. Roots or bare root plants shall be properly spread out and planting mixture carefully worked in among them. Broken or frayed roots shall be cleanly cut.
- J. Backfill plant pits with planting mixture in layers of not more than 9-inches and firmly tamp each layer and water to sufficiently settle the backfilled soil before the next layer is put in place. When the planting pit is 2/3 backfilled, the hole shall be flooded and watered thoroughly so that the water level reaches the top of the planting pit. Allow water to soak in, then complete the backfilling operation. Immediately after planting pit is backfilled, a shallow basin 3-inches deep and slightly larger than the pit shall be formed with a ridge of soil for water retention. Form a common basin for plant materials throughout mass planting beds. After planting, lightly till the soil in planting beds between planting pits and rake smooth to eliminate compaction of soils.
- K. All planting hole basins shall be flooded with water twice within the first 24 hours of planting, and watered not less than twice per week until final acceptance of the work.
- L. Stake trees immediately after planting as detailed. All staking apparatus shall be adequate to hold the tree in a vertical position under severe weather conditions. All

staking apparatus and tree trunk wrapping shall be removed and disposed of off-site by the Contractor at the end of one growing season.

- M. Immediately after planting and staking operations are complete, all plant pit basins and plant beds shall be covered with approved mulch to the depths designated on the plans. Mulch shall not contact tree bark, cover tree root flares, or shrub crowns. No mulch shall be applied prior to the first watering.
- N. The pruning of trees shall only be permitted to remove dead or dying branch limbs and tips, sucker growth, water sprouts, crossing or rubbing branches, broken or damaged branches, diseased or insect infested limbs, and to preserve the natural character of the plant. Plant materials shall be pruned in accordance with American Nurserymen Association Standards and as required by the Engineer. Questionable weak limbs and branch removals that may disfigure the plant shall be left to the discretion of the Engineer. The tree leader shall never be permitted to be cut. Pruning shall be done with clean, sharp tools. All large pruning cuts that are ½-inch in diameter or larger shall be made along the bark branch ridge. Pruning cuts shall not breach or otherwise interfere with the branch collar. All pruning cuts less than ¼-inch diameter shall be made with hand pruners as close to the main stem as possible without damaging the cambium or bud. Tree paint shall not be used to cover pruning cuts.
- O. As the work proceeds, the Contractor shall remove all debris from the site, including but not limited to branches, rock, paper, and rubbish. All areas shall be kept clean, neat and in an orderly condition at all times. Prior to final acceptance, the Contractor shall cleanup the entire area to the satisfaction of the Engineer.

3.02 MAINTENANCE:

- A. Maintenance shall begin immediately after each plant is planted and shall continue until completion of the guarantee period and final acceptance of the project. Plants shall be watered, pruned, sprayed, fertilized, cultivated and otherwise maintained and protected. Tree guys and stakes shall be tightened and repaired. Defective work shall be corrected as soon as possible after it becomes apparent and weather and season permit.
- B. Settled plants shall be reset to proper grade and position, planting pits and common basins restored, and dead materials removed and replaced. Planting beds and individual basins shall be neat in appearance, maintained to their original layout lines and kept free of weeds. Mulch shall be replaced as required to maintain proper depths.
- C. Contractor shall make arrangements to provide sufficient water to maintain all trees, until final acceptance. Plants shall be sprayed with anti-transpirant or anti-desiccant if required by seasonal conditions or as required by the Engineer.
- D. Planting areas shall be protected against trespass and damage of any kind during the maintenance period. This shall include the furnishing and installation of approved temporary fencing if necessary. If any plants become damaged during the maintenance

period, they shall be treated or replaced as required by the Engineer at no additional cost to the Owner.

3.03 INSPECTION AND PRELIMINARY ACCEPTANCE:

- A. 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.
- B. Inspection and acceptance of plantings 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.

3.04 GUARANTEE:

- A. All plant materials shall be guaranteed for a period of one year after the date of completion of the specified maintenance period and preliminary acceptance of the project by the Owner.
- 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. Plants shall be healthy, free of pests and disease. Plants shall exhibit vigorous growth, shall bear foliage of normal density, size and color and shall have no less than seventy-five percent (75%) of their branches alive at the end of the guarantee period. If the leader of any single-leader species is dead, the entire plant shall be considered dead.
- D. Any plant required under this Contract that is dead or unsatisfactory, as determined by the Engineer, shall be removed from the site. These shall be replaced as soon as weather permits during the specified planting season, at no additional cost to the Owner, until the plants live through one year.
- E. All replacements shall be plants of the same kind and size as specified on the Plant List. They shall be furnished and planted as specified above.
- F. The guarantee of all replacement plants shall extend for an additional one-year period from the date of their acceptance as replacement.
- G. Guarantee shall not apply to the replacement of unacceptable plants 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.

- H. 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.

3.05 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

Scope of Work

Furnish, install and test all concrete work and appurtenant work in complete accordance with the Drawings and Specifications.

Contractor's Duties

Except as specifically noted, provide and pay for all labor, materials, equipment, tools, machinery, water, heat, other facilities and services necessary for proper execution and completion of the work.

Contents of Division

<u>Section No.</u>	<u>Section Title</u>
03000	Concrete – General
03010	Concrete Testing
03100	Concrete Formwork
03200	Concrete Reinforcement
03300	Cast-in-Place Concrete & Flowable Fill
03305	Concrete Cradles, Arches, Encasements & Thrust Blocks
03320	Mow Curb

SECTION 03000

CONCRETE - GENERAL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included: Furnish and install all concrete work of the type(s) and size(s) and in the locations shown on the Drawings and as specified herein.

1.2 QUALITY ASSURANCE

- A. Testing:
 - 1. Have tests conducted as specified in the Concrete Testing Section of these specifications.
 - 2. Perform all concrete work in accordance with the latest ACT Code and Manual.

1.3 SUBMITTALS TO THE ENGINEER

- A. Shop Drawings:
 - 1. Submit shop drawings in accordance with the General Conditions of the Construction Contract.
 - 2. Submit schedules and detailed setting diagrams for all reinforcing steel.
 - 3. Submit copies of test results on all aggregates and on all mix design proportions for concrete strengths specified in this Division.
- B. Informational Data:
 - 1. Have informational data available on the site at all times as a standard of reference when applicable.
 - 2. Informational data shall consist of the latest edition of the P.C.A. Manual of Concrete Mix Design.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle materials to prevent damage of any nature.
- B. Store cement in undamaged condition with seals and labels intact as packaged by the manufacturer.
- C. Store cement in weathertight bins or buildings and keep cement dry at all times.
- D. Store aggregate in separate piles or bins and handle in a manner that will minimize segregation and prevent contamination.
- E. Protect anchors, ties, reinforcement and other hardware from the elements.

1.5 JOB CONDITIONS

- A. Wet Weather Protection:
 - 1 Do not place concrete during rain, sleet, or snow unless adequate protection is provided.

2. Do not allow rain water or other weather conditions to damage the surface finish.
- B. Cold Weather Protection:
 1. Do not place concrete in an ambient air temperature below 40 degrees F.
 2. When Work must be performed in temperatures below 40 degrees F, make approved provisions for heating materials and the completed work in accordance with A.C.I. 306.
 3. The minimum temperature of concrete as placed shall be 50 degrees F.
- C. Hot Weather Protection:
 1. During hot weather conditions, place concrete in accordance with A.C.I. 305.
 2. Place concrete at a temperature which will not cause difficulty from loss of slump, flash set, or cold joints, usually somewhat less than 90 degrees F.
- D. Metal Protection: Paint metal to be in contact with mortar, concrete or other masonry materials with alkali-resistant coatings, such as heavy bodied bituminous paint.

PART 2- PRODUCTS

2.1 MATERIALS

- A. Materials are specified in the appropriate sections of these Specifications.

PART 3- EXECUTION

3.1 ACCEPTANCE OF STRUCTURE

- A. Work which meets all applicable requirements will be accepted without qualification.
- B. Work which fails to meet one or more requirements, but which has been repaired to bring it into compliance, will be accepted without qualification.
- C. Work which fails to meet one or more requirements and which cannot be brought into compliance may be accepted or rejected, as determined by the Engineer.

Concrete failing to meet the strength requirements as stated in these Specifications may require additional curing as directed by the Engineer. Modifications may be required in the concrete mix design for the remaining concrete work, at no additional cost to the Owner.
- E. Formed surfaces larger or smaller than dimensional tolerances specified may be rejected. If the Engineer permits the Contractor to correct errors, such corrections shall be as directed and in such a manner as to maintain the strength, function and appearance of the structure.

- F. Concrete members cast in the wrong location may be rejected and shall be removed at no additional cost to the Owner.
- G. Inaccurately formed surfaces exposed to view may be rejected and shall be repaired or removed at no additional cost to the Owner.
- H. Finished flatwork exceeding specified tolerances may be repaired by grinding high spots or patching low spots with an approved epoxy grout.
- I. Concrete exposed to view with defects which adversely affect the appearance of the Specified finish may be repaired, if possible. If, in the opinion of the Engineer, the defects cannot be repaired, the concrete shall be removed and replaced at no additional cost the Owner.
- J. The strength of the structures in place will be considered potentially defective if it fails to comply with any of the following requirements:
 - 1. Low concrete strength as evaluated by the requirements of these Specifications.
 - 2. Reinforcing steel size, quantity, strength, position or arrangement at variance with the Drawings.
 - 3. Concrete which differs from the required dimensions or locations in such a manner as to reduce the strength.

END OF SECTION

SECTION 03010
CONCRETE TESTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included: Perform all testing of concrete as specified herein and as directed by the Engineer.

1.2 QUALITY ASSURANCE

- A. Have all testing conducted by an independent testing laboratory approved in writing by the Engineer.
- B. ASTM Requirements:
 - 1. Curing Test Cylinders: ASTM C31/C31M - 03.
 - 2. Slump Testing: ASTM C143/C143M - 03.
 - 3. Air Content Testing: ASTM C231 - 03.
 - 4. Core Testing: ASTM C42/C42M - 03.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Concrete materials are specified in the appropriate Sections in these Specifications.

PART 3 - EXECUTION

3.1 PERFORMANCE

- A. Test Cylinders:
 - 1. Have 4 standard test cylinders made and cured for each 50 cubic yards, or fraction thereof, of each type of concrete placed in any one day.
 - 2. Have 2 cylinders tested after 7 days, and 2 cylinders tested after 28 days.
 - 3. The necessity of breaking cylinders at intermediate periods will be determined by the testing laboratory.
- B. Slump Tests:
 - 1. Have tests for slump made at the place of deposit.
 - 2. Have 1 slump test made for each 50 cubic yards of each type of concrete placed in any one day. Have at least 1 slump test made for each concrete pour.
 - 3. Have more frequent slump tests made if, in the opinion of the Engineer, the concrete delivered does not appear to be consistent.
- C. Air Content:
 - 1. Have 1 air content test made for each 50 cubic yards of each type of concrete placed in any one day. Have at least 1 air content test made for each concrete pour.

D. Changes of Materials:

1. Have the above specified tests made for each change of materials and mix proportions.
2. Make test occasioned by changes of materials and mix proportions at no additional cost to the Owner.

E. Disputes:

1. Have additional tests necessary to resolve disputes made only by the designated independent testing laboratory.
2. If the work or materials are found to be deficient, testing shall be at no additional cost to the Owner.
3. If the work or materials are found to be satisfactory, testing will be paid by the Owner.

3.2 EVALUATION OF STRUCTURES

A. Concrete Strength: The strength of the concrete shall be considered satisfactory if the average of any 5 consecutive strength tests of the laboratory cured specimens representing each strength of concrete is equal to or greater than the specified strength, and if not more than 10 percent of the strength tests have values less than the specified strength, and no single test has a value more than 500 psi below the specified strength.

B. Additional Tests:

1. Impact hammers, sonoscopes, or other non-destructive testing devices may be used, if approved by the Engineer, to determine relative strengths of various areas of the structure, and as an aid in evaluating concrete strength in place or in determining locations of areas to be cored. Test results, so obtained, shall be used as a basis for acceptance or rejection only if these results are properly calibrated and correlated with other test data.
2. When required by the Engineer, have core tests conducted.
3. Have cores tested saturated-surface-dry if the concrete they represent will be wet at any time during the use of the completed structure. Have cores tested air-dry if the concrete they represent will be dry at all times during the use of the completed structure. The laboratory report shall state whether the cores were tested saturated-surface-dry or air-dry.
4. Have at least 3 cores taken from each potentially deficient area. Locations will be determined by the Engineer. Damaged cores may be replaced.
5. The strength of the cores from the concrete from each member or area shall be considered satisfactory if their average is equal to or greater than 90 percent of the specified strength, and no single core is less than 80% of the specified strength.
6. Plug holes solid with 2:1 grout.

END OF SECTION

SECTION 03100
CONCRETE FORMWORK

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included: Furnish and erect formwork to provide concrete of the size(s) and in the location(s) shown on the Drawings and specified herein.

1.2 QUALITY ASSURANCE

- A. Formwork Design:
 - 1. A.C.I. 347
 - 2. Wind loads: As specified by local building codes.
- B. Earth Cut Forms: Do not use earth cuts as forms for vertical surfaces.
- C. Allowable Tolerances:
 - 1. Construct forms so that the concrete surfaces conform to the tolerances stated in A.C.I. 347.
 - 2. The maximum deflection of facing materials reflected in concrete surfaces exposed to view shall be 1/240 of the span between structural members.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Form Accessories:
 - 1. Provide commercially manufactured types of form accessories to be partially or completely embedded in the concrete, such as ties and hangers. Non-fabricated wire is not acceptable. Furnish and install form ties with a water seal in walls which will withstand a hydrostatic head.
 - 2. The portion of accessories remaining within the concrete shall leave no metal within 1 inch of the surface when concrete is exposed to view.
 - 3. Spreader cones on ties shall not exceed 1 inch in diameter.
 - 4. Furnish and install removable thru-wall ties with suitable plugs tested to withstand a hydrostatic head of at least two times the hydrostatic head in the structure.

PART 3 - EXECUTION

3.1 FABRICATION

- A. Construct moldings or chamfer strips in the corners of column, beam, and wall forms where the concrete will be exposed to view.
- B. Construct temporary openings at the base of column forms, wall forms and at other points where necessary to facilitate cleaning and observation immediately before concrete is placed.

- C. Construct forms sufficiently tight to prevent leakage of grout or cement paste. Swell board forms having joints opened by shrinkage of wood by wetting before concrete is placed.
- D. Seal plywood, and other wood surfaces not subject to shrinkage against absorption of moisture from the concrete by one of the following methods:
 - 1. A suitable field applied oil or sealer.
 - 2. A suitable factory applied non-absorptive liner.
- E. Coating Forms (shall be compatible with potable water):
 - 1. Coat form prior to placing reinforcing steel.
 - 2. Do not allow coating material to stand in puddles in forms nor to come in.
 - 3. Where as-cast finishes are required, do not coat form surfaces with materials that will impart a stain to the concrete.
 - 4. Where painted finished surfaces are required, coat form surfaces with materials compatible with the type of paint to be used.
- F. Clean all form surfaces before reuse.

3.2 INSTALLATION

- A. Camber formwork to compensate for anticipated deflections in the formwork due to the weight and pressure of the fresh concrete and construction loads.
- B. Provide positive means of adjustment (wedges or jacks) of shores and struts to take up settlement during concrete placing operation. Brace shores and struts securely against lateral deflections.
- C. Edge Forms and Intermediate Screed Strips:
 - 1. Set accurately to produce the designed elevations and contours.
 - 2. Sufficiently strong to support vibrating bridge screeds or roller pipe screeds if finish requires the use of such equipment.
 - 3. Align concrete surface to the contours of screed strips by use of strike-off templates or approved compacting type screeds.
 - 4. When the formwork is cambered, set the screeds to a like camber to maintain the proper concrete thickness.

3.3 REMOVAL

- A. Formwork for columns, walls, sides of beams, and other parts not supporting the weight of the concrete may be removed as soon as concrete has hardened sufficiently to resist damage from removal operations, but must remain a minimum of 3 days after the placement of the concrete, when ambient temperatures are below 50°F or 2 days after placement when ambient temperatures are above 50°F
- B. Leave formwork for beam soffits, slabs, and other parts that support the weight of the concrete in place until the concrete has reached 75 percent of the specified 28 day strength.
- C. Do not place live loads on slabs until the concrete has reached the specified 28 day strength, unless the slab is reshored.

3.4 RESHORING

- A. When required, plan reshoring in advance.
- B. Loads and Strength:
 - 1. Perform reshoring so that at no time will large areas of new construction be required to support their own weight.
 - 2. While reshoring is under way, do not permit live loads on the new construction.
 - 3. Leave reshores in place until concrete has reached its specified 28 day strength.
- C. Reshore Supports:
 - 1. Reshore floors supporting shores under wet conditions or leave their original shores in place.
 - 2. The reshores shall have at least one-half the load capacity of the shores above and shall be distributed in approximately the same pattern as those above.
 - 3. Leave these reshores in place until the freshly-placed concrete has reached 75 percent of its specified 28 day strength.

3.5 REMOVAL STRENGTH

- A. When formwork removal or reshoring removal is based on the concrete reaching its 28 day strength (or a specified percentage thereof), the concrete shall be presumed to have reached this strength when any of the following conditions has been met:
 - 1. When test cylinders, field cured under the most unfavorable conditions prevailing for any portion of the concrete represented, have reached the required strength. Except for the field curing and age at test, the cylinders shall be molded and tested as specified in the Concrete Testing Section of these Specifications.
 - 2. When the concrete has been cured as specified for the same length of time as the age at test of laboratory-cured cylinders which reached the required strength. The length of time the concrete has been cured in the field shall be determined by the cumulative number of days or fractions thereof, not necessarily consecutive, during which the temperature of the air in contact with the concrete is above 50 degrees F. and the concrete has been damp or thoroughly sealed from evaporation and loss of moisture.
 - 3. When the concrete has reached a specified strength as determined by non-destructive tests.

END OF SECTION

SECTION 03200
CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included: Furnish and install reinforcement for concrete of the type(s) and size(s) and in the location(s) shown on the Drawings and specified herein.

1.2 QUALITY ASSURANCE

- A. Reinforcing Steel:
1. Yield strength of 60 ksi as shown on the Drawings.
 2. ASTM A 615
 3. Allowable fabrication tolerances:
 - a. Sheared length: +/- 1 inch.
 - b. Depth of truss bars: to, 1/2 inch.
 - c. Stirrups, ties, and spirals: +/- 1/2 inch.
 - d. All other bends: +/- 1/2 inch.
- B. Welded Wire Fabric: ASTM A185.

1.3 SUBMITTALS TO THE ENGINEER

- A. Submit shop drawings and schedules in accordance with the General Conditions of the Construction Contract.

1.4 DELIVERY AND STORAGE

- A. Protect reinforcement from the elements to prevent corrosion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All reinforcement shall be free of corrosion.

PART 3 - EXECUTION

3.1 PLACING

- A. Allowable Placement Tolerances:
1. Concrete cover to formed surfaces: +/- 1/4 inch.
 2. Minimum spacing between bars: +/- 1/4 inch.
 3. Top bars in slabs and beams:
 - a. Members 8-inches deep or less: +/- 1/4 inch.
 - b. Members more than 8-inches but not over 1 foot deep: +/- 1/2 inch.
 4. Crosswise of Members: Spaced evenly within 2 inches.

5. Lengthwise of members: +/- 2 inches.
- B. Interference:
 1. Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits, or embedded items.
 2. If bars are moved more than one bar diameter, or enough to exceed the above specified placement tolerances, the resulting arrangement of bars shall be subject to the written approval of the Engineer.
- C. Supports:
 1. Support all reinforcing bars, wire together to prevent displacement by construction loads or the placing of concrete beyond the above specified placement tolerances.
 2. Use metal or plastic sand plate chairs on the ground at spacing called for on the drawings.
 3. Use concrete, metal, plastic, or other approved bar chairs and spacers over framework.
 4. Use galvanized or plastic accessories where concrete surface will be exposed to the weather in the finished structure, or where rust would impair architectural finishes.
- D. Load Carrying Welded Wire Fabric Reinforcement:
 1. Lap splice so that the overlap measured between outermost cross wires of each fabric sheet is not less than the spacing of the cross wires plus 2 inches.
 2. Support welded wire fabric as required for reinforcing bars.
- E. Non-Load Carrying Welded Wire Fabric Reinforcement:
 1. Lap splice so that the overlap measured between outermost cross wires of each fabric sheet is not less than 2 inches.
 2. Extend welded wire fabric across supporting beams and walls and to within 2 inches of concrete edges.
 3. Extend welded wire fabric through contraction joints and construction joints except keyed joints in slabs on ground.
 4. Position welded wire fabric during the placing of concrete to insure its proper position in the slab.
- F. Column Reinforcement:
 1. Offset vertical bars in columns at least one bar diameter.
 2. To insure proper placement, provide templates for all column dowels.
- G. Obtain the Engineer's written approval of all splices not shown on the Drawings.
- H. Do not bend reinforcement partially embedded in hardened concrete.
- I. Do not tack weld reinforcement.
- J. Splicing:
 1. Lapped splices will be used except where other methods are shown on the Drawings.
 2. Minimum splices: 50 bar diameters.
 3. Stagger splices by 50 bar diameters.

4. Spliced bars shall be in contact and wired together to maintain the bar alignment.
 5. No splices will be permitted at points of high stress.
- K. Minimum concrete cover when not shown on the plans.
1. Footings - 3 inches.
 2. Walls, beams, columns, and slabs exposed to liquid immersion, earth or weather: 2 inches.
 3. Walls, beams, columns, and slabs not exposed to liquid immersion, earth or weather: 1-1/2 inches.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE & FLOWABLE FILL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included: Furnish and install the following, when applicable and as shown on the Drawings and as specified herein.
 - 1. Cast-in-place concrete, including building foundations, walls, slabs, beams, columns, equipment bases, conduit envelopes, concrete stair fill, and other concrete Work shown on the Drawings.
 - 2. Do all cutting, patching and repairing of concrete which may be required for **proper completion of the work.**
 - 3. **Place flowable fill into abandoned pipes/structures (minimum 85% of total void for pipes) where directed by the Owner or the Owner's Representative including narrative summarizing execution and verification of the work.**

1.2 REFERENCE SPECIFICATIONS

- A. "Specifications for Structural Concrete for Buildings" by the American Concrete Institute (ACI-301), latest edition.
- B. "Building Code Requirements for Structural Concrete and Commentary" (ACI-318). latest edition.
- C. NHDOT Standard Specifications for Road and Bridge Construction (Latest Edition)

1.3 SHOP DRAWINGS

- A. Submit complete shop drawings as stated in the General Conditions of the Construction Contract.
- B. Provide shop drawings for fabricating and placing reinforcing steel. Show all required information for cutting, bending and placing reinforcing bars and show all accessories and support bars on placing drawings. Indicate suitable marks for placing bars.
- C. Fabrication of any material or performing of any Work prior to the final approval of the shop drawings will be entirely at the risk of the Contractor.
- D. **For Flowable Fill: Provide narrative to Engineer prior to placement of flowable fill including the following:**
 - 1. **Sequence of placement including fill/pump points and vent locations.**
 - 2. **Method of verification that all voids (85% minimum for pipes) have been filled.**

CAST-IN-PLACE CONCRETE & FLOWABLE FILL

1.4 RELATED TRADES

- A. Notify all trades responsible for installing chases, inserts, sleeves, anchors, louvers, etc., when ready for such installation, and for final checking immediately before concrete is placed.
- B. Leave openings in walls for pipes, ducts and other items for mechanical and electrical work, as shown on the Drawings, or required by layout of mechanical and electrical systems.

PART 2 - PRODUCTS2.1 MATERIALS FOR CONCRETE

- A. Cement: Portland cement - ASTM Specification C-150, Type II.
- B. Aggregates:
 - 1. Coarse aggregate: Hard, durable, uncoated crushed stone or gravel conforming to ASTM, Specification C-33 and shall pass through sieves 1-1/2 inch.
 - 2. Fine aggregate: Sand, clean, hard, durable, uncoated grains, free from silt, loam, and clay, to meet ASTM Specification C-33.
- C. Water: Potable from the local municipal supply.
- D. Admixtures:
 - 1. High range water Reducing Agent, ASTM 494 Type F or G, (superplasticizer) by same manufacturer as air-entraining agent.
 - a. Daracem 100 by Grace Construction Products
 - b. Sikament by Sika Corporation
 - c. Or approved equal.
 - 2. Water Reducing Agent, ASTM 494 Type A, by same manufacturer as air-entraining agent.
 - a. WRDA with HYCOL by Grace Construction Products
 - b. Plastocrete 161 by Sika Corporation
 - c. Or approved equal.
 - 3. Air-Entraining Agent, ASTM C-260, to be used to obtain percent air-entrainment specified unless obtained by cement used.
 - a. "Daravair 1000" by Grace Construction Products
 - b. Sika AER by Sika Corporation
 - c. Or approved equal.
 - 4. Water Reducing, Retarding Admixture, ASTM 494 Type D.
 - a. Daratard 17 by Grace Construction Products
 - b. Plastiment 161 by Sika Corporation
 - c. Or approved equal.
 - 5. Non-Corrosive, Non-Chloride Set Accelerating Admixture, ASTM 494 Type C, by same manufacturer as air-entraining agent.

CAST-IN-PLACE CONCRETE & FLOWABLE FILL

- a. Polaset by Grace Construction Products
 - b. Sikaset NC by Sika Corporation
 - c. Or approved equal.
- 6. No other admixtures may be used without written approval by the Engineer.
- 7. Calcium chloride will not be permitted.
- E. Joint Sealer: Furnish and install as specified in these Specifications.
- F. Floor Hardener: Apply to concrete floors to remain exposed and not receiving floor cover.
 - 1. "Lapidolith" by Sonneborn Building Products,
 - 2. "Hornlith" by A.C. Horn Company,
 - 3. "Saniseal 5" by Master Builders Company,
 - 4. Or approved equal.
- G. Moisture Barrier:
 - 1. Black polyethylene film extruded onto both sides of high quality kraft paper and laminated with asphalt to rot and fungus resistant kraft paper. Kraft paper shall have crossed reinforcing fibers which are embedded in asphalt lamenent for high resistance to puncturing and tearing during the application.
 - 2. Moistop, Grade 395.
 - 3. Or approved equal.
- H. Perimeter and Under Slab Insulation as specified in Division 7.
- I. **Flowable Fill materials shall be in accordance with Section 520.2 of the NHDOT Standard Specifications for Road and Bridge Construction (latest edition).**

2.2 STORAGE OF MATERIALS

- A. Store all materials to prevent damage from the elements and other causes.
- B. Store cement and aggregates in such a manner as to prevent deterioration or intrusion of foreign matter. Do not use any materials which have deteriorated, or which have been damaged, for concrete.
- C. Store reinforcing steel on wood skids to protect it from weather, oil, earth and damage from trucking or other construction operations. Reinforcement shall be free from loose mill scale, rust, from oil, concrete spatter and other extraneous coatings at the time it is embedded in the concrete.
- D. Store all forms in a neat manner and orderly fashion, protected from the weather and abuse.
- E. Do not store materials which, in the opinion of the Engineer, are not acceptable for the Work and immediately remove them from the site.

2.3 CONCRETE MIXTURES

A. Strength, cement, and water requirements:

Use	Min.Strength @28 day-psi	Max.Size Coarse Agg.	% Air (+/-1%)	Min.-Max Slump	Min Cem.Fac.	Max W/C
Concrete	4,000	3/4"	5	2" - 4"	---	0.40
Concrete	3,000	3/4"	5	2" - 4"	---	0.45
Concrete	2,000	3/4"	5	1" - 3"	---	0.55

B. If a pumping process is utilized to convey concrete, established concrete mixtures may require increased proportion of cement and fine aggregate and a decreased proportion of coarse aggregate, but these mixtures may not be altered more than:

1. Cement plus 20 lbs./cu.yd.
2. Fine Aggregate plus 50 lbs./cu.yd.
3. Coarse Aggregate minus 50 lbs./cu.yd.

C. Concrete shall contain specified admixtures.

D. Flowable fill shall be mixed using the approximate proportions described below (per cubic yard):

Type II Portland Cement	20 lb.
Ground Granulated Blas Furnace Slag	100 lb.
Sand	2,830 lb.
Water	40 – 50 gal.
Air Entrainment	10% to 15%

a. Flowable fill shall have a minimum 28 day compressive strength of 100 psi.

2.4 CURB BARS

A. Wooster type 150, cast aluminum, or similar by National Guard, Granite State, or McKinley.

PART 3 - EXECUTION

3.1 MIXING PROCESS

A. Use ready-mix process, ACI 301-72 Par. 7.1.

3.2 PLACING

- A. Notify the Engineer at least 24 hours prior to each placement.
- B. Do not place concrete until soil bottoms, reinforcing steel, and inserts, sleeves and other work to be built into the concrete have been completed.
- C. Conveying: Handle concrete from the mixer to the place of final deposit as rapidly as practicable by methods which will prevent separation or loss of ingredients and in a manner which will assure that the required quality of the concrete is retained.

CAST-IN-PLACE CONCRETE & FLOWABLE FILL

- D. Depositing: Program the delivery and placement of concrete so that the time between batching and placement shall not exceed 1-1/2 hours. Do not allow concrete to free fall over 4 feet. Deposit concrete as nearly as practicable in its final position to avoid segregation due to rehandling or flowing.
- E. Deposit concrete continuously, in horizontal layers of such thickness (not deeper than 24 inches) that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. Carry out placing at such a rate that the concrete which is being integrated with fresh concrete is still plastic. Do not deposit concrete which has partially hardened or has been contaminated by foreign materials. No horizontal construction joints will be allowed in foundation walls.
- F. Vibrate concrete thoroughly to produce a dense, homogenous mass without voids or pockets. Place vibrators in concrete rapidly to penetrate approximately 3 inches to 4 inches into the preceding lift and blend the two layers. Vibrating techniques must assure that when the coarse aggregate reaches the form, it stops and the matrix fills the voids.

3.3 FLOOR AND OTHER FLATWORK FINISHES

- A. Use a "troweled finish" ACI 302, Sections 7.2.1 - 7.2.10, including tops of exposed walls, except where otherwise shown on the Drawings.
- B. Screed all floors to establish elevations, then steel trowel level, with allowable tolerance not exceeding 1/8 inch in any direction when tested with a 10 foot long straightedge. Where floors contain drains, pitch the floors to drain as shown on the Drawings.
- C. If either or both of the above requirements are not met, correct the conditions by grinding and filling, as directed by the Engineer, using materials and methods which will be compatible with all finish and surface materials to be installed on floors at no additional cost to the Owner.

3.4 MOISTURE BARRIER

- A. Apply specified moisture barriers under all interior and exterior slabs-on-grade, after ensuring that gravel subbase or crushed stone base is level and well compacted.
- B. Apply moisture barrier parallel with the direction of the concrete pour. Lap and seal all joints to a minimum width of 6 inches with adhesive provided by the moisture barrier manufacturer. Ensure that the moisture barrier lies flat against sides and bottom of wall footing trenches. Trim moisture barrier to fit neatly around column bases; seal to concrete footings for a minimum of 6 inches around base.
- C. Do not damage the moisture barrier at any time; repair any accidental punctures with a patch of the same material extending a minimum of 6 inches in all directions, and seal.

3.5 SURFACE REPAIRS

- A. Remove all honeycombed and other defective concrete down to sound concrete. Dampen area to be patched and area around it to prevent absorption of water from patching mortar. Fill areas concealed in the finished work with a trowel.

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- B. Make a patching mixture of the same sand and cement as necessary to match color of existing concrete as determined by trial patches in exposed areas.
- C. Limit the amount of mixing water to that necessary for handling and placing. Mix mortar in advance, allow to stand with frequent manipulation with a trowel, without addition of water, until it has reached the stiffest consistency that will permit placing.
- D. After surface water has evaporated from the area to be patched, brush area with neat cement grout, let it set until the grout loses its sheen and apply the patching mortar. Pack the mortar thoroughly into place, strike off to leave the patch slightly higher than surrounding surfaces to permit initial shrinkage. Keep patched area damp for 7 days. Finish exposed surfaces of patch to match adjacent surfaces.
- E. After cleaning and thoroughly dampening, fill all tie holes with patch mortar. Finish off as above specified for all exposed areas.

3.6 CUTTING OF HOLES

- A. Cut holes required by all trades in any cast-in-place concrete which did not receive sleeves. Use a core drilling process or sawing process which produces clean sharp edges and the minimum hole size which accommodates the piping, conduit, or equipment requiring the opening.
- B. Obtain written approval from the Engineer before cutting any holes for any trades.

3.7 NON-SHRINK GROUT

- A. Grout solid all bearing plates in accordance with manufacturer's recommendations and as specified. Grout mixture for Steel Sleeves to be in accordance with Section 02445.

3.8 INSULATION

- A. Under-Slab Insulation: Lay insulation under slabs directly on moisture barrier, tightly butting each sheet of insulation against adjacent piece, where shown on the Drawings.
- B. Perimeter Insulation: Install vertical perimeter insulation dry, against foundation walls in a continuous manner as the backfill is placed, or hold in place with styrofoam mastic #7 or #11, or an approved equal.

3.9 STRENGTH OF STRUCTURE

- A. The strength of the structure in place will be considered potentially deficient if it fails to comply with any requirements which control the strength of the structure, as outlined below:
 - 1. Low concrete strength, as evaluated by the requirements of this Section.
 - 2. Reinforcing steel size, quantity, strength, position, or arrangement at variance with the project drawings.
 - 3. Concrete which differed from the required dimensions or locations in such a manner as to reduce the strength.

3.10 CONCRETE CURING AND PROTECTION

A. General:

1. Prevent premature drying of freshly placed concrete, and protect from excessively cold or hot temperatures until concrete has cured.
2. Provide curing of concrete by one of the methods listed and as appropriate to service conditions and type of applied finish in each case.
3. Curing and protection shall be in accordance with ACI 301-12 and ACI 308

B. Curing Period:

1. Not less than 14 days for slabs.
2. For elements other than slabs, not less than 7 days for standard cements and mixes.
3. For elements other than slabs, not less than 4 days for high early strength concrete using Type III cement.

C. Formed Surfaces: Cure formed concrete surfaces by moist curing with forms in place for full curing period or until forms are removed.

1. Keep wooden or metal forms moist when exposed to heat of the sun.
2. If forms are removed prior to completion of curing process, continue curing by one of the applicable methods specified.

D. Surfaces Not in Contact with Forms:

1. Start initial curing as soon as free water has disappeared, but before the surface is dry.
2. Keep concrete slabs continuously moist for not less than 7 days and all other concrete elements continuously moist for not less than 3 days by uninterrupted use of any of the following:
 - a. Water ponding.
 - b. Water-saturated sand.
 - c. Water-fog spray.
 - d. Saturated burlap: Provide 4-inch minimum overlap at joints.
3. Begin final curing procedures following initial curing and before concrete has dried but not sooner than 1 day after.
4. Acceptable final curing methods:
 - a. Water ponding.
 - b. Water-saturated sand.
 - c. Water-fog spray.
 - d. Saturated burlap: Provide 4-inch minimum overlap at joints.
 - e. Moisture-retaining sheet.

CAST-IN-PLACE CONCRETE & FLOWABLE FILL

- f. Moisture-retaining cover: Lap not less than 3 inches at edges and ends, and seal with waterproof tape or adhesive. Repair holes or tears during curing period with same tape or adhesive. Maintain covering intimate contact with concrete surface. Secure to avoid displacement.
 - 1. Extend covering past slab edges at least twice the thickness of slab.
- g. Do not use plastic sheeting on surfaces which will be exposed to view when in service.
- h. Curing compound: Apply at rate stated by manufacturer to conform with moisture-retention requirements specified, using second, immediate application at right angles to first, if necessary, and reapply if damaged by rain.
- i. Liquid curing compounds.
 - 1. Use curing compounds only in locations permitted or required.
 - 2. Do not apply to surfaces to receive other finishes, coating, coverings unless documentation is provided that the curing compound is compatible with the finish, coating or covering.
 - 3. For curing compounds used in contact with potable water, provide documentation of NSF 61 approval.
- 5. Continue final curing to end of curing period.
- E. Avoid rapid drying at end of curing period.
- F. During and following curing period, protect concrete from temperature changes of adjacent air in excess of 5 degrees F per hour and 50 degrees F per 24 hours. Progressively adjust protective measures to provide uniform temperature changes over entire concrete surface.

END OF SECTION

SECTION 03320
REINFORCED CEMENT CONCRETE FENCE STRIP
(MOW CURB)

1.01 SCOPE OF WORK

The work to be done in this section shall be to construct a cast in place reinforced concrete fence strip (mower strip) as located and detailed in the plans and as specified herein. The Contractor shall furnish all labor, material, equipment and transportation necessary to accomplish this task.

A. Reference Standards

1. References herein to any technical society, organization, group of body are made in accordance with the following abbreviations.

AASHTO	American Association of State Highway and Transportation Officials
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ANSI	American National Standards Institute
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ASTM	American Society for Testing Materials
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1.02 MATERIALS

- A. Gravel base shall conform to Section 02100 SITE WORK and 02229 BACKFILL AND COMPACTION of these Specifications.
- B. Forms, reinforcing steel and cement concrete cast-in-place shall conform to Section 03300 CAST IN PLACE CONCRETE of these Specifications.
- C. All fence posts shall be set into place in accordance with shop drawings and fencing layout; mower strip to be poured between post footings with tooled construction joints.
- D. Cement Concrete shall conform to Section 03300 CAST IN PLACE CONCRETE of these Specifications.
- E. Preformed expansion joint filler shall be of a non-extruding and resilient non-bituminous type conforming to AASHTO-M135.

1.03 EXECUTION

- A. Excavation shall conform to Section 02200 EARTHWORK of these Specifications.
- B. Placement and compaction of processed gravel shall conform to Section 02100 SITE WORK and 02229 BACKFILL AND COMPACTION of these Specifications.
- C. Placement of reinforcing steel shall conform to Section 03300 CAST IN PLACE CONCRETE of these Specifications; Coordinate with fencing sections; cast cement concrete against post footings and tool joints.

Placement and Finish of Cement Concrete: The concrete shall be placed in such quantity that after being thoroughly consolidated in place it shall be to the minimum depth and width as designated on the plans and details. No finishing operation shall be performed until all bleed 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 shall be eliminated. 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.

- D. Curing of cement concrete shall conform to Section 03300 CAST IN PLACE CONCRETE of these Specifications.

END OF SECTION

Scope of Work

Furnish, install and test all concrete work and appurtenant work in complete accordance with the Drawings and Specifications.

Contractor's Duties

Except as specifically noted, provide and pay for all labor, materials, equipment, tools, machinery, water, heat, other facilities and services necessary for proper execution and completion of the work.

Contents of Division

<u>Section No.</u>	<u>Section Title</u>
16500	Light Pole with Solar Powered LED Luminaire
26 00 50	Electrical Work – General Provisions
26 05 19	Low-Voltage Electrical Conductors and Cables
26 05 26	Grounding and Bonding for Electrical Systems
26 05 33	Raceways and Boxes for Electrical Systems
26 05 53	Identification for Electrical System
26 24 16	Panelboards
26 27 13	Electricity Metering
26 27 26	Wiring Devices
26 56 68	Sports Lighting

LIGHT POLE WITH SOLAR POWERED LED LUMINAIRE (18' TALL)

SECTION 16500LIGHT POLE WITH SOLAR POWERED LED LUMINAIRE (18' TALL)PART 1 - GENERAL1.1 DESCRIPTION

A. Work Included:

1. The Contractor shall provide the labor, tools, equipment, and materials necessary to furnish and install light poles with solar powered LED luminaires, including base, in accordance with the plans and schedules as specified herein.
2. The Contractor shall provide a proposed design with lighting fixture samples for approval prior to installation for approval by the Engineer.

1.2 REFERENCE STANDARDS

Contractor shall perform all work to be in conformance with local and national code requirements.

A. Reference Standards:

1. National Electrical Code (NEC) compliance.
2. National Electrical Manufacturers Association (NEMA) Compliance. NEMA Standard LE 1 and LE 2.
3. Underwriters' Laboratories, Inc. (UL) Compliance. UL 486A and B, standards.
4. National Fire Protection Association (NFPA) Compliance. NFPA 78, NFPA 101.

1.4 SUBMITTALS

- A. Furnish manufacturer's product data, test reports, and materials certifications as required.
- B. Submit the following in accordance with Conditions of Contract and Division 1 specification sections:
 1. Submit manufacturer's product data and installation instructions on each type lighting fixture and component including lamp data.
 2. Provide isofootcandle (isolux) plot diagram of footcandles on horizontal pavement surface which shows composite values of illuminance projected from the arrangement of light sources from indicated fixture locations and heights in outdoor applications.

LIGHT POLE WITH SOLAR POWERED LED LUMINAIRE (18' TALL)

PART 2 - PRODUCTS**2.1 MATERIALS**

The contractor shall use all new materials of high quality. The contractor shall submit product specifications for approval.

A. Light Pole Bases

1. Bases shall conform to Section 625
2. Base shall be round with a minimum diameter of 12 inches, a minimum depth of 6 feet, and contain reinforcing.

B. Light Pole

1. Poles shall be spun aluminum round taper poles, or equivalent.
2. Poles shall have a nominal pole height of 18 feet.
3. Poles shall have a breakaway base.

C. LED Light Head

1. LED light head shall conform to the following lighting parameters:

Light Parameters	
Min Qty, of LED Chips (pcs)	18
Light Output (w)	20
Optical Distribution	Asymmetrical
Visual Angle	140°×70°
Color Temperature (K)	5000
Typical Luminous Flux (lm)	3000
Light Photosensitivity (lx)	30

2. LED light head shall conform to the following mounting requirements:

Mounting Requirements	
EPA (effective projected area) (ft ²)	0.45
APA (actual projected area) (ft ²)	0.37
Wind Load Rate (mph)	110
Top of Pole or Tenon OD (mm)	60 - 90
Recommended Installation Height (m)	7-Apr
Recommended Installation Distance (m)	15 - 25

LIGHT POLE WITH SOLAR POWERED LED LUMINAIRE (18' TALL)

D. Solar Power System

1. Solar power system shall conform to the following physical requirements:

Physical Parameters	
Power of PV Module (W)	80
Lithium Battery Capacity	36Ah(460Wh)
Visual Angle	140°×70°
Color Temperature (K)	5000
Typical Luminous Flux (lm)	3000
Light Photosensitivity (lx)	30

2. Solar power system shall conform to the following mounting requirements:

Mounting Requirements	
EPA (effective projected area) (ft ²)	3.75
APA (actual projected area) (ft ²)	3.13
Wind Load Rate (mph)	110
Top of Pole or Tenon OD (mm)	60 - 76

PART 3 - EXECUTION3.1 INSTALLATION

- A. Examine areas and conditions under which lighting fixtures are to be installed. Examine substrate/substrata for supporting lighting fixtures. Notify the Engineer in writing of conditions detrimental to proper completion of the work. Do not proceed with work until satisfactory conditions have been corrected in a manner acceptable to the Engineer.
- B. Install lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, National Electrical Contractors Association's (NECA) "Standard of Installation," NEMA standards.
- C. Provide fixtures and/or fixture outlet boxes with hangers to properly support fixture weight. Submit design of hangers, method of fastening, other than indicated or specified herein, for review by the Engineer.
- D. Support fixtures in lay in type grid ceilings by hangers or wire anchors from the structural ceiling, not from the lay in grid.

END OF SECTION

SECTION 26 00 50

ELECTRICAL WORK - GENERAL PROVISIONS

PART 1 - GENERAL

1.1 WORK INCLUDED:

- A. The Contractor shall furnish all labor, materials, equipment and incidentals required to make ready for use the complete electrical systems as shown on the Drawings and as specified hereinafter.
- B. In conjunction with other sections of Division 26, the work shall include but not be limited to furnishing and installing the following:
 - 1. Electrical service
 - 2. Electrical raceway systems
 - 3. Wires and cables
 - 4. Panelboards
 - 5. Miscellaneous equipment
 - 6. Grounding systems
 - 7. Circuit breakers
 - 8. Sports Lighting
- C. Make all necessary connections at "packaged" equipment furnished under other sections and Divisions of these specifications.
- D. Make all connections to equipment and devices furnished under Division 26 and other sections of these specifications except as otherwise specified.
- E. Connect process and instrumentation cables furnished with field-mounted equipment under other sections and Divisions of these specifications.
- F. Mount all motor control equipment enclosures not factory mounted, unless otherwise indicated.
- G. It is the intent of these specifications that the electrical system shall be suitable in every way for the service required. All material and all work which may be reasonably implied as being incidental to the work of this section shall be furnished at no extra cost to the Owner.

1.2 RELATED WORK:

- A. The Contractor's attention is directed to the General Conditions, Supplementary Conditions.
 - B. Excavation and backfilling required for underground electrical work is included under Division 2.
 - C. Concrete work and reinforcing for electrical equipment pads is included under Division 3.
- 1.3 CODES, INSPECTIONS, PERMITS AND FEES:
- A. All material and installations shall be in accordance with the latest edition of the National Electric code (NEC) and all applicable local codes and ordinances.
 - B. Obtain all necessary permits and pay all fees for permits and inspections.
- 1.4 INTERPRETATION OF DRAWINGS:
- A. The Drawings are not intended to show exact locations of conduit runs.
 - B. Each three-phase circuit shall be run in a separate conduit unless otherwise shown on the Drawings.
 - C. Unless otherwise noted and/or approved by the Engineer all conduits shall be installed concealed.
 - D. Where circuits are shown as "home-runs" all necessary fittings and boxes shall be provided for a complete raceway installation.
 - E. Any work installed contrary to or without review by the Engineer shall be subject to change as required by the Engineer, and no extra compensation will be allowed for making these changes.
 - F. The locations of equipment, shown on the drawings are approximate only. Exact locations shall be as determined by the Engineer during construction. Obtain in the field all information relevant to the placing of electrical work and in case of any interference with other work, proceed as required by the Engineer and furnish all labor and materials necessary to complete the work in an acceptable manner.
 - G. Circuit layouts are not intended to show the number of fittings, or other installation details. Furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting and other electrical systems shown. Additional circuits shall be installed wherever needed to conform to the specific requirements of the equipment.

- H. All connections to equipment shall be made as required and in accordance with the approved shop and setting drawings.

1.5 SUBMITTALS:

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

- A. Complete shop drawings shall be submitted for but not limited to the following equipment: panelboards, fire alarm, service cabinets, load centers, conduit and wire.
- B. The manufacturer's name, product designation or catalog number, descriptive literature and data shall be submitted for the following material and equipment:
 - 1. Conduit
 - 2. Boxes and fittings
 - 3. Wires, cables and appurtenances
 - 4. Service cabinets
 - 5. Wiring devices and appurtenances
 - 6. Circuit breakers
 - 7. Panelboards
 - 8. Grounding Equipment
 - 9. Light Fixtures.
- C. Prior to submittal, all shop drawings shall be checked for accuracy and conformance to contract requirements. Shop drawings shall bear the date checked and shall be accompanied by a statement that the shop drawings have been examined for conformity to the specifications and drawings. This statement shall also list all discrepancies with the specifications and drawings. Shop drawings not so checked and noted shall be returned.
- D. The Engineer's review shall be only for conformance with the design concept of the project and compliance with the specifications and drawings. The responsibility of, and the necessity of, furnishing materials and workmanship required by the specifications and drawings which may not be indicated on the shop drawings is included under the work of this section.
- E. The responsibility for all dimensions to be confirmed and correlated at the job site and for coordination of this work with the work of all other trades is also included under the work of this section.

1.6 MANUFACTURER'S SERVICES:

Furnish manufacturer's services for testing and start-up when required.

1.7 ELECTRIC SERVICES:

- A. The electric service is existing as indicate and shall be utilized to service the project needs.

PART 2 - PRODUCTS

2.1 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 specifications shall be submitted for review as required by the Engineer.
- B. Materials and equipment used shall be Underwriters' Laboratories, Inc. listed.
- C. Electrical equipment shall at all times during construction be adequately protected against mechanical injury or damage by water. Electrical equipment shall not be stored out-of- doors. Electrical equipment shall be stored in dry permanent shelters. If any apparatus has been damaged, such damage shall be repaired at no additional cost. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such special tests as required by the Engineer or shall be replaced at no additional cost to the Owner.
- D. The Contractor's attention is directed to the requirements of the various sections of division 26 for additional product specifications.

2.2 MANUFACTURER'S NAMEPLATES:

- A. All equipment shall have the manufacturer's name, address, model or type designation, serial number and all applicable ratings clearly marked thereon in a location which can be readily observed after installation. The required information may be die-stamped into the surface of the equipment or may be marked on durable nameplates permanently fastened to the equipment.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Provide and place all sleeves for conduit penetrations through floors, walls, partitions, etc. Locate all necessary slots and inserts for electrical work and place in form before concrete is poured.

- B. Equipment shall be kept upright at all times. When equipment has to be tilted for ease of passage through restricted areas during transportation, the manufacturer shall be required to brace the equipment suitably, to insure that the tilting does not impair the functional integrity of the equipment.

3.2 RECORD DRAWINGS:

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.

3.3 TESTS AND ADJUSTMENTS:

- A. Test all systems furnished under Division 26 and repair or replace all defective work. Make all necessary adjustments to the systems and equipment and instruct the Owner's personnel in the proper operation of the systems and equipment.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Copper building wire rated 600 V or less.
 - 2. Metal-clad cable, Type MC, rated 600 V or less.
 - 3. Connectors, splices, and terminations rated 600 V and less.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 COPPER WIRE

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Alpha Wire Company.
 - 2. American Bare Conductor.

3. Belden Inc.
4. Okonite Company (The).
5. Southwire Company.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

E. Conductor Insulation:

1. Type RHH and Type RHW-2: Comply with UL 44.
2. Type THHN and Type THWN-2: Comply with UL 83.
3. Type XHHW-2: Comply with UL 44.

2.2 METAL-CLAD CABLE, TYPE MC

A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alpha Wire Company.
2. Belden Inc.
3. Okonite Company (The).
4. Southwire Company.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Comply with UL 1569.
3. RoHS compliant.
4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Circuits:

1. Single circuit.
- E. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.
- F. Ground Conductor: Bare.
- G. Conductor Insulation:
 1. Type THHN/THWN-2: Comply with UL 83.
 2. Type XHHW-2: Comply with UL 44.
- H. Armor: Steel, interlocked.
- I. Jacket: PVC applied over armor.

2.3 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 1. 3M Electrical Products.
 2. AFC Cable Systems; a part of Atkore International.
 3. Hubbell Power Systems, Inc.
 4. O-Z/Gedney; a brand of Emerson Industrial Automation.
 5. Thomas & Betts Corporation; A Member of the ABB Group.
- C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.
- D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
 1. Material: Copper.
 2. Type: One hole with standard barrels.
 3. Termination: Compression.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type XHHW-2, single conductors in raceway.
- B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
- C. Feeders Concealed in Concrete and Underground: Type THHN/THWN-2, single conductors in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Complete raceway installation between conductor and cable termination points according to Section 26 05 33 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- B. 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.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

3.4 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-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.

- C. Wiring at Outlets: Install conductor at each outlet, with at least 12-inches of slack.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 26 05 53 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes grounding and bonding systems and equipment, plus the following special applications:
 - 1. Underground distribution grounding.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article.
- B. Qualification Data: For testing agency and testing agency's field supervisor.
- C. Field quality-control reports

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.
 - 1. Plans showing as-built, dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
 - a. Ground rods.
 - b. Grounding arrangements and connections for separately derived systems.

2. Instructions for periodic testing and inspection of grounding features at grounding connections for separately derived systems based on NETA MTS.
 - a. Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
 - b. Include recommended testing intervals.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Certified by NETA.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Burndy; Part of Hubbell Electrical Systems.
 2. ERICO International Corporation.
 3. Harger Lightning & Grounding.
 4. O-Z/Gedney; a brand of Emerson Industrial Automation.
 5. SIEMENS Industry, Inc.; Energy Management Division.
 6. Thomas & Betts Corporation; A Member of the ABB Group.

2.3 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 1. Solid Conductors: ASTM B 3.

2. Stranded Conductors: ASTM B 8.
 3. Tinned Conductors: ASTM B 33.
 4. Bonding Cable: 28 kc mil, 14 strands of No. 17 AWG conductor, 1/4-inch in diameter.
 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8-inches wide and 1/16-inch thick.
- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4-inches in cross section, with 9/32-inch holes spaced 1-1/8-inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.4 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
- D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
- E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- F. Conduit Hubs: Mechanical type, terminal with threaded hub.
- G. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
- H. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.
- I. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.
- J. Straps: Solid copper, copper lugs. Rated for 600 A.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare copper conductor.
 - 1. Bury at least 24-inches below grade.
- C. Grounding Bus: Install in electrical cabinet.
 - 1. Install bus horizontally, on insulated spacers 2-inches minimum from wall, 6-inches above finished floor unless otherwise indicated.
- D. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except as otherwise indicated.

3.2 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Flexible raceway runs.

3.4 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections with the assistance of a factory-authorized service representative.
- B. Tests and Inspections:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 - 3. Test completed grounding system at service disconnect enclosure grounding terminal. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
 - 4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven, their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- C. Grounding system will be considered defective if it does not pass tests and inspections.

- D. Prepare test and inspection reports.
- E. Report measured ground resistances that exceed the following values:
 - 1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10ohms.
- F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 05 33

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Handholes and boxes for exterior underground cabling.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

- A. Metal Conduit:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. AFC Cable Systems; a part of Atkore International.

- b. Allied Tube & Conduit; a part of Atkore International.
 - c. Anamet Electrical, Inc.
 - d. Opti-Com Manufacturing Network, Inc (OMNI).
 - e. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - 2. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 3. GRC: Comply with ANSI C80.1 and UL 6.
 - 4. ARC: Comply with ANSI C80.5 and UL 6A.
 - 5. IMC: Comply with ANSI C80.6 and UL 1242.
 - 6. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
 - a. Comply with NEMA RN 1.
 - b. Coating Thickness: 0.040-inch, minimum.
 - 7. EMT: Comply with ANSI C80.3 and UL 797.
 - 8. FMC: Comply with UL 1; zinc-coated steel or aluminum.
 - 9. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- B. Metal Fittings: Comply with NEMA FB 1 and UL 514B.
- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. AFC Cable Systems; a part of Atkore International.
 - b. Allied Tube & Conduit; a part of Atkore International.
 - c. Anamet Electrical, Inc.
 - d. FSR Inc.
 - e. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - 2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 3. Fittings, General: Listed and labeled for type of conduit, location, and use.
 - 4. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
 - 5. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: Setscrew.
 - 6. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

7. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040-inch, with overlapping sleeves protecting threaded joints.
- C. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

A. Nonmetallic Conduit:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. AFC Cable Systems; a part of Atkore International.
 - b. Anamet Electrical, Inc.
 - c. FRE Composites.
 - d. RACO; Hubbell.
 - e. Thomas & Betts Corporation; A Member of the ABB Group.

B. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1. ENT: Comply with NEMA TC 13 and UL 1653.
2. RNC: Type EPC-40-PVC, or type EPC-80-PVC as noted complying with NEMA TC 2 and UL 651 unless otherwise indicated.
3. LFNC: Comply with UL 1660.

C. Nonmetallic Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. AFC Cable Systems; a part of Atkore International.
 - b. Anamet Electrical, Inc.
 - c. Arnco Corporation.
 - d. FRE Composites.
 - e. RACO; Hubbell.
2. Fittings, General: Listed and labeled for type of conduit, location, and use.
3. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

4. Fittings for LFNC: Comply with UL 514B.
5. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 1. B-line, an Eaton business.
 2. Hoffman; a brand of Pentair Equipment Protection.
 3. MonoSystems, Inc.
 4. Square D.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.
 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.4 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 1. Crouse-Hinds, an Eaton business.
 2. Erickson Electrical Equipment Company.
 3. Hoffman; a brand of Pentair Equipment Protection.
 4. Hubbell Incorporated.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- D. Cabinets:

1. NEMA 250, Type 1 or Type 3R galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.5 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Armorcast Products Company.
 - b. NewBasis.
 - c. Oldcastle Enclosure Solutions.
 - d. Oldcastle Precast, Inc.
 - e. Quazite: Hubbell Power Systems, Inc.
2. Standard: Comply with SCTE 77.
3. Configuration: Designed for flush burial with closed bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "ELECTRIC." or per appropriate system.
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of hot-dip galvanized-steel diamond plate.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Armorcast Products Company.
 - b. NewBasis.
 - c. Nordic Fiberglass, Inc.
 - d. Oldcastle Precast, Inc.
 - e. Quazite: Hubbell Power Systems, Inc.
2. Standard: Comply with SCTE 77.
3. Configuration: Designed for flush burial with closed bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "ELECTRIC." or per appropriate system.
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
 1. Exposed Conduit: GRC.
 2. Concealed Conduit, Aboveground: GRC.
 3. Underground Concrete Encased Conduit: RNC, Type EPC-40-PVC.
 4. Underground Direct Buried Conduit: RNC, Type EPC-80-PVC.
 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Minimum Raceway Size: 1/2-inch trade size.
- C. Raceway Fittings: Compatible with raceways and suitable for use and location.
 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 3. EMT: Use setscrew, steel fittings. Comply with NEMA FB 2.10.

- 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- D. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- E. Install surface raceways only where indicated on Drawings.
- F. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- C. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12-inches of changes in direction.
- D. Support conduit within 12-inches of enclosures to which attached.
- E. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- F. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- G. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- H. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- 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. Cap underground raceways designated as spare above grade alongside raceways in use.
- J. Surface Raceways:
 - 1. Install surface raceway with a minimum 2-inch radius control at bend points.

- K. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with 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.
- L. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service raceway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

- 1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 31 20 00 "Earth Moving" for pipe less than 6-inches in nominal diameter.
- 2. Install backfill as specified in Section 31 20 00 "Earth Moving."
- 3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12-inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 31 20 00 "Earth Moving."
- 4. Install manufactured duct elbows for stub-up at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
- 5. Install manufactured rigid steel conduit elbows for stub-ups at poles.
 - a. Couple steel conduits to ducts with adapters designed for this purpose and encase coupling with 3-inches of concrete for a minimum of 12-inches on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60-inches from edge of equipment base. Install insulated grounding bushings on terminations at equipment.
- 6. Underground Warning Tape: Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1-inch above finished grade.
- D. Install handholes with bottom below frost line.
- E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

2. SUMMARY

A. Section Includes:

- 1. Color and legend requirements for raceways, conductors, and warning labels and signs.
- 2. Labels.
- 3. Bands and tubes.
- 4. Tapes and stencils.
- 5. Tags.
- 6. Signs.
- 7. Cable ties.
- 8. Paint for identification.
- 9. Fasteners for labels and signs.

3. ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

1. PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1.
- B. Comply with NFPA 70.
- C. Comply with ANSI Z535.4 for safety signs and labels.

- D. Comply with NFPA 70E requirements for arc-flash warning labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

2. COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage.
- B. Color-Coding for Phase-Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit] conductors.
 - 1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
 - 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - 3. Colors for 480/277-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 - 4. Color for Neutral: White or gray.
 - 5. Color for Equipment Grounds: Green.
- C. Warning Label Colors:
 - 1. Identify system voltage with black letters on an orange background.
- D. Warning labels and signs shall include, but are not limited to, the following legends:
 - 1. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36-INCHES."
- E. Equipment Identification Labels:
 - 1. Black letters on a white field.

3. LABELS

- A. Self-Adhesive Labels: Polyester or Vinyl, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Brady Corporation.
 - b. Brother International Corporation.
 - c. Ideal Industries, Inc.
 - d. Panduit Corp.
 - 2. Minimum Nominal Size:
 - a. 1-1/2 by 6-inches for raceway and conductors.
 - b. 3-1/2 by 5-inches for equipment.
 - c. As required by authorities having jurisdiction.

4. TAPES AND STENCILS

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Champion America.
 - b. Ideal Industries, Inc.
 - c. Panduit Corp.
- B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2-inches wide; compounded for outdoor use.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Brady Corporation.
 - b. emedco.
 - c. Marking Services, Inc.

- C. Underground-Line Warning Tape:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Brady Corporation.
 - b. Ideal Industries, Inc.
 - c. Marking Services, Inc.
2. Tape:
 - a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
 - b. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
3. Color and Printing:
 - a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
 - b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".
 - c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".

5. SIGNS

A. Laminated Acrylic or Melamine Plastic Signs:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Brady Corporation.
 - b. Carlton Industries, LP.
 - c. emedco.
2. Engraved legend.
3. Thickness:
 - a. For signs up to 20 sq. in., minimum 1/16-inch thick.

- b. For signs larger than 20 sq. in., 1/8-inch thick.
- c. Engraved legend with black letters on white face.
- d. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

6. CABLE TIES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. HellermannTyton.
 - 2. Ideal Industries, Inc.
 - 3. Marking Services, Inc.
 - 4. Panduit Corp.
- B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
 - 1. Minimum Width: 3/16-inch.
 - 2. Tensile Strength at 73 Deg F according to ASTM D 638: 12,000 psi.
 - 3. Temperature Range: Minus 40 to plus 185 deg F.
 - 4. Color: Black, except where used for color-coding.

7. MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

PART 3 - EXECUTION

1. INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Verify identity of each item before installing identification products.

- C. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
 - D. Apply identification devices to surfaces that require finish after completing finish work.
 - E. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
 - F. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.
 - G. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
 - H. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.
 - I. Underground Line Warning Tape:
 - 1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8-inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.
 - 2. Install underground-line warning tape for direct-buried cables and cables in raceways.
 - J. Laminated Acrylic or Melamine Plastic Signs:
 - 1. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on minimum 1-1/2-inch-high sign; where two lines of text are required, use signs minimum 2-inches high.
 - K. Cable Ties: General purpose, for attaching tags, except as listed below:
 - 1. Outdoors: UV-stabilized nylon.
 - 2. In Spaces Handling Environmental Air: Plenum rated.
2. IDENTIFICATION SCHEDULE
- A. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.

- B. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.
- C. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive equipment labels.
 - 1. Apply to exterior of door, cover, or other access.
 - 2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
 - a. Controls with external control power connections.
- D. Arc Flash Warning Labeling: Self-adhesive labels.
- E. Operating Instruction Signs: Laminated acrylic or melamine plastic signs.
- F. Equipment Identification Labels:
 - 1. Indoor Equipment: Laminated acrylic or melamine plastic sign.
 - 2. Outdoor Equipment: Laminated acrylic or melamine sign.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

- A. MCCB: Molded-case circuit breaker.
- B. SPD: Surge protective device.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details.
 - 2. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 5. Include evidence of NRTL listing for SPD as installed in panelboard.
 - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 7. Include wiring diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Panelboard schedules for installation in panelboards.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.7 FIELD CONDITIONS

- A. Service Conditions: NEMA PB 1, usual service conditions, as follows:
 - 1. Ambient temperatures within limits specified.
 - 2. Altitude not exceeding 6600 feet.

1.8 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.
 - 1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS COMMON REQUIREMENTS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA PB 1.
- D. Comply with NFPA 70.
- E. Enclosures: Flush and Surface -mounted, dead-front cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.

- b. Outdoor Locations: NEMA 250, Type 3R.
 - c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - 2. Height: 84-inches maximum.
 - 3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.
 - 4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
- F. Incoming Mains Location: Top or Bottom.
- G. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.
- H. Conductor Connectors: Suitable for use with conductor material and sizes.
- 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
 - 3. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
- I. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- J. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- 1. 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. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 2.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Eaton.
 - 2. General Electric Company; GE Energy Management - Electrical Distribution.
 - 3. SIEMENS Industry, Inc.; Energy Management Division.
 - 4. Square D; by Schneider Electric.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker.
- D. Branch Overcurrent Protective Devices: Plug-in or Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Eaton.
 - 2. General Electric Company; GE Energy Management - Electrical Distribution.
 - 3. SIEMENS Industry, Inc.; Energy Management Division.
 - 4. Square D; by Schneider Electric.
- B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers:
 - a. Inverse time-current element for low-level overloads.
 - b. Instantaneous magnetic trip element for short circuits.
 - c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2.5 IDENTIFICATION

- A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.
- B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.
- C. Circuit Directory: Directory card inside panelboard door, mounted in metal frame with transparent protective cover.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Install panelboards and accessories according to NECA 407.
- C. Mount top of trim 90-inches above finished floor unless otherwise indicated.
- D. Mount panelboard cabinet plumb and rigid without distortion of box.
- E. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
- F. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
- G. Install filler plates in unused spaces.
- H. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 26 05 53 "Identification for Electrical Systems."

- B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
- E. Install warning signs complying with requirements in Section 26 05 53 "Identification for Electrical Systems" identifying source of remote circuit.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA Acceptance Testing Specification. 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.
- D. Panelboards will be considered defective if they do not pass tests and inspections.

END OF SECTION

SECTION 26 27 13
ELECTRICITY METERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes electricity metering.

1.3 DEFINITIONS

- A. KY or KYZ Pulse: Term used by the metering industry to describe a method of measuring consumption of electricity (kWh) that is based on a relay opening and closing in response to the rotation of the disk in the meter. Electronic meters generate pulses electronically.

1.4 ACTION SUBMITTALS

- A. Product Data:
 - 1. For each type of meter.
 - 2. For metering infrastructure components.
 - 3. For metering software.
- B. Shop Drawings: For electricity-metering equipment.
 - 1. Include elevation views of front panels of control and indicating devices and control stations.
 - 2. Include diagrams for power, signal, and control wiring.
 - 3. Wire Termination Diagrams and Schedules: Include diagrams for power, signal, and control wiring. Identify terminals and wiring designations and color-codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit

protection features. Differentiate between manufacturer-installed and field-installed wiring.

4. Include series-combination rating data for modular meter centers with main disconnect device.
5. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices used. Describe characteristics of network and other data communication lines.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Submit evidence that meters are compatible and conform to Eversource requirements
- B. Qualification Data: For testing agency.
- C. Field quality-control reports.
- D. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: In addition to items specified in division 1 Section "Operation and Maintenance Data," include the following:
 1. Application and operating software documentation.
 2. Software licenses.
 3. Software service agreement.
 4. Device address list.
 5. Hard copies of manufacturer's operating specifications, user's guides for software and hardware, and PDF files on a USB storage device of hard-copy Submittal.
 6. Meter data sheet for each meter, listing nameplate data and serial number, accuracy certification, and test results.
 7. Meter installation and billing software startup report.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An NRTL.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of metering equipment that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Damage from transient voltage surges.
 - 2. Warranty Period: Cost to repair or replace any parts for 1 year from date of Substantial Completion.
 - 3. Extended Warranty Period: Cost of replacement parts (materials only, f.o.b. the nearest shipping point to Project site), for eight years, that failed in service due to transient voltage surges.

1.9 COORDINATION

- A. Electrical Service Connections:
 - 1. Coordinate with utility companies and utility-furnished components.
 - a. Comply with requirements of utility providing electrical power services.
 - b. Coordinate installation and connection of utilities and services, including provision for electricity-metering components.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 916.

2.2 UTILITY METERING INFRASTRUCTURE

- A. Install metering accessories furnished by the utility company, complying with its requirements.
- B. Utility-Furnished Meters: Connect data transmission facility of metering equipment installed by the Utility.

- C. Current-Transformer Cabinets: Comply with requirements of electrical-power utility company.
- D. Meter Sockets:
 - 1. Comply with requirements of electrical-power utility company.
 - 2. Meter Sockets: Steady-state and short-circuit current ratings shall meet indicated circuit ratings.
- E. Arc-Flash Warning Labels;
 - 1. Labels: Comply with requirements for "Self-Adhesive Equipment Labels" and "Signs" in Section 260553 "Identification for Electrical Systems." Apply a 3-1/2-by-5-inch thermal transfer label of high-adhesion polyester for each work location included in the analysis. Labels shall be machine printed, with no field-applied markings.
 - a. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:
 - 1) Location designation.
 - 2) Nominal voltage.
 - 3) Flash protection boundary.
 - 4) Hazard risk category.
 - 5) Incident energy.
 - 6) Working distance.
 - 7) Engineering report number, revision number, and issue date.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with equipment installation requirements in NECA 1.
- B. Install meters furnished by utility company. Install raceways and equipment according to utility company's written instructions. Provide empty conduits for metering leads and extend grounding connections as required by utility company.
- C. Install arc-flash labels as required by NFPA 70.
- D. Wiring Method:

1. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 IDENTIFICATION

- A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
 1. Series Combination Warning Label: Self-adhesive labels, with text as required by NFPA 70.
 2. Equipment Identification Labels: Self-adhesive labels with clear protective overlay. For residential meters, provide an additional card holder suitable for printed, weather-resistant card with occupant's name.

3.3 FIELD QUALITY CONTROL

- A. Testing: By Contractor.
- B. Perform tests and inspections with the assistance of a factory-authorized service representative.
- C. Prepare test and inspection reports.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Straight-blade convenience receptacles.
 - 2. GFCI receptacles.
 - 3. Toggle switches.
 - 4. Wall plates.

1.3 DEFINITIONS

- A. Abbreviations of Manufacturers' Names:
 - 1. Cooper: Copper Wiring Devices; Division of Cooper Industries, Inc.
 - 2. Hubbell: Hubbell Incorporated: Wiring Devices-Kellems.
 - 3. Leviton: Leviton Mfg. Company, Inc.
 - 4. Pass & Seymour: Pass& Seymour/Legrand.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GFCI RECEPTACLES

- A. General Description:
 - 1. 125 V, 20 A, straight blade, feed-through type.
 - 2. Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 943 Class A, and FS W-C-596.
 - 3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
- B. Duplex GFCI Convenience Receptacles:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).

2.3 TOGGLE SWITCHES

- A. Comply with NEMA WD 1, UL 20, and FS W-S-896.
- B. Switches, 120/277 V, 20 A:

1. Single Pole:
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1) Eaton (Arrow Hart).
 - 2) Hubbell Incorporated; Wiring Device-Kellems.
 - 3) Leviton Manufacturing Co., Inc.
 - 4) Pass & Seymour/Legrand (Pass & Seymour).

2.4 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
 1. Plate-Securing Screws: Metal with head color to match plate finish.
 2. Material for Finished Spaces: High-impact thermoplastic in finished spaces.
 3. Material for Unfinished Spaces: Galvanized steel.
 4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover and listed and labeled for use in wet and damp locations.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.5 FINISHES

- A. Device Color:
 1. Wiring Devices Connected to Normal Power System: As required by NFPA 70 or device listing.
- B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
- C. Device Installation:
1. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 2. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 3. Connect devices to branch circuits using pigtails that are not less than 6-inches in length.
 4. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
 5. Use a torque screwdriver when a torque is recommended or required by manufacturer.
 6. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
 7. Tighten unused terminal screws on the device.
 8. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
- D. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.
- E. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- F. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.
- G. GFCI Receptacles: Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.2 FIELD QUALITY CONTROL

- A. Test Instruments: Use instruments that comply with UL 1436.

- B. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- C. Perform the following tests and inspections:
 - 1. Tests for Convenience Receptacles:
 - a. Line Voltage: Acceptable range is 105 to 132 V.
 - b. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - c. Using the test plug, verify that the device and its outlet box are securely mounted.
 - d. Correct circuit conditions remove malfunctioning units and replace with new ones, and retest as specified above.
- D. Wiring device will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

END OF SECTION

SECTION 26 56 68

EXTERIOR LED ATHLETIC LIGHTING

PART 1 – GENERAL

1.1 SUMMARY

- A. Work covered by this section of the specifications shall conform to the contract documents, engineering plans as well as state and local codes.
- B. The purpose of these specifications is to define the lighting system performance and design standards for the Portsmouth Soccer Fields lighting project using an LED Lighting source. The manufacturer / contractor shall supply lighting equipment to meet or exceed the standards set forth in these specifications.
- C. The sports lighting will be for the following venues:
 - 1. Soccer (3 Fields)
- D. The primary goals of this sports lighting project are:
 - 1. Guaranteed Light Levels: Selection of appropriate light levels impact the safety of the players and the enjoyment of spectators. Therefore light levels are guaranteed to not drop below specified target values for a period of 25 years.
 - 2. Environmental Light Control: It is the primary goal of this project to minimize spill light to adjoining properties and glare to the players, spectators and neighbors.
 - 3. Control and Monitoring: To allow for optimized use of labor resources and avoid unneeded operation of the facility, customer requires a remote on/off control system for the lighting system. Fields should be proactively monitored to detect luminaire outages over a 25-year life cycle. All communication and monitoring costs for 25-year period shall be included in the bid.

1.2 LIGHTING PERFORMANCE

- A. Illumination Levels and Design Factors: Playing surfaces shall be lit to an average target illumination level and uniformity as specified in the chart below. Lighting calculations shall be developed and field measurements taken on the grid spacing with the minimum number of grid points specified below. Appropriate light loss factors shall be applied and submitted for the basis of design. Average illumination level shall be measured in accordance with the IESNA LM-5-04 (IESNA Guide for Photometric Measurements of Area and Sports Lighting Installations). Illumination levels shall not to drop below desired target values in accordance to IES RP-6-15, Page 2, Maintained Average Illuminance and shall be guaranteed for the full warranty period.

Area of Lighting	Average Target Illumination Levels	Maximum to Minimum Uniformity Ratio	Grid Points	Grid Spacing
Soccer	30FC	2.5:1	96	30' x 30'

- B. Color: The lighting system shall have a minimum color temperature of 5700K and a CRI of 75.
- C. Mounting Heights: To ensure proper aiming angles for reduced glare and to provide better playability, minimum mounting heights shall be as described below. Higher mounting heights may be required based on photometric report and ability to ensure the top of the field angle is a minimum of 10 degrees below horizontal.

# of Poles	Pole Designation	Pole Height
4	S1, S2, S5, and S6	70'
4	S3, S4, S7, and S8	100'

1.3 ENVIRONMENTAL LIGHT CONTROL

- A. Light Control Luminaires: All luminaires shall utilize spill light and glare control devices including, but not limited to, internal shields, louvers and external shields. No symmetrical beam patterns are accepted.
- B. Spill Light and Glare Control: To minimize impact on adjacent properties, spill light and candela values must not exceed the following levels taken at 3 feet above grade.

Property Line	Maximum
Horizontal Footcandles	< 13 FC
Vertical Footcandles	< 15 FC

- C. Spill Scans: Spill scans must be submitted indicating the amount of horizontal and vertical footcandles along the specified lines. Light levels shall be taken at 30-foot intervals along the boundary line. Readings shall be taken with the meter orientation at both horizontal and aimed towards the most intense bank of lights. Illumination level shall be measured in accordance with the IESNA LM-5-04 after 1 hour warm up.
- D. The first page of a photometric report for all luminaire types proposed showing horizontal and vertical axial candle power shall be provided to demonstrate the capability of achieving the specified performance. Reports shall be certified by a qualified testing laboratory with a minimum of five years experience or by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products. A summary of the horizontal and vertical aiming angles for each luminaire shall be included with the photometric report.

PART 2 – PRODUCT

2.1 SPORTS LIGHTING SYSTEM CONSTRUCTION

- A. Manufacturing Requirements: All components shall be designed and manufactured as a system. All luminaires, wire harnesses, drivers and other enclosures shall be factory assembled, aimed, wired and tested.

- B. Durability: All exposed components shall be constructed of corrosion resistant material and/or coated to help prevent corrosion. All exposed carbon steel shall be hot dip galvanized per ASTM A123. All exposed aluminum shall be powder coated with high performance polyester or anodized. All exterior reflective inserts shall be anodized, coated, and protected from direct environmental exposure to prevent reflective degradation or corrosion. All exposed hardware and fasteners shall be stainless steel of 18-8 grade or better, passivated and coated with aluminum-based thermosetting epoxy resin for protection against corrosion and stress corrosion cracking. Structural fasteners may be carbon steel and galvanized meeting ASTM A153 and ISO/EN 1461 (for hot dipped galvanizing), or ASTM B695 (for mechanical galvanizing). All wiring shall be enclosed within the cross-arms, pole, or electrical components enclosure.
- C. System Description: Lighting system shall consist of the following:
1. Galvanized steel poles and cross-arm assembly.
 2. Non-approved pole technology:
 - a. Square static cast concrete poles will not be accepted.
 - b. Direct bury steel poles which utilize the extended portion of the steel shaft for their foundation will not be accepted due to potential for internal and external corrosive reaction to the soils and long term performance concerns.
 3. Lighting systems shall use concrete foundations. See Section 2.4 for details.
 - a. For a foundation using a pre-stressed concrete base embedded in concrete backfill the concrete shall be air-entrained and have a minimum compressive design strength at 28 days of 3,000 PSI. 3,000 PSI concrete specified for early pole erection, actual required minimum allowable concrete strength is 1,000 PSI. All piers and concrete backfill must bear on and against firm undisturbed soil.
 - b. For anchor bolt foundations or foundations using a pre-stressed concrete base in a suspended pier or re-inforced pier design pole erection may occur after 7 days. Or after a concrete sample from the same batch achieves a certain strength.
 4. Manufacturer will supply all drivers and supporting electrical equipment
 - a. Remote drivers and supporting electrical equipment shall be mounted approximately 10 feet above grade in aluminum enclosures. The enclosures shall be touch-safe and include drivers and fusing with indicator lights on fuses to notify when a fuse is to be replaced for each luminaire. Disconnect per circuit for each pole structure will be located in the enclosure. Integral drivers are not allowed.
 - b. Manufacturer shall provide surge protection at the pole equal to or greater than 40 kA for each line to ground (Common Mode) as recommended by IEEE C62.41.2_2002.
 5. Wire harness complete with an abrasion protection sleeve, strain relief and plug-in connections for fast, trouble-free installation.
 6. All luminaires, visors, and cross-arm assemblies shall withstand 150 mph winds and maintain luminaire aiming alignment.
 7. Control cabinet to provide remote on-off control, monitoring, and entertainment features of the lighting system. See Section 2.3 for further details.

8. Manufacturer shall provide lightning grounding as defined by NFPA 780 and be UL Listed per UL 96 and UL 96A.
 - a. Integrated grounding via concrete encased electrode grounding system.
 - b. If grounding is not integrated into the structure, the manufacturer shall supply grounding electrodes, copper down conductors, and exothermic weld kits. Electrodes and conductors shall be sized as required by NFPA 780. The grounding electrode shall be minimum size of 5/8 inch diameter and 8 feet long, with a minimum of 10 feet embedment. Grounding electrode shall be connected to the structure by a grounding electrode conductor with a minimum size of 2 AWG for poles with 75 feet mounting height or less, and 2/0 AWG for poles with more than 75 feet mounting height.
9. Enhanced corrosion protection package: Due to the potentially corrosive environment for this project, manufacturers must provide documentation that their products meet the following enhanced requirements in addition to the standard durability protection specified above:
 - a) Exposed carbon steel horizontal surfaces on the crossarm assembly shall be galvanized to no less than a five (5) mil average thickness.
 - b) Exposed die cast aluminum components shall be Type II anodized per MIL-STD-8625 and coated with high performance polyester.
 - c) Exposed extruded aluminum components shall be Type II anodized per MIL-STD-8625 and coated with high performance polyester.

D. Safety: All system components shall be UL listed for the appropriate application.

2.2 ELECTRICAL

- A. Electric Power Requirements for the Sports Lighting Equipment:
 1. Electric power: 480 Volt, 3 Phase
 2. Maximum total voltage drop: Voltage drop to the disconnect switch located on the poles shall not exceed three (3) percent of the rated voltage.
- B. Energy Consumption: The kW consumption for the field lighting system shall be 98kW, or less.

2.3 CONTROL

- A. Instant On/Off Capabilities: System shall provide for instant on/off of luminaires.
- B. Lighting contactor cabinet(s) constructed of NEMA Type 4 aluminum, designed for easy installation with contactors, labeled to match field diagrams and electrical design. Manual off-on-auto selector switches shall be provided.
- C. Dimming: System shall provide for 3-stage dimming (high-medium-low). Dimming will be set via scheduling options (Website, app, phone, fax, email)
- D. Remote Lighting Control System: System shall allow owner and users with a security code to schedule on/off system operation via a web site, phone, fax or email up to ten years in advance. Manufacturer shall provide and maintain a two-way TCP/IP communication link. Trained staff shall be available 24/7 to provide scheduling support and assist with reporting needs.

The owner may assign various security levels to schedulers by function and/or fields. This function must be flexible to allow a range of privileges such as full scheduling capabilities for all fields to only having permission to execute “early off” commands by phone. Scheduling tool shall be capable of setting curfew limits.

Controller shall accept and store 7-day schedules, be protected against memory loss during power outages, and shall reboot once power is regained and execute any commands that would have occurred during outage.

- E. Remote Monitoring System: System shall monitor lighting performance and notify manufacturer if individual luminaire outage is detected so that appropriate maintenance can be scheduled. The controller shall determine switch position (manual or auto) and contactor status (open or closed).
- F. Management Tools: Manufacturer shall provide a web-based database and dashboard tool of actual field usage and provide reports by facility and user group. Dashboard shall also show current status of luminaire outages, control operation and service. Mobile application will be provided suitable for IOS, Android and Blackberry devices.

Hours of Usage: Manufacturer shall provide a means of tracking actual hours of usage for the field lighting system that is readily accessible to the owner.
 - 1. Cumulative hours: shall be tracked to show the total hours used by the facility
 - 2. Report hours saved by using early off and push buttons by users.
- G. Communication Costs: Manufacturer shall include communication costs for operating the control and monitoring system for a period of 25 years.
- H. Communication with luminaire drivers: Control system shall interface with drivers in electrical components enclosures by means of powerline communication.

2.4 STRUCTURAL PARAMETERS

- A. Wind Loads: Wind loads shall be based on the 2015 International Building Code. Wind loads to be calculated using ASCE 7-10, an ultimate design wind speed of 130mph and exposure category C.
- B. Pole Structural Design: The stress analysis and safety factor of the poles shall conform to 2013 AASHTO Standard Specification for Structural Supports for Highway Signs, Luminaires, and Traffic Signals (LTS-6).
- C. Foundation Design: The foundation design shall be based on soil parameters as outlined in the geotechnical report. If no geotechnical report is available, the foundation design shall be based on soils that meet or exceed those of a Class 5 material as defined by 2015 IBC Table 1806.2.

- D. Foundation Drawings: Project specific foundation drawings stamped by a registered engineer in the state where the project is located are required. The foundation drawings must list the moment, shear (horizontal) force, and axial (vertical) force at ground level for each pole. These drawings must be submitted at time of bid to allow for accurate pricing.

PART 3 – EXECUTION

3.1 SOIL QUALITY CONTROL

- A. It shall be the Contractor's responsibility to notify the Owner if soil conditions exist other than those on which the foundation design is based, or if the soil cannot be readily excavated. Contractor may issue a change order request / estimate for the Owner's approval / payment for additional costs associated with:
1. Providing engineered foundation embedment design by a registered engineer in the State of New Hampshire for soils other than specified soil conditions;
 2. Additional materials required to achieve alternate foundation;
 3. Excavation and removal of materials other than normal soils, such as rock, caliche, etc.

3.2 DELIVERY TIMING

- A. Delivery Timing Equipment On-Site: The equipment must be on-site 6-8 weeks from receipt of approved submittals and receipt of complete order information.

3.3 FIELD QUALITY CONTROL

- A. Illumination Measurements: Upon substantial completion of the project and in the presence of the Contractor, Project Engineer, Owner's Representative, and Manufacturer's Representative, illumination measurements shall be taken and verified. The illumination measurements shall be conducted in accordance with IESNA LM-5-04.
- B. Field Light Level Accountability
1. Light levels are guaranteed not to fall below the target maintained light levels for the entire warranty period of 25 years. These levels will be specifically stated as "guaranteed" on the illumination summary provided by the manufacturer.
 2. The contractor/manufacturer shall be responsible for conducting initial light level testing and an additional inspection of the system, in the presence of the owner, one year from the date of commissioning of the lighting.
 3. The contractor/manufacturer will be held responsible for any and all changes needed to bring these fields back to compliance for light levels and uniformities. Contractor/Manufacturer will be held responsible for any damage to the fields during these repairs.
- C. Correcting Non-Conformance: If, in the opinion of the Owner or his appointed Representative, the actual performance levels including footcandles and uniformity ratios are not in conformance with the requirements of the performance specifications and submitted information, the Manufacturer shall be required to make adjustments to meet specifications and satisfy Owner.

3.4 WARRANTY AND GUARANTEE

- A. 25-Year Warranty: Each manufacturer shall supply a signed warranty covering the entire system for 25 years from the date of shipment. Warranty shall guarantee specified light levels. Manufacturer shall maintain specifically-funded financial reserves to assure fulfillment of the warranty for the full term. Warranty does not cover weather conditions events such as lightning or hail damage, improper installation, vandalism or abuse, unauthorized repairs or alterations, or product made by other manufacturers.
- B. Maintenance: Manufacturer shall monitor the performance of the lighting system, including on/off status, hours of usage and luminaire outage for 25 years from the date of equipment shipment. Parts and labor shall be covered such that individual luminaire outages will be repaired when the usage of any field is materially impacted. Manufacturer is responsible for removal and replacement of failed luminaires, including all parts, labor, shipping, and equipment rental associated with maintenance. Owner agrees to check fuses in the event of a luminaire outage.

PART 4 – DESIGN APPROVAL

4.0 PRE-BID SUBMITTAL REQUIREMENTS (Non-Musco)

- A. Design Approval: The owner / engineer will review pre-bid submittals per section 4.0.B from all the manufacturers to ensure compliance to the specification 10 days prior to bid. If the design meets the design requirements of the specifications, a letter and/or addendum will be issued to the manufacturer indicating approval for the specific design submitted.
- B. Approved Product: Musco's Light-Structure System™ with TLC for LED™ is the approved product. All substitutions must provide a complete submittal package for approval as outlined in Submittal Information at the end of this section at least 10 days prior to bid. Special manufacturing to meet the standards of this specification may be required. An addendum will be issued prior to bid listing any other approved lighting manufacturers and designs.
- C. All listed manufacturers not pre-approved shall submit the information at the end of this section at least 10 days prior to bid. An addendum will be issued prior to bid; listing approved lighting manufacturers and the design method to be used.
- D. Bidders are required to bid only products that have been approved by this specification or addendum by the owner or owner's representative. Bids received that do not utilize an approved system/design, will be rejected.

REQUIRED SUBMITTAL INFORMATION FOR ALL MANUFACTURERS (NOT PRE-APPROVED) 10 DAYS PRIOR TO BID

All items listed below are mandatory, shall comply with the specification and be submitted according to pre-bid submittal requirements. Complete the Yes/No column to indicate compliance (Y) or noncompliance (N) for each item. Submit checklist below with submittal.

Yes / No	Tab	Item	Description
	A	Letter/ Checklist	Listing of all information being submitted must be included on the table of contents. List the name of the manufacturer's local representative and his/her phone number. Signed submittal checklist to be included.
	B	Equipment Layout	Drawing(s) showing field layouts with pole locations
	C	On Field Lighting Design	Lighting design drawing(s) showing: <ul style="list-style-type: none"> a. Field Name, date, file number, prepared by b. Outline of field(s) being lighted, as well as pole locations referenced to the center of the field (x & y), Illuminance levels at grid spacing specified c. Pole height, number of fixtures per pole, horizontal and vertical aiming angles, as well as luminaire information including wattage, lumens and optics d. Height of light test meter above field surface. e. Summary table showing the number and spacing of grid points; average, minimum and maximum illuminance levels in foot candles (fc); uniformity including maximum to minimum ratio, coefficient of variance (CV), coefficient of utilization (CU) uniformity gradient; number of luminaires, total kilowatts, average tilt factor; light loss factor.
	D	Off Field Lighting Design	Lighting design drawing showing initial spill light levels along the boundary line (defined on bid drawings) in footcandles. Lighting design showing glare along the boundary line in candela. Light levels shall be taken at 30-foot intervals along the boundary line. Readings shall be taken with the meter orientation at both horizontal and aimed towards the most intense bank of lights.
	E	Photometric Report	Provide first page of photometric report for all luminaire types being proposed showing candela tabulations as defined by IESNA Publication LM-35-02. Photometric data shall be certified by laboratory with current National Voluntary Laboratory Accreditation Program or an independent testing facility with over 5 years experience.
	F	Performance Guarantee	Provide performance guarantee including a written commitment to undertake all corrections required to meet the performance requirements noted in these specifications at no expense to the owner. Light levels must be guaranteed to not fall below target levels for warranty period.
	G	Structural Calculations	Pole structural calculations and foundation design showing foundation shape, depth backfill requirements, rebar and anchor bolts (if required). Pole base reaction forces shall be shown on the foundation drawing along with soil bearing pressures. Design must be stamped by a structural engineer in the state of New Hampshire, if required by owner. (May be supplied upon award).
	H	Control & Monitoring System	Manufacturer of the control and monitoring system shall provide written definition and schematics for automated control system. They will also provide ten (10) references of customers currently using proposed system in the state of New Hampshire.

	I	Electrical Distribution Plans	Manufacturer bidding an alternate product must include a revised electrical distribution plan including changes to service entrance, panels and wire sizing, signed by a licensed Electrical Engineer in the state of New Hampshire.
	J	Warranty	Provide written warranty information including all terms and conditions. Provide ten (10) references of customers currently under specified warranty in the state of New Hampshire.
	K	Project References	Manufacturer to provide a list of ten (10) projects where the technology and specific fixture proposed for this project has been installed in the state of New Hampshire. Reference list will include project name, project city, installation date, and if requested, contact name and contact phone number.
	L	Product Information	Complete bill of material and current brochures/cut sheets for all product being provided.
	M	Delivery	Manufacturer shall supply an expected delivery timeframe from receipt of approved submittals and complete order information.
	N	Non-Compliance	Manufacturer shall list all items that do not comply with the specifications. If in full compliance, tab may be omitted.
	O	Cost of Ownership	Document cost of ownership as defined in the specification. Identify energy costs for operating the luminaires. Maintenance cost for the system must be included. All costs should be based on 25 Years

The information supplied herein shall be used for the purpose of complying with the specifications for the Portsmouth Soccer lighting project. By signing below I agree that all requirements of the specifications have been met and that the manufacturer will be responsible for any future costs incurred to bring their equipment into compliance for all items not meeting specifications and not listed in the Non-Compliance section.

Manufacturer: _____ Signature: _____

Contact Name: _____ Date: ____/____/____

Contractor: _____ Signature: _____

APPENDIX A

Geotechnical Information

REPORT

18-1170 S

January 30, 2019

Explorations and Geotechnical Engineering Services

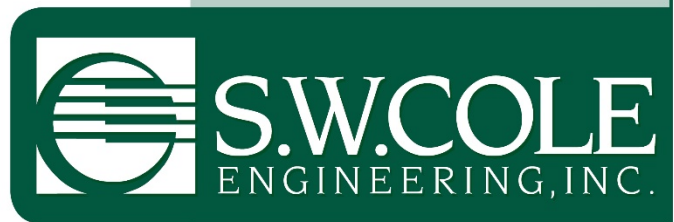
Proposed Athletic Fields
Portsmouth, New Hampshire

Prepared For:

CMA Engineers
Attention: Mr. Phillip A. Corbett, P.E.
35 Bow Street
Portsmouth, NH 03801

Prepared By:

S. W. Cole Engineering, Inc.
10 Centre Road
Somersworth, NH 03878-2926
T: 603-692-0088



- *Geotechnical Engineering*
- *Construction Materials Testing and Special Inspections*
- *GeoEnvironmental Services*
- *Test Boring Explorations*

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18-1170 S

January 30, 2019

CMA Engineers
Attention: Mr. Phillip A. Corbett, P.E.
35 Bow Street
Portsmouth, NH 03801

Subject: Explorations and Geotechnical Engineering Services
Proposed Athletic Fields
Portsmouth, New Hampshire

Dear Phil:

In accordance with our Proposal dated August 30, 2018, the following presents results of our geotechnical evaluation for proposed athletic fields in the City of Portsmouth, New Hampshire. This report summarizes our findings and geotechnical recommendations, and its contents are subject to the limitations set forth in Appendix A.

1.0 INTRODUCTION

1.1 Scope and Purpose

The purpose of our services was to explore subsurface conditions at the site in order to provide geotechnical recommendations relative to earthwork associated with proposed athletic field construction. Our scope of services included nine test boring and five test pit explorations, soils laboratory testing, a geotechnical evaluation of the findings relative to proposed athletic field construction, and preparation of this report.

Our overall scope of services under the August 30, 2018 Proposal included a proposed transfer station northeast of the proposed athletic field location. We were not authorized to undertake subsurface exploration work for the proposed transfer station, therefore this portion of our scope is not addressed herein. At the request of CMA Engineers, one of the test pits (TP-5) was excavated in the transfer station area for informational purposes.

1.2 Site and Proposed Construction

We understand the proposed athletic fields are to be located on the southerly side of Banfield Road and northerly side of West Road in the City of Portsmouth. The site is accessed by a gravel drive located off of Campus Drive. The proposed athletic fields are to be sited in an open area southwest of a reclaimed gravel pit and east of a wooded area. We understand porous pavement is under consideration for associated parking.

The proposed athletic field construction area encompasses about 8 acres, with site grades having a relative low area at about elevations 26 to 27 feet along the property boundary with the reclaimed gravel pit. Existing grades increase generally radially from this low point throughout the area up to about elevations 40 to 45 feet. There are several debris piles present in the southeasterly portion of the area. While project planning is in conceptual stages, we understand three soccer fields are planned, each having synthetic turf. We understand it is preferred that earthwork require fairly balanced cuts and fills. The main focus of our work has been to assess issues that will impact earthwork, including the potential for shallow bedrock and groundwater as well as reuse of excavated site soils. It is understood that synthetic turf and porous pavement design will be undertaken by others.

We have attached the initial concept plan forwarded to us by CMA Engineers depicting the exploration locations in relation to the general construction area in Appendix B. Also included are existing conditions plans dated January 8, 2019 (Sheets 1 through 8). We have outlined the approximate location of the area explored for the athletic fields on Sheet 1 of the plans.

2.0 EXPLORATION AND TESTING

2.1 Explorations

Nine test borings (B-1 through B-9) were made at the site on November 15, 2018 by S. W. Cole Explorations, LLC, a subsidiary of S. W. Cole Engineering, Inc. (S.W. COLE). Additionally, five test pits were excavated on November 26, 2018 by a local excavation subcontractor. Test Pits TP-1 through TP-4 were made in the proposed athletic field area while Test Pit TP-5 was made in the proposed transfer station area at the request of CMA Engineers, Inc. for information purposes. Test Pit TP-6 was planned nearby Test Pit TP-5 but cancelled by CMA Engineers, Inc. due to presence of wetlands.

The exploration locations were jointly selected by CMA Engineers, Inc. and S.W.COLE. We located the explorations by a combination of using a mapping grade GPS unit and measuring from existing site features. CMA Engineers provided us the coordinates to this end. Subsequent to undertaking the explorations, the explorations were located by the project surveyor, the locations of which have been included by CMA Engineers on the existing conditions plans. The plans indicated the location of Boring B-7 was in question and upon our review, we relocated this boring on the attached plan to more closely match our field observations during the exploration work.

We highlighted the exploration locations on the attached plans in Appendix B. Logs of the explorations, and a key to the notes and symbols used on the logs are attached in Appendix C.

2.2 Field Testing

The test borings were drilled using hollow stem augers and carried to depths varying from 4.1 to 17.0 feet. The soils were sampled where shown on the logs using a split spoon sampler and Standard Penetration Testing (SPT) procedures. SPT blow counts are shown on the logs. Refusals based on resistance to auger penetration or advancement of the split-spoon sampler were recorded in Borings B-1, B-2, B-5 and B-6 at depths of 7.8, 11.3, 4.2 and 4.1 feet, respectively. We also recorded refusals in three of the five test pits at comparable depths. Open standpipe piezometers were installed in Borings B-1 through B-4 after completion of the borings. Please see the attached logs for installation details.

2.3 Laboratory Testing

Soil samples retrieved from the test borings were visually classified in our laboratory. We performed two laboratory gradation and four moisture content tests on selected samples to assist in our evaluation. Gradation test results are included in Appendix D. Moisture test results are presented on the boring logs.

3.0 SUBSURFACE CONDITIONS

3.1 Soils

The explorations that were undertaken in the area where athletic fields are proposed generally encountered miscellaneous fills overlying native silt-fine sand mixtures, silty clays, glacial till and what appeared to be shallow bedrock in some locations. The fills are predominantly granular with varying amounts of wood, asphalt, brick and other debris and

for the most part extend as deep as 4 to 7 feet in many locations. The fills are loose to medium dense based on SPT N-values (the number of hammer blows required to advance the soil sampler 12 inches).

Borings B-4 and B-7, made in the southerly portion of the athletic field area and encountered medium dense silts and fine sands beneath the fills. The stratum grades to a silt-clay mixture in Borings B-2, B-3 and B-7.

Where encountered, the glacial till consists of a medium dense heterogeneous mixture of silt, sand and gravel.

Borings B-8 and B-9, made along the access drive into the site, encountered 5 feet of very dense silty sand and gravel fill overlying gravelly sands that, in turn, overly silts and fine sands.

Refusals were encountered in several explorations. The following tabulates refusal depths and elevations.

Exploration	Approximate Ground Surface Elevation (ft)	Approximate Depth to Refusal (ft)	Approximate Refusal Elevation (ft)
B-1	36.8	7.8	29
B-2	36.0	11.3	25
B-3	38.7	-	-
B-4	40.7	-	-
B-5	40.0	4.2	36
B-6	28.8	4.1	25
B-7	37 (estimated)	-	-
B-8	44.2	-	-
B-9	42.2	-	-
TP-1	33.6	6	28
TP-2	30.4	2 - 4	26 - 28
TP-3	39.9	-	-
TP-4	28.3	-	-
TP-5	35.3	5	30

From our observations, the refusal in Test Pit TP-1 appeared to be on a boulder, while the refusals in Test Pits TP-2 and TP-5 likely reflect bedrock. It is more difficult to distinguish bedrock from large obstacles such as boulders in test borings, however with the exception of Boring B-5, the refusal elevations in Borings B-1, B-2 and B-6 are consistent with the apparent bedrock observed in Test Pit TP-2. For planning purposes, we suggest assuming refusals are on or near the bedrock surface. It may be prudent to undertake additional test pit work to obtain supplementary bedrock observations.

Please refer to the attached logs for more detailed subsurface information.

3.2 Groundwater

Groundwater and/or moist soils were observed in most of the explorations, the majority of which were within about 5 feet of existing grade. We returned to the site on December 5, 2018 and measured groundwater in the wells installed in Borings B-1 through B-4 at depths of 7.6, 0.9, 1.2 and 5.5 feet, respectively.

It is of note these observations were made during a seasonally wet period of the year. Groundwater levels will fluctuate, particularly in response to periods of snowmelt and precipitation, as well as changes in site use.

4.0 ASSESSMENT

We understand project planning is in the preliminary stages and the configuration of the athletic fields as well as proposed grading are in flux. From the perspective of balancing cuts and fills, a cursory look at site grades suggests the potential for fields to be established at elevations in the range of 31 to 34 feet, requiring site grading cuts along the southerly and southwesterly portions of the area. However, the shallow groundwater levels, subgrade soils expected to be highly susceptible to disturbance, and presence of shallow bedrock in the cut areas may render finish grades above elevation 34 feet more desirable. Further, there is the potential for encountering existing fills with asphalt and other debris that may be classified as “urban fills,” with associated disposal costs should they be excavated in the course of subgrade preparation and require off-site disposal.

We recommend that excavation to subgrade be made utilizing an excavator with a smooth-edge bucket. Use of equipment directly on the subgrade creates high potential for subgrade disturbance and should be avoided. Generally, an excavator working from existing grade to prepare the subgrade will create less potential for subgrade disturbance.

Where subgrades become yielding or difficult to work, we recommend over-excavation by at least 12 inches and replacement with Crushed Stone overlying non-woven geotextile filter fabric such as Mirafi 180N or equivalent. The Crushed Stone should meet the requirements of ASTM D-448, No. 57 stone.

Where subgrades are fills containing clustered boulders, blast spoils or excessive oversized materials, voids where present should be choked with Crushed Stone.

It is apparent that groundwater is at least seasonally within 2 to 4 feet of the ground surface. The explorations indicate that excavations made to these depths will likely encounter for the most part granular fills with the erratic presence of various debris. Excavations made deeper in fills are likely to encounter wetter conditions. Excavated fill materials may be used in compacted lifts to raise grades in ball field areas provided that organics, objectionable foreign debris and rocks larger than 6 inches in size are culled, and the materials are at a moisture content consistent with meeting project compaction requirements. We expect this effort will be easier during the typically drier summer months. The underlying native fine sand-silt-clays are expected to be more difficult to reuse as they will likely be at or near saturation.

Where imported borrow is needed, we recommend the material consist of Granular Borrow meeting the following gradation requirements.

GRANULAR BORROW	
Sieve Size	Percent Finer by Weight
6 Inch	100
Portion Passing 3 Inch Sieve	
No. 40	0 to 70
No. 200	0 to 20

Fill should be placed in horizontal lifts and compacted such that the desired density is achieved throughout the lift thickness with 3 to 5 passes of the compaction equipment. Loose lift thicknesses for soil used in grading, fill and backfill activities should not exceed 12 inches. We recommend that fill and backfill be compacted to at least 92 percent of its maximum dry density as determined by ASTM D1557 (Modified Proctor).

Depending upon proposed site grading, it would be prudent to consider an interceptor trench drain along the south-southwesterly perimeter to improve new field performance.

Borings B-8 and B-9 were made along the gravel access road to the site and encountered silty sand and gravel fills within 5 feet of the ground surface. Results from a gradation test performed on a fill sample from Boring B-9 were not favorable for meeting the requirements for either NHDOT 304.2 Gravel or NHDOT 304.5 Crushed Stone (Coarse) Subbase due to excessive amounts of fines.

5.0 CLOSURE

Refusals in the test borings were generally within about 12 feet of existing grade, a reachable depth using a large excavator. Consideration should be given to undertaking additional test pit exploration work as project planning progresses, specifically in anticipated cut areas, to provide additional refusal/bedrock information.

We recommend that S.W.COLE be retained during construction to provide soil testing services to observe compliance with design concepts, plans and specifications.

It has been a pleasure to be of assistance to you with this phase of your project. If you have any questions or we may be of further assistance, please do not hesitate to contact us.

Sincerely,

S. W. Cole Engineering, Inc.



Anthony J. Hersh, P.E.
Senior Geotechnical Engineer

AJH:cbm



APPENDIX A

Limitations

This report has been prepared for the exclusive use of CMA Engineers, Inc. for specific application to proposed Athletic Fields in Portsmouth, New Hampshire. S. W. Cole Engineering, Inc. (S.W.COLE) has endeavored to conduct our services in accordance with generally accepted soil and foundation engineering practices. No warranty, expressed or implied, is made.

The soil profiles described in the report are intended to convey general trends in subsurface conditions. The boundaries between strata are approximate and are based upon interpretation of exploration data and samples.

The analyses performed during this investigation and recommendations presented in this report are based in part upon the data obtained from subsurface explorations made at the site. Variations in subsurface conditions may occur between explorations and may not become evident until construction. If variations in subsurface conditions become evident after submission of this report, it will be necessary to evaluate their nature and to review the recommendations of this report.

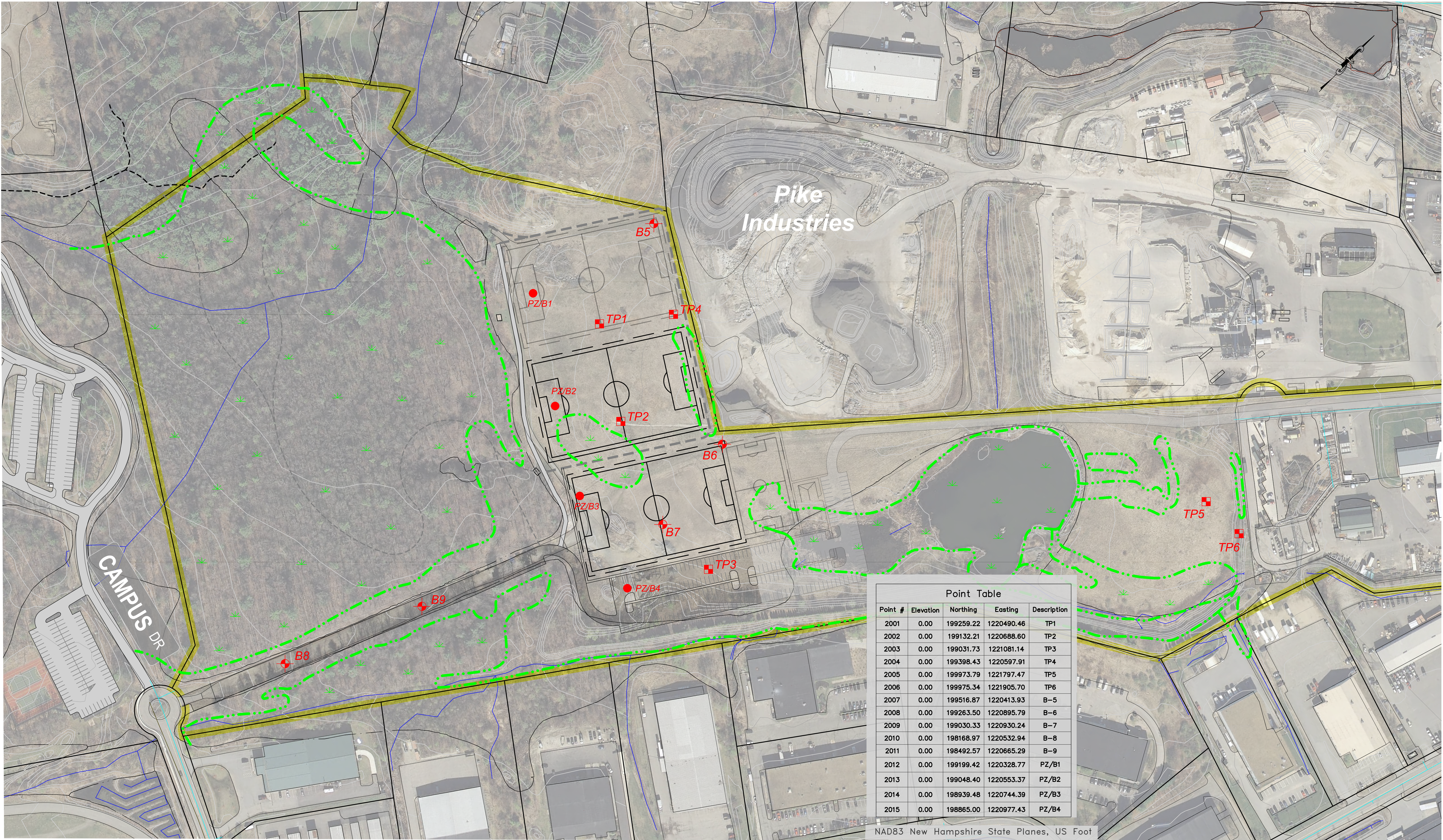
Observations have been made during exploration work to assess site groundwater levels. Fluctuations in water levels will occur due to variations in rainfall, temperature, and other factors.

S.W.COLE's scope of services has not included the investigation, detection, or prevention of any Biological Pollutants at the project site or in any existing or proposed structure at the site. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, and viruses, and the byproducts of any such biological organisms.

Recommendations contained in this report are based substantially upon information provided by others regarding the proposed project. In the event that any changes are made in the design, nature, or location of the proposed project, S.W.COLE should review such changes as they relate to analyses associated with this report. Recommendations contained in this report shall not be considered valid unless the changes are reviewed by S.W.COLE.

APPENDIX B

Figures




Point Table				
Point #	Elevation	Northing	Easting	Description
2001	0.00	199259.22	1220490.46	TP1
2002	0.00	199132.21	1220688.60	TP2
2003	0.00	199031.73	1221081.14	TP3
2004	0.00	199398.43	1220597.91	TP4
2005	0.00	199973.79	1221797.47	TP5
2006	0.00	199975.34	1221905.70	TP6
2007	0.00	199516.87	1220413.93	B-5
2008	0.00	199263.50	1220895.79	B-6
2009	0.00	199030.33	1220930.24	B-7
2010	0.00	198168.97	1220532.94	B-8
2011	0.00	198492.57	1220665.29	B-9
2012	0.00	199199.42	1220328.77	PZ/B1
2013	0.00	199048.40	1220553.37	PZ/B2
2014	0.00	198939.48	1220744.39	PZ/B3
2015	0.00	198865.00	1220977.43	PZ/B4

NAD83 New Hampshire State Planes, US Foot


Portsmouth Multi-purpose Recreation Fields

Round 1: Subsurface Investigation




**B#**


Boring

**PZ/B#**

Piezometer

**TP#**

Test Pit

Approximate Wetland Limits



MAP-LOT

ABUTTERS LIST

OWNER OF RECORDDEED REFERENCE

252-2-10	JMK REALTY LLC PO BOX 971, PORTSMOUTH, NH 03802	3656/744
252-2-11	HEG WEST ROAD LLC, 2 INTERNATIONAL WAY, LAWRENCE, MA 01843	5835/67
252-2-12	60 WEST RD, PORTSMOUTH, NH 03801	
252-2-12	ONE HUNDRED WEST LLC, 100 WEST RD, PORTSMOUTH, NH 03801	3589/1427
252-2-14	LITCHFIELD PORTSMOUTH LLC	4800/1185
252-3	C/O EATON PARTNERS INC, 175 CANAL ST STE 401, MANCHESTER, NH 03101	
252-4 & 252-5	LIGHTHOUSE MANUFACTURING LLC, 25 SOUTH SATELLITE RD, SOUTH WINDSOR, CT 06074	N/A
253-4	4 AMIGOS LLC, 321 LAFAYETTE RD, HAMPTON, NH 03842	N/A
253-4	DPH REALTY LLC, 30 MIRONA RD EXT, PORTSMOUTH, NH 03801	N/A
253-5	GERALD W. & TERESA M. REYNOLDS, 164 MASON RD, MILTON, NH 03851	N/A
253-5-1	BOURAS GROUP LLC, 10 MIRONA RD, PORTSMOUTH, NH 03801	N/A
254-7	PIKE INDUSTRIES, INC., 3 EASTGATE PARK RD, BELMONT, NH 03220	3192/1085
254-8-1	MCM ACQUISITION 2017 LLC	N/A
	ATTN: TAX DEPT NH22094-A, 8051 CONGRESS AVE, BOCA RATON, FL 33487-1307	
266-1	RICCI CONSTRUCTION CO., INC., 225 BANFIELD RD, PORTSMOUTH, NH 03801	2527/322
266-3	ANDREW R. & CAROL ANN CROTEAU, 285 BANFIELD RD, PORTSMOUTH, NH 03801	2274/1868
266-4	FOUNDATION FOR SEACOAST HEALTH, 100 CAMPUS DR SUITE 1, PORTSMOUTH, NH 03801	3276/2980 & 3259/2178
266-5	HOPE FOR TOMORROW FOUNDATION, 1 STONERIDGE DR, RYE, NH 03870	5783/602
267-17-1	300 WEST RD LLC, 300 WEST ROAD UNIT #1, PORTSMOUTH, NH 03801	4453/1140
267-17-2	GRAYWOLF PROPERTIES LLC, 1 LIBBEY LN, RYE, NH 03870	4397/2371
267-17-3	GRAYWOLF PROPERTIES LLC, 1 LIBBEY LN, RYE, NH 03870	4439/1934
267-17-4	GRAYWOLF PROPERTIES LLC, 1 LIBBEY LN, RYE, NH 03870	4397/2371
267-19-1	BBJ PROPERTIES, INC., 38 RAINBOW LN, SANFORD, ME 04073	3396/126
267-19-2	PETER PARADIS, 481 DENNETT ST, PORTSMOUTH, NH 03801	3090/1083
267-19-3	KEVIN J. DUPLISEA, 270 WEST RD #3, PORTSMOUTH, NH 03801	5564/2186
267-19-4	WEST ROAD EQUIPMENT LLC, 270 WEST RD UNIT 4A, PORTSMOUTH, NH 03801	5059/2202
267-20	HARVEY PROPCO LLC, 1400 MAIN ST, WALTHAM, MA 02451	5660/1693
267-21	P A M REALTY TRUST C/O CP MANAGEMENT, INC., 11 COURT ST. SUITE 100, EXETER, NH 03833	4438/828
267-21	STERLING REALTY, INC., 143 PINELOCH DR, PORTLAND, ME 04103	2762/2839
267-22	MICRONICS, INC., 200 WEST RD, PORTSMOUTH, NH 03801	5423/2254
267-23	ENGEL FAMILY TRUST, ROBERT ENGEL TRUSTEE, PO BOX 6070, MANCHESTER, NH 03108	3459/1842
273-5	BELLWOOD ASSOCIATES LTD PARTNERSHIP C/O FESTIVAL FUN PARK PROPERTY TAX SERVICES PO BOX 543185, DALLAS, TX 75354	3471/2972

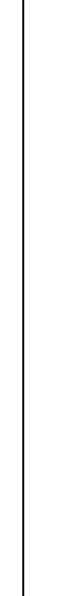
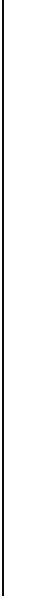
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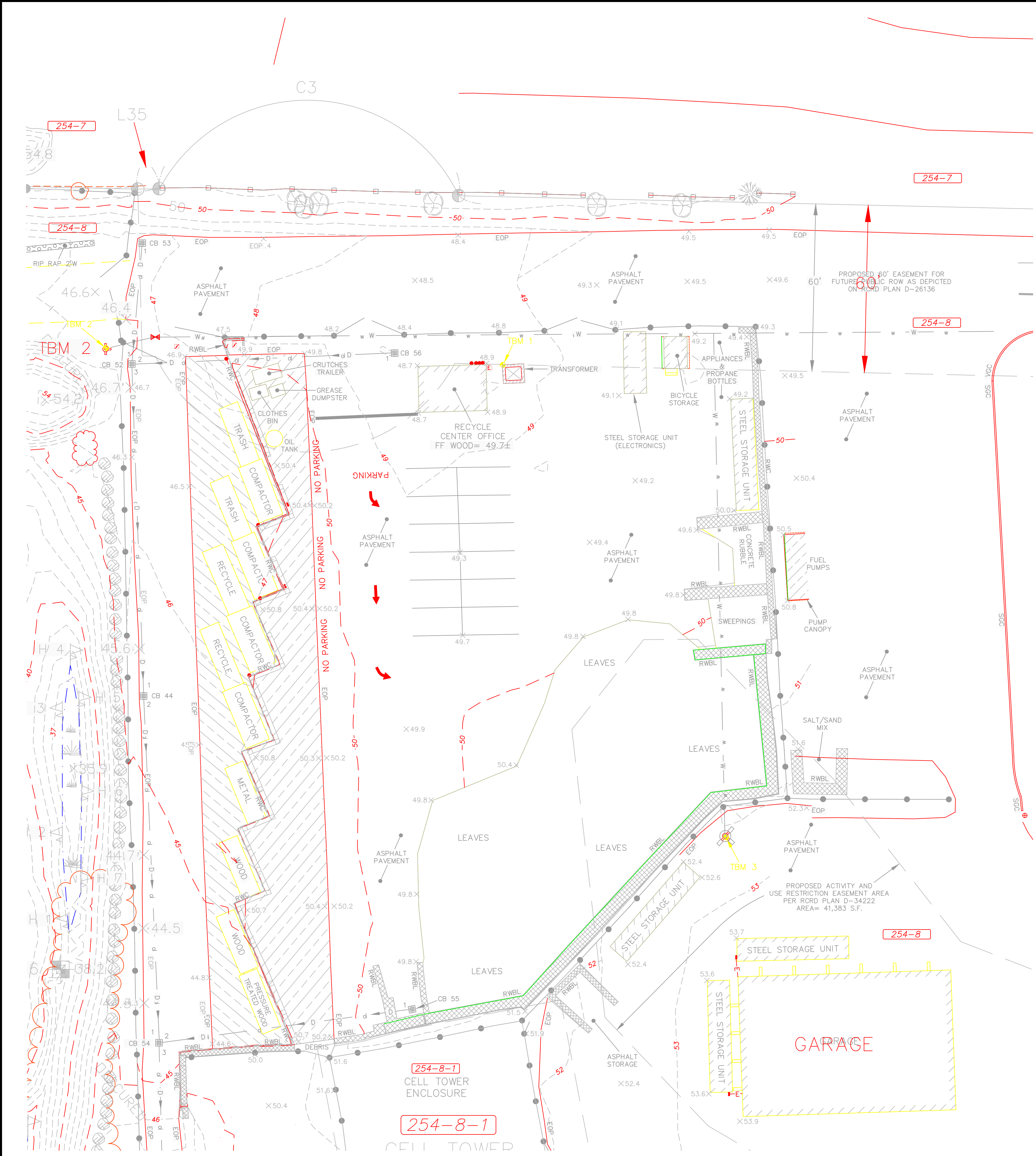
1. OWNER OF RECORD.....CITY OF PORTSMOUTH, N.H.
ADDRESS.....1 JUNKINS AVE, PORTSMOUTH, NH 03801
DEED REFERENCE.....3276/2986 & 5819/2310
TAX SHEET / LOT.....254-8
ZONED:..... MUNICIPAL FRONT YARD SETBACK.....N/A
MINIMUM LOT AREA N/A SIDE YARD SETBACK.....N/A
FRONTAGE..... N/A REAR YARD SETBACK.....N/A
2. THE RELATIVE ERROR OF CLOSURE WAS LESS THAN 1 FOOT IN 15,000 FEET.
3. THIS PLAN IS BASED ON A FIELD SURVEY, INFORMATION FROM PLANS OF RECORD AND AERIAL MAPPING BY EASTERN TOPOGRAPHICS.
PRIMARY BM: CITY CONTROL POINT "INDU"
HORIZONTAL DATUM: NAD 1983 (1986 CONTROL ADJUSTMENT)
VERTICAL DATUM: NAVD 1988
4. THE LOCATION OF ALL UNDERGROUND UTILITIES SHOWN HEREON ARE APPROXIMATE AND ARE BASED UPON THE FIELD LOCATION OF ALL VISIBLE STRUCTURES (IE CATCH BASINS, MANHOLES, WATER GATES ETC.) AND INFORMATION COMPILED FROM PLANS PROVIDED BY UTILITY COMPANIES AND GOVERNMENTAL AGENCIES. ALL CONTRACTORS SHOULD NOTIFY, IN WRITING, SAID AGENCIES PRIOR TO ANY EXCAVATION WORK AND CALL DIG-SAFE @ 1-888-DIG-SAFE.
5. THE SUBJECT TRACTS LIE IN ZONE X (UNSHADED), AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN, AS SHOWN ON FLOOD INSURANCE MAP NO. 33015C0270E, EFFECTIVE DATE MAY 17, 2005, BY FEMA.
6. PARCEL 254-8 AND A PORTION OF PARCEL 266-4 ARE SUBJECT TO A RESTRICTIVE COVENANT AGREEMENT BETWEEN JOHN IAFOLLA CO., INC. & PIKE INDUSTRIES, INC., SEE RCRD BOOK 3192, PAGE 1088, BOOK 3193, PAGE 2059 AND BOOK 3198, PAGE 853.
7. WETLANDS DELINEATION 10/2018 BY GZA ENVIRONMENTAL.
8. ENGINEER OR CONTRACTOR TO VERIFY SITE BENCHMARKS BY LEVELING BETWEEN 2 BENCHMARKS PRIOR TO THE SETTING OR ESTABLISHMENT OF ANY GRADES/ELEVATIONS. DISCREPANCIES ARE TO BE REPORTED TO JAMES VERRA AND ASSOC., INC.



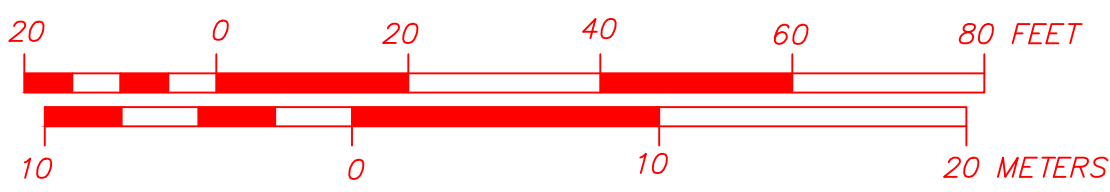
REFERENCE PLANS:

1. AMENDED SITE PLAN, PROPERTY OF MICRONICS INC, 200 WEST ROAD, PORTSMOUTH, N.H., DATED 12/30/2014, RCRD PLAN D-38846.
2. LOT LINE REVISION PLAN, 755 BANFIELD ROAD REALTY, LLC, CONSTITUTION AVENUE, PORTSMOUTH, N.H., REVISED TO 11/28/2011, RCRD PLAN D-37091.
3. DRAINAGE EASEMENT PLAN OVER LAND OF BELLWOOD ASSOCIATES LIMITED PARTNERSHIP, CAMPUS DRIVE, PORTSMOUTH, N.H., DATED 7/30/2007, RCRD PLAN D-35073.
4. ACTIVITY AND USE RESTRICTION EASEMENT PLAN FOR PORTSMOUTH DEPARTMENT OF PUBLIC WORKS, 680 PEVERLY HILL ROAD, PORTSMOUTH, N.H., REVISED TO 9/13/2006, RCRD PLAN D-34222.
5. LATTICE TOWER EASEMENT PLAN, PEVERLY HILL ROAD, PORTSMOUTH, N.H., FOR MESSAGE CENTER MANAGEMENT, REVISED TO 4/16/2002, RCRD PLAN D-30056.
6. FOUNDATION FOR SEACOAST HEALTH, PORTSMOUTH, N.H., LOT LINE ADJUSTMENT, JOHN IAFOLLA COMPANY, INC. AND CITY OF PORTSMOUTH, REVISED TO 4/14/1998, RCRD PLAN D-26202.
7. SUBDIVISION & LOT LINE RELOCATION PLAN FOR PIKE INDUSTRIES, INC. & JOHN IAFOLLA COMPANY, INC, PEVERLY HILL ROAD/ BANFIELD ROAD, PORTSMOUTH, N.H., REVISED TO 11/21/1997, RCRD PLAN D-26136.
8. SUBDIVISION PLAN FOR JOHN IAFOLLA COMPANY, INC., PEVERLY HILL ROAD/ BANFIELD ROAD, PORTSMOUTH, N.H., REVISED TO 11/20/1996, RCRD PLAN D-25124.
9. LOT LINE ELIMINATION PLAN FOR BELLWOOD ASSOCIATES LIMITED PARTNERSHIP, LAFAYETTE ROAD/ CONSTITUTION AVENUE, PORTSMOUTH, N.H., DATED 9/3/1991, RCRD PLAN D-21288.
10. PLAN OF DRAINAGE EASEMENT FOR LAFAYETTE WEST CORP & FFP INTERIM PARTNERS, WEST ROAD, PORTSMOUTH, N.H., REVISED TO 3/28/1989, RCRD PLAN D-22902.
11. SUBDIVISION PLAN, LINCOLN AND MARY HANSCOM, PORTSMOUTH, N.H., DATED 1/1983, RCRD PLAN D-11441.
12. LOT LINE REVISION PLAN, CAMPUS DRIVE, BANFIELD & PEVERLY HILL ROADS, PORTSMOUTH, N.H., FOR CITY OF PORTSMOUTH, N.H. & FOUNDATION FOR SEACOAST HEALTH, REVISED TO 12/14/2016, RCRD PLAN D-39897.

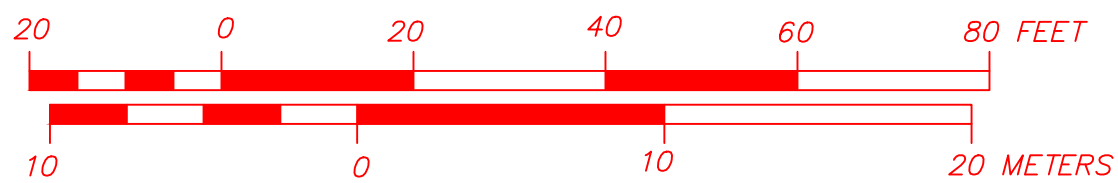
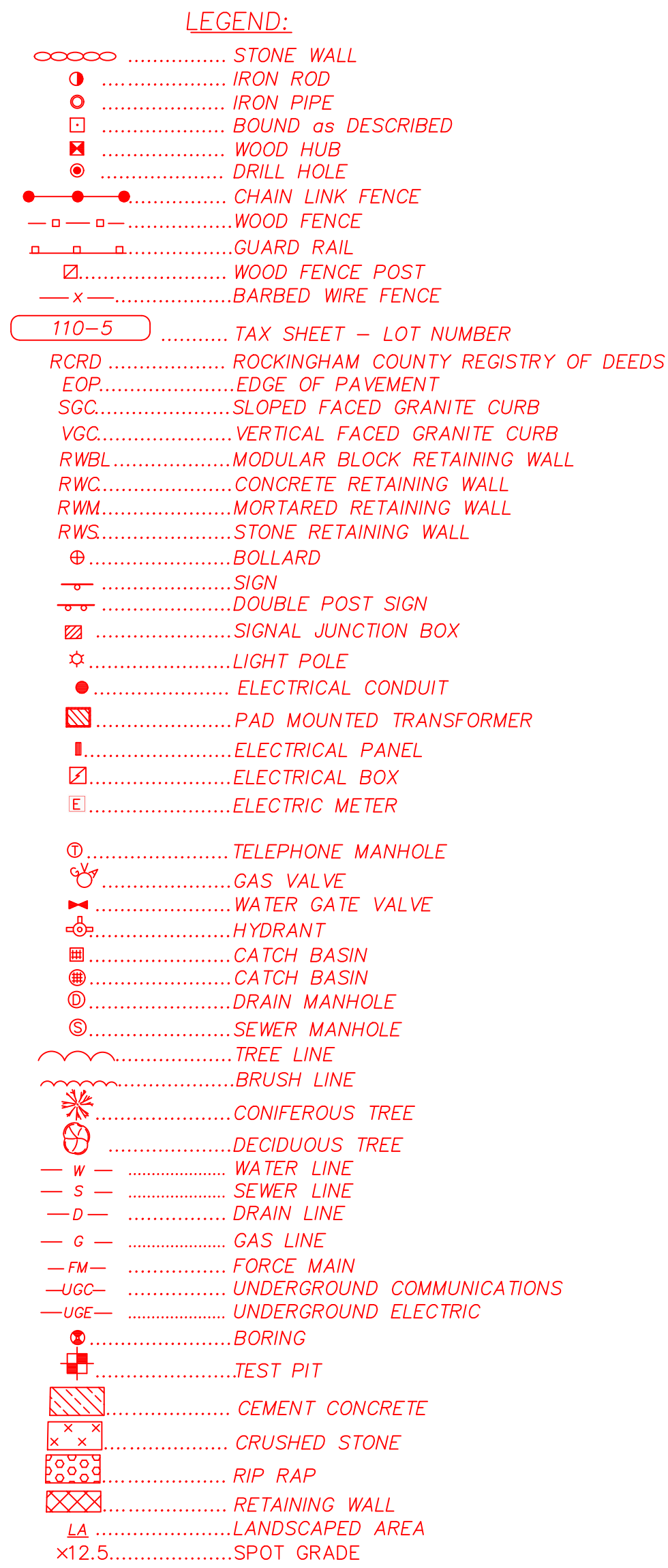
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	file name: 1119XREF-SURVEI.dwg	approved by: JV				
						
Existing Conditions Plan						
drawing no. EC-1						
sheet: 1 of 8						

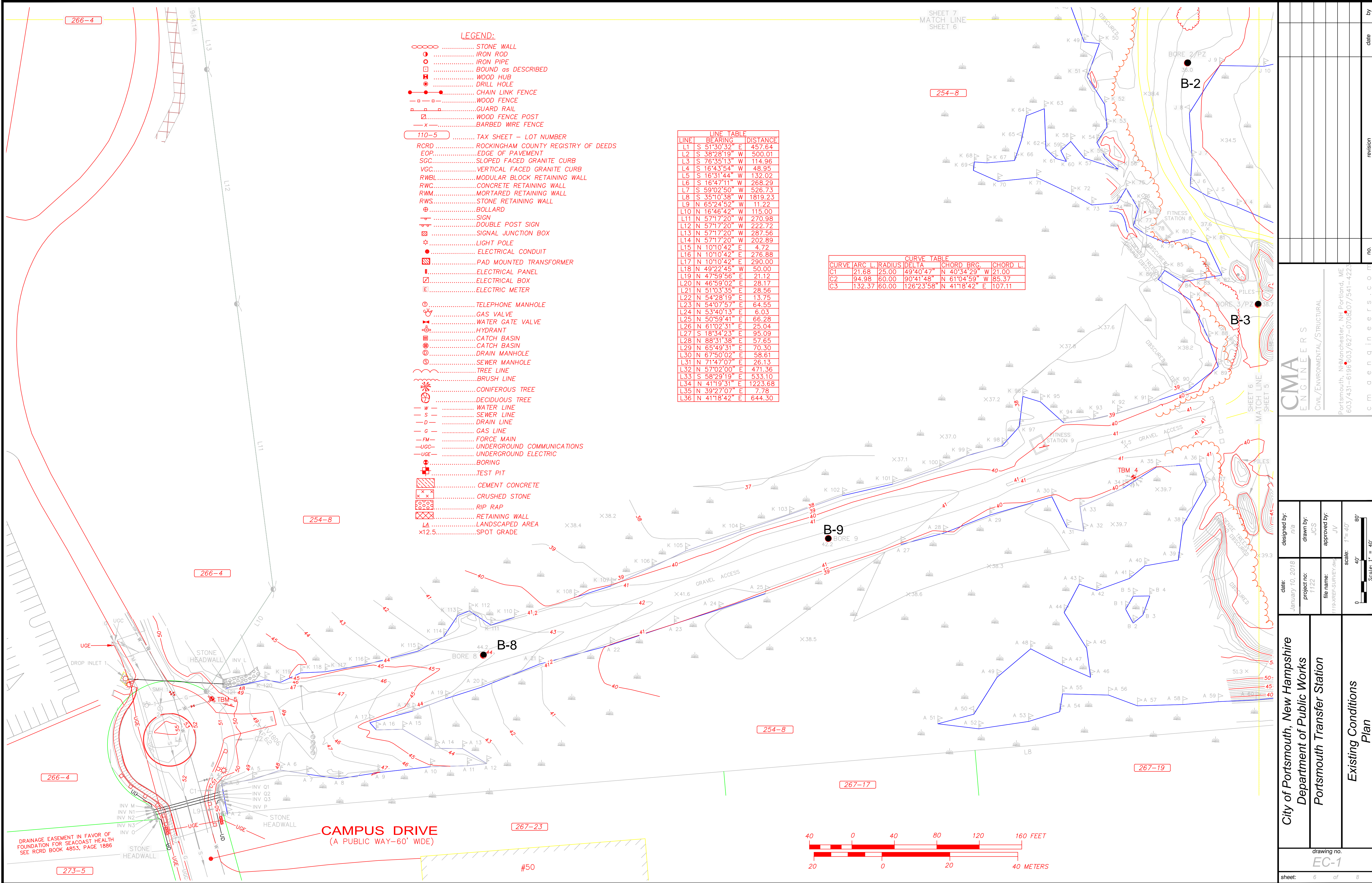


- LEGEND:**
- STONE WALL
 - IRON ROD
 - IRON PIPE
 - BOUND as DESCRIBED
 - WOOD HUB
 - DRILL HOLE
 - CHAIN LINK FENCE
 - WOOD FENCE
 - GUARD RAIL
 - WOOD FENCE POST
 - BARBED WIRE FENCE
 - TAX SHEET - LOT NUMBER
 - ROCKINGHAM COUNTY REGISTRY OF DEEDS
 - EDGE OF PAVEMENT
 - SLOPED FACED GRANITE CURB
 - VERTICAL FACED GRANITE CURB
 - MODULAR BLOCK RETAINING WALL
 - CONCRETE RETAINING WALL
 - MORTARED RETAINING WALL
 - STONE RETAINING WALL
 - BOLLARD
 - SIGN
 - DOUBLE POST SIGN
 - SIGNAL JUNCTION BOX
 - LIGHT POLE
 - ELECTRICAL CONDUIT
 - PAD MOUNTED TRANSFORMER
 - ELECTRICAL PANEL
 - ELECTRICAL BOX
 - ELECTRIC METER
 - TELEPHONE MANHOLE
 - GAS VALVE
 - WATER GATE VALVE
 - HYDRANT
 - CATCH BASIN
 - CATCH BASIN
 - DRAIN MANHOLE
 - SEWER MANHOLE
 - TREE LINE
 - BRUSH LINE
 - CONIFEROUS TREE
 - DECIDUOUS TREE
 - WATER LINE
 - SEWER LINE
 - DRAIN LINE
 - GAS LINE
 - FORCE MAIN
 - UNDERGROUND COMMUNICATIONS
 - UNDERGROUND ELECTRIC
 - BORING
 - TEST PIT
 - CEMENT CONCRETE
 - CRUSHED STONE
 - RIP RAP
 - RETAINING WALL
 - LANDSCAPED AREA
 - SPOT GRADE



City of Portsmouth, New Hampshire Department of Public Works Portsmouth Transfer Station		drawing no. EC-1		sheet: 2 of 8	
date: January 10, 2018	designed by: n/a	project no: 1122	drawn by: JCS	revision no.	date
file name: 1119-XREF-SURVEY.dwg			approved by: JW	cm a e n g i n e e r s . c o m	
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Scale 1" = 20'			c m a e n g i n e e r s . c o m		

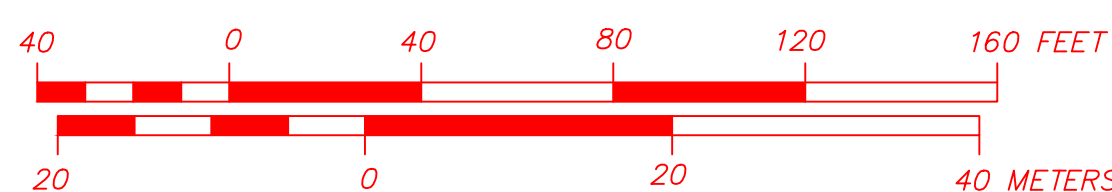




- LEGEND:**
- STONE WALL
 - IRON ROD
 - IRON PIPE
 - BOUND as DESCRIBED
 - WOOD HUB
 - DRILL HOLE
 - CHAIN LINK FENCE
 - WOOD FENCE
 - GUARD RAIL
 - WOOD FENCE POST
 - BARBED WIRE FENCE
 - TAX SHEET - LOT NUMBER
 - ROCKINGHAM COUNTY REGISTRY OF DEEDS
 - EOP.....EDGE OF PAVEMENT
 - SGC.....SLOPED FACED GRANITE CURB
 - VGC.....VERTICAL FACED GRANITE CURB
 - RWBL.....MODULAR BLOCK RETAINING WALL
 - RWC.....CONCRETE RETAINING WALL
 - RWM.....MORTARED RETAINING WALL
 - RWS.....STONE RETAINING WALL
 - BOLLARD
 - SIGN
 - DOUBLE POST SIGN
 - SIGNAL JUNCTION BOX
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 - CATCH BASIN
 - CATCH BASIN
 - DRAIN MANHOLE
 - SEWER MANHOLE
 - TREE LINE
 - BRUSH LINE
 - CONIFEROUS TREE
 - DECIDUOUS TREE
 - W.....WATER LINE
 - S.....SEWER LINE
 - D.....DRAIN LINE
 - G.....GAS LINE
 - FM.....FORCE MAIN
 - UGC.....UNDERGROUND COMMUNICATIONS
 - UGE.....UNDERGROUND ELECTRIC
 - BORING
 - TEST PIT
 - CEMENT CONCRETE
 - CRUSHED STONE
 - RIP RAP
 - RETAINING WALL
 - LANDSCAPED AREA
 - SPOT GRADE

LINE TABLE				
LINE	BEARING	DISTANCE		
L1	S 51°30'32" E	457.64		
L2	S 38°28'19" W	500.01		
L3	S 76°35'13" W	114.96		
L4	S 16°43'54" W	48.95		
L5	S 16°31'44" W	132.02		
L6	S 16°47'11" W	268.29		
L7	S 59°02'50" W	526.73		
L8	S 35°10'38" W	1819.23		
L9	N 65°24'52" W	11.22		
L10	N 16°46'42" W	115.00		
L11	N 57°17'20" W	270.98		
L12	N 57°17'20" W	222.72		
L13	N 57°17'20" W	287.56		
L14	N 57°17'20" W	202.89		
L15	N 10°10'42" E	4.72		
L16	N 10°10'42" E	276.88		
L17	N 10°10'42" E	290.00		
L18	N 49°22'45" W	50.00		
L19	N 47°59'56" E	21.12		
L20	N 46°59'02" E	28.17		
L21	N 51°03'35" E	28.56		
L22	N 54°28'19" E	13.75		
L23	N 54°07'57" E	64.55		
L24	N 53°40'13" E	6.03		
L25	N 50°59'41" E	66.28		
L26	N 61°02'31" E	25.04		
L27	S 18°34'23" E	95.09		
L28	N 88°31'38" E	57.65		
L29	N 65°49'31" E	70.30		
L30	N 67°50'02" E	58.61		
L31	N 71°47'07" E	26.13		
L32	N 57°02'00" E	471.36		
L33	S 58°29'19" E	533.10		
L34	N 41°19'31" E	1223.68		
L35	N 39°27'07" E	7.78		
L36	N 41°18'42" E	644.30		

CURVE TABLE				
CURVE	ARC L	RADIUS	DELTA	CHORD BRG.
C1	21.68	25.00	49°40'47"	N 40°34'29" W 21.00
C2	94.98	60.00	90°41'48"	N 61°04'59" W 85.37
C3	132.37	60.00	126°23'58"	N 41°18'42" E 107.11



CITY OF PORTSMOUTH, NEW HAMPSHIRE
DEPARTMENT OF PUBLIC WORKS
PORTSMOUTH TRANSFER STATION

designed by: n/a
date: January 10, 2018
project no: 1122
file name: 119-AREF-SURVEY.dwg

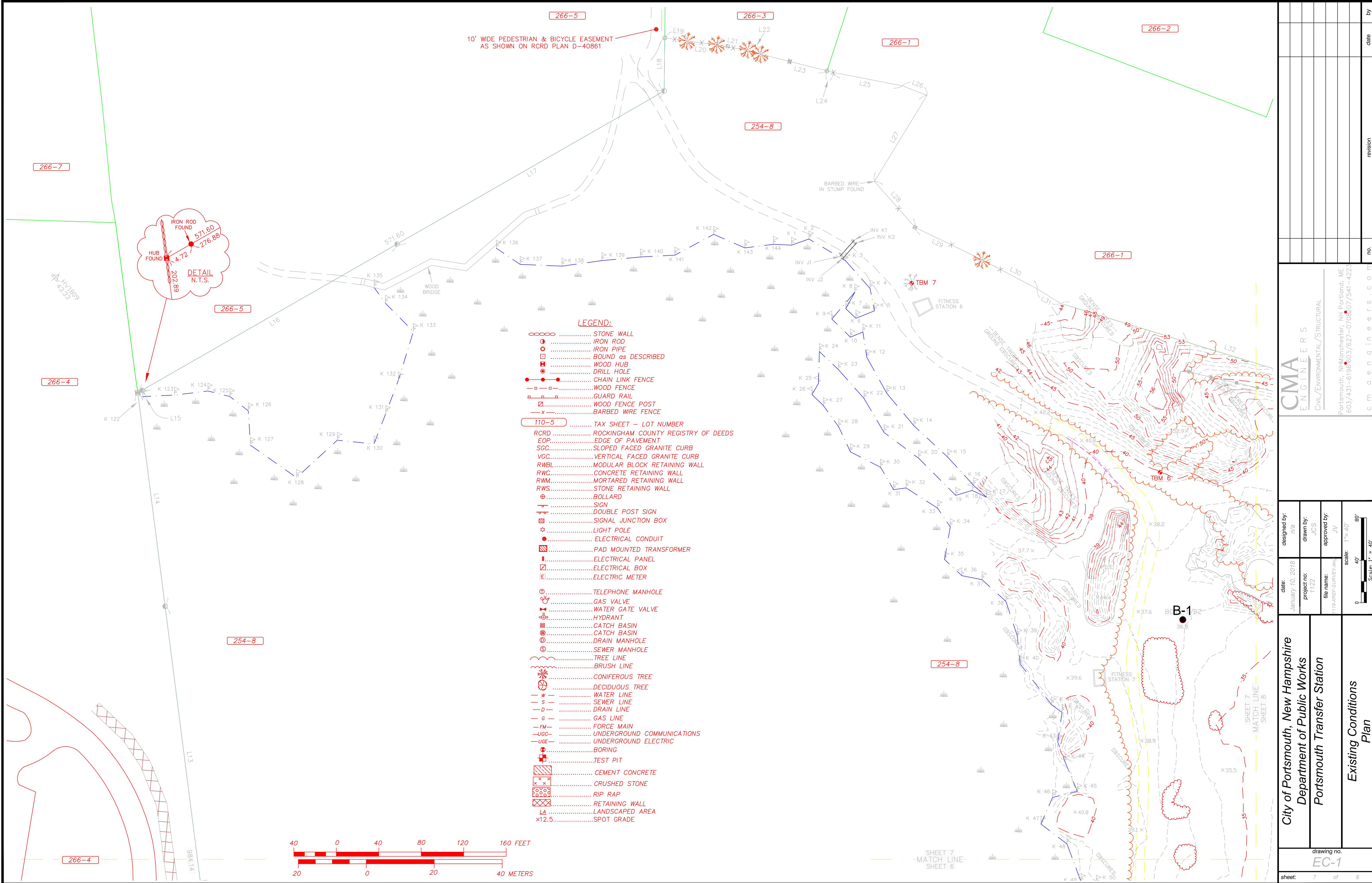
drawn by: JCS
approved by: JV
scale: 1" = 40'

CMA
ENGINEERS
CIVIL/ENVIRONMENTAL/STRUCTURAL
Portsmouth, NH Manchester, NH Portland, ME
603/431-6196 603/627-0700 603/541-4223
c m a e n g i n e e r s . c o m

no. revision date by

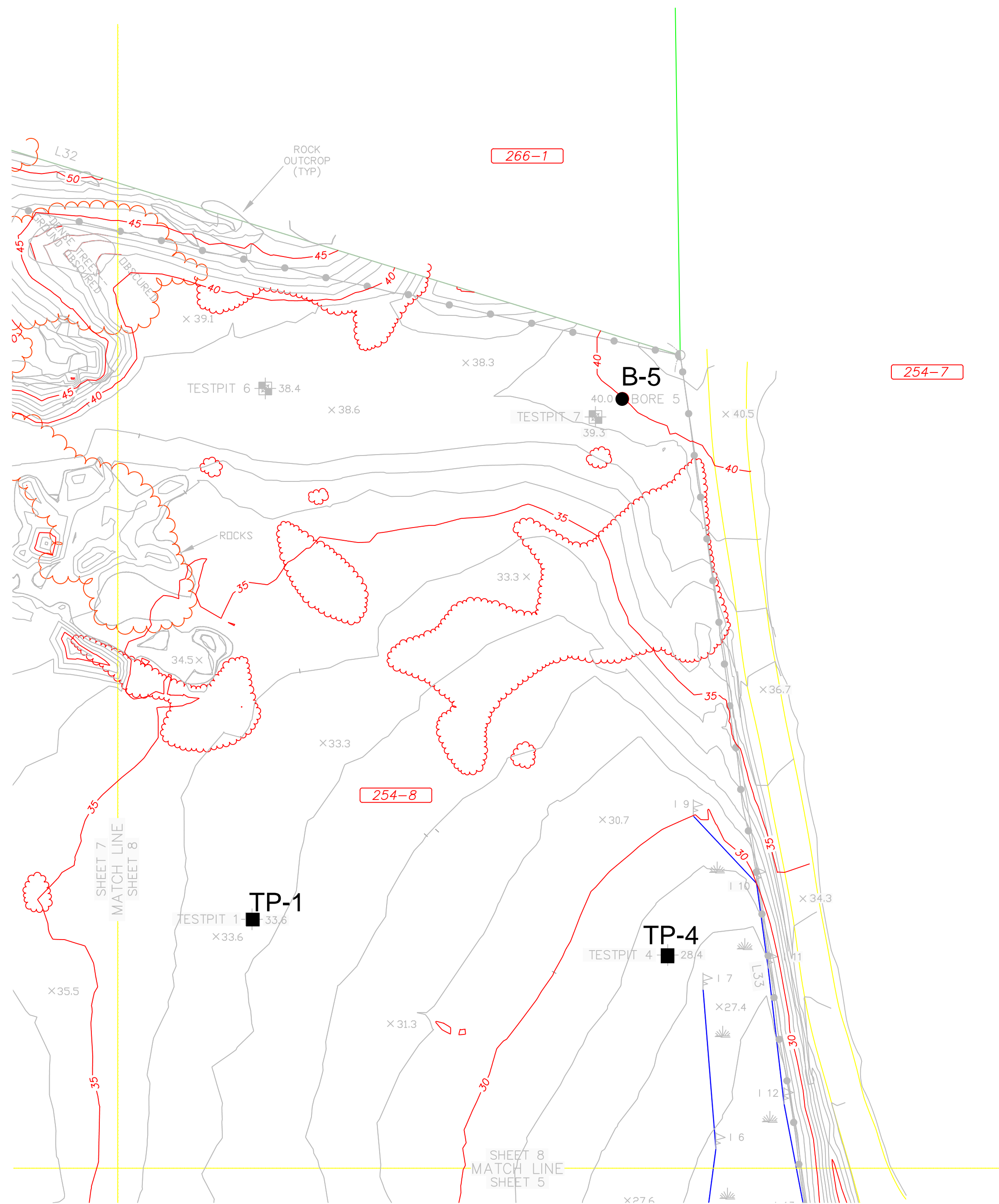
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EC-1

sheet: 6 of 8

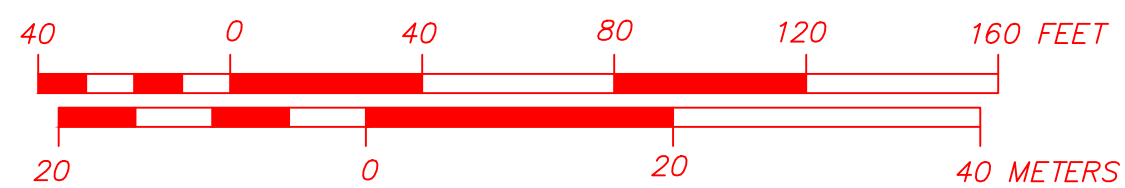



































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designed by: n/a	drawn by: JCS	approved by: JV	scale: 1" = 40'
no.		revision	
date		by	
CMA ENGINEERS CIVIL/ENVIRONMENTAL/STRUCTURAL Portsmouth, NH Manchester, NH Portland, ME 603/431-6196 603/627-0708 207/541-4223 c.m.a.e.n.g.i.n.e.e.r.s.-c.o.r.p.			

R:\2018\18-1170\CAD\External References\DWG\1119-XREF-SURVEY.dwg, 1/14/2019 4:12:10 PM, L1: CMA, L2: W. Coe Engineers, Inc.



<u>PIEZOMETER REFERENCE ELEVATIONS</u>		
<u>(TOP OF PVC PIPE – MARK SET)</u>		
<u>LOCATION</u>	<u>TOP OF PIPE</u>	<u>GROUND</u>
BORE1/PZ	39.56	36.8
BORE2/PZ	39.26	36.0
BORE3/PZ	42.21	38.7
BORE4/PZ	43.32	40.7



- LEGEND:**
- | | |
|---|-------------------------------------|
|  | STONE WALL |
|  | IRON ROD |
|  | IRON PIPE |
|  | BOUND as DESCRIBED |
|  | WOOD HUB |
|  | DRILL HOLE |
|  | CHAIN LINK FENCE |
|  | WOOD FENCE |
|  | GUARD RAIL |
|  | WOOD FENCE POST |
|  | BARBED WIRE FENCE |
| 110-5 | TAX SHEET - LOT NUMBER |
| RCRD | ROCKINGHAM COUNTY REGISTRY OF DEEDS |
| EOP | EDGE OF PAVEMENT |
| SGC | SLOPED FACED GRANITE CURB |
| VGC | VERTICAL FACED GRANITE CURB |
| RWBL | MODULAR BLOCK RETAINING WALL |
| RWC | CONCRETE RETAINING WALL |
| RWM | MORTARED RETAINING WALL |
| RWS | STONE RETAINING WALL |
| ⊕ | BOLLARD |
|  | SIGN |
|  | DOUBLE POST SIGN |
|  | SIGNAL JUNCTION BOX |
| ☆ | LIGHT POLE |
| ● | ELECTRICAL CONDUIT |
|  | PAD MOUNTED TRANSFORMER |
|  | ELECTRICAL PANEL |
|  | ELECTRICAL BOX |
|  | ELECTRIC METER |
| ① | TELEPHONE MANHOLE |
|  | GAS VALVE |
|  | WATER GATE VALVE |
|  | HYDRANT |
|  | CATCH BASIN |
|  | CATCH BASIN |
| ⊕ | DRAIN MANHOLE |
| Ⓢ | SEWER MANHOLE |
|  | TREE LINE |
|  | BRUSH LINE |
|  | CONIFEROUS TREE |
|  | DECIDUOUS TREE |
| — W — | WATER LINE |
| — S — | SEWER LINE |
| — D — | DRAIN LINE |
| — G — | GAS LINE |
| — FM — | FORCE MAIN |
| — UGC — | UNDERGROUND COMMUNICATIONS |
| — UGE — | UNDERGROUND ELECTRIC |
|  | BORING |
|  | TEST PIT |
|  | CEMENT CONCRETE |
|  | CRUSHED STONE |
|  | RIP RAP |
|  | RETAINING WALL |
| LA | LANDSCAPED AREA |
| x12.5 | SPOT GRADE |

City of Portsmouth, New Hampshire Department of Public Works Portsmouth Transfer Station Existing Conditions Plan	drawing no. EC-1	date: January 10, 2018	designed by: n/a		CMA ENGINEERS CIVIL/ENVIRONMENTAL/STRUCTURAL Portsmouth, New Hampshire, NH 603/431-6196 603/627-0708 603/541-4223 c m a e n g i n e e r s . c o m				
		project no: 1122	drawn by: JCS						
		file name: P119-XREF-SURVEY.dwg	approved by: JV						
sheet:	8	of	8						

APPENDIX C

Exploration Logs and Key



BORING LOG

CLIENT: CMA Engineers
PROJECT: Proposed Athletic Fields and Transfer Station
LOCATION: , Portsmouth, NH

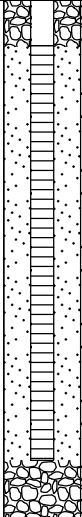
BORING NO.: B-2
SHEET: 1 of 1
PROJECT NO. 18-1170
DATE START: 11/15/2018
DATE FINISH: 11/15/2018

Drilling Information

LOCATION: See Exploration Location Plan ELEVATION (FT): 36' Surveyed TOTAL DEPTH (FT): 11.3 LOGGED BY: Tyler Demers
DRILLING CO.: S.W.Cole Explorations, LLC DRILLER: Matt Leonard DRILLING METHOD: Hollow Stem Auger
RIG TYPE: Track Mounted Mobile Drill B-53 AUGER ID/OD: 2 1/4 in / 5 5/8 in SAMPLER: Standard Split-Spoon
HAMMER TYPE: Automatic HAMMER WEIGHT (lbs): 140 CASING ID/OD: N/A /N/A CORE BARREL: N/A
HAMMER EFFICIENCY FACTOR: HAMMER DROP (inch): 30
WATER LEVEL DEPTHS (ft): 0.9 ft 12/5/2018

GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level
At time of Drilling
At Completion of Drilling
After Drilling
D = Split Spoon Sample
U = Thin Walled Tube Sample
R = Rock Core Sample
V = Field Vane Shear
Pen. = Penetration Length
Rec. = Recovery Length
bpf = Blows per Foot
mpf = Minute per Foot
WOR = Weight of Rods
WOH = Weight of Hammer
RQD = Rock Quality Designation
PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.
q_u = Unconfined Compressive Strength, kips/sq.ft.
Ø = Friction Angle (Estimated)
N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H ₂ O Depth	Well Diagram
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
35			1D		0-2	24/14	2-4-7-8		Medium dense, brown Gravelly Silty SAND with asphalt and wood (Fill)		 Auger Cuttings Filter Sand
			2D		2-4	24/12	5-6-2-2	1.5	Medium, brown-gray SILT and CLAY		
5			3D		5-7	24/14	2-1-1-1				
30			4D		10-11.3	16/18	WOH- WOH- 50/4"				
10											
25								11.0	Possible Glacial Till		
Refusal at 11.3 feet (Probable Boulder or Bedrock)											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B-2



BORING LOG

CLIENT: CMA Engineers
PROJECT: Proposed Athletic Fields and Transfer Station
LOCATION: , Portsmouth, NH

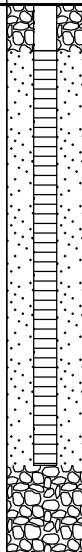
BORING NO.: **B-3**
SHEET: 1 of 1
PROJECT NO. 18-1170
DATE START: 11/15/2018
DATE FINISH: 11/15/2018

Drilling Information

LOCATION: See Exploration Location Plan ELEVATION (FT): 38.7' Surveyed TOTAL DEPTH (FT): 12.0 LOGGED BY: Tyler Demers
DRILLING CO.: S.W. Cole Explorations, LLC DRILLER: Matt Leonard DRILLING METHOD: Hollow Stem Auger
RIG TYPE: Track Mounted Mobile Drill B-53 AUGER ID/OD: 2 1/4 in / 5 5/8 in SAMPLER: Standard Split-Spoon
HAMMER TYPE: Automatic HAMMER WEIGHT (lbs): 140 CASING ID/OD: N/A /N/A CORE BARREL: N/A
HAMMER EFFICIENCY FACTOR: HAMMER DROP (inch): 30
WATER LEVEL DEPTHS (ft): 1.2 ft 12/5/2018

GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level
At time of Drilling
At Completion of Drilling
After Drilling
D = Split Spoon Sample
U = Thin Walled Tube Sample
R = Rock Core Sample
V = Field Vane Shear
Pen. = Penetration Length
Rec. = Recovery Length
bpf = Blows per Foot
mpf = Minute per Foot
WOR = Weight of Rods
WOH = Weight of Hammer
RQD = Rock Quality Designation
PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.
q_u = Unconfined Compressive Strength, kips/sq.ft.
Ø = Friction Angle (Estimated)
N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H ₂ O Depth	Well Diagram
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
			1D		0-2	24/12	10-14- 11-10		Medium dense, brown Silty Gravelly SAND (Fill)		 Auger Cuttings Filter Sand
			2D		2-4	24/2	7-8-8- 10				
35	5		3D		5-7	24/18	5-1-2-2	5.0	Medium, gray-brown SILT and CLAY		
30	10		4D		10-12	24/18	3-1-2-2				

Bottom of Exploration at 12.0 feet

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: **B-3**



BORING LOG

CLIENT: CMA Engineers
PROJECT: Proposed Athletic Fields and Transfer Station
LOCATION: , Portsmouth, NH

BORING NO.: B-4
SHEET: 1 of 1
PROJECT NO. 18-1170
DATE START: 11/15/2018
DATE FINISH: 11/15/2018

Drilling Information

LOCATION: See Exploration Location Plan ELEVATION (FT): 40.7' Surveyed TOTAL DEPTH (FT): 12.0 LOGGED BY: Tyler Demers
DRILLING CO.: S.W. Cole Explorations, LLC DRILLER: Matt Leonard DRILLING METHOD: Hollow Stem Auger
RIG TYPE: Track Mounted Mobile Drill B-53 AUGER ID/OD: 2 1/4 in / 5 5/8 in SAMPLER: Standard Split-Spoon
HAMMER TYPE: Automatic HAMMER WEIGHT (lbs): 140 CASING ID/OD: N/A /N/A CORE BARREL: N/A
HAMMER EFFICIENCY FACTOR: HAMMER DROP (inch): 30
WATER LEVEL DEPTHS (ft): 5.5 ft 2/5/2018

GENERAL NOTES:

KEY TO NOTES: Water Level
AND SYMBOLS: At time of Drilling
At Completion of Drilling
After Drilling
D = Split Spoon Sample
U = Thin Walled Tube Sample
R = Rock Core Sample
V = Field Vane Shear
Pen. = Penetration Length
Rec. = Recovery Length
bpf = Blows per Foot
mpf = Minute per Foot
WOR = Weight of Rods
WOH = Weight of Hammer
RQD = Rock Quality Designation
PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.
q_u = Unconfined Compressive Strength, kips/sq.ft.
Ø = Friction Angle (Estimated)
N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H ₂ O Depth	Well Diagram
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data			
40			1D		0-2	24/12	8-7-14-12		Medium dense, brown-gray Silty SAND and GRAVEL with brick (Fill)		
			2D		2-4	24/12	10-10-14-15	w =20.6 %	1.5 Medium dense, gray SILT and fine SAND		
35	5		3D		5-7	24/8	16-15-13-14	w =5.2 %	5.0 Medium dense, gray Silty SAND and GRAVEL (Glacial Till)		
30	10		4D		10-12	24/12	10-12-12-13	w =8.8 %			

Bottom of Exploration at 12.0 feet

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B-4



BORING LOG

CLIENT: CMA Engineers
PROJECT: Proposed Athletic Fields and Transfer Station
LOCATION: , Portsmouth, NH

BORING NO.: B-5
SHEET: 1 of 1
PROJECT NO. 18-1170
DATE START: 11/15/2018
DATE FINISH: 11/15/2018

Drilling Information

LOCATION: See Exploration Location Plan ELEVATION (FT): 40' Surveyed TOTAL DEPTH (FT): 4.2 LOGGED BY: Tyler Demers
DRILLING CO.: S.W.Cole Explorations, LLC DRILLER: Matt Leonard DRILLING METHOD: Hollow Stem Auger
RIG TYPE: Track Mounted Mobile Drill B-53 AUGER ID/OD: 2 1/4 in / 5 5/8 in SAMPLER: Standard Split-Spoon
HAMMER TYPE: Automatic HAMMER WEIGHT (lbs): 140 CASING ID/OD: N/A /N/A CORE BARREL: N/A
HAMMER EFFICIENCY FACTOR: HAMMER DROP (inch): 30
WATER LEVEL DEPTHS (ft): No free water observed

GENERAL NOTES:

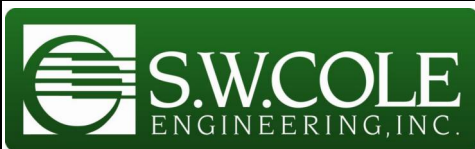
KEY TO NOTES AND SYMBOLS:
Water Level
At time of Drilling
At Completion of Drilling
After Drilling
D = Split Spoon Sample
U = Thin Walled Tube Sample
R = Rock Core Sample
V = Field Vane Shear
Pen. = Penetration Length
Rec. = Recovery Length
bpf = Blows per Foot
mpf = Minute per Foot
WOR = Weight of Rods
WOH = Weight of Hammer
RQD = Rock Quality Designation
PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.
q_u = Unconfined Compressive Strength, kips/sq.ft.
Ø = Friction Angle (Estimated)
N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H ₂ O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
			1D		0-2	24/18	3-5-18- 19		Medium dense, brown Gravelly Silty SAND with asphalt and brick (Fill)		
			2D		2-4	24/12	18-18- 21-20				

Refusal at 4.2 feet
(Probable Boulder or Bedrock)

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B-5



BORING LOG

CLIENT: CMA Engineers
PROJECT: Proposed Athletic Fields and Transfer Station
LOCATION: , Portsmouth, NH

BORING NO.: B-6
SHEET: 1 of 1
PROJECT NO. 18-1170
DATE START: 11/15/2018
DATE FINISH: 11/15/2018

Drilling Information

LOCATION: See Exploration Location Plan ELEVATION (FT): 28.8' Surveyed TOTAL DEPTH (FT): 4.1 LOGGED BY: Tyler Demers
DRILLING CO.: S.W.Cole Explorations, LLC DRILLER: Matt Leonard DRILLING METHOD: Hollow Stem Auger
RIG TYPE: Track Mounted Mobile Drill B-53 AUGER ID/OD: 2 1/4 in / 5 5/8 in SAMPLER: Standard Split-Spoon
HAMMER TYPE: Automatic HAMMER WEIGHT (lbs): 140 CASING ID/OD: N/A /N/A CORE BARREL: N/A
HAMMER EFFICIENCY FACTOR: HAMMER DROP (inch): 30
WATER LEVEL DEPTHS (ft): No free water observed

GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level
At time of Drilling
At Completion of Drilling
After Drilling
D = Split Spoon Sample
U = Thin Walled Tube Sample
R = Rock Core Sample
V = Field Vane Shear
Pen. = Penetration Length
Rec. = Recovery Length
bpf = Blows per Foot
mpf = Minute per Foot
WOR = Weight of Rods
WOH = Weight of Hammer
RQD = Rock Quality Designation
PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.
q_u = Unconfined Compressive Strength, kips/sq.ft.
Ø = Friction Angle (Estimated)
N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H ₂ O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
			1D		0-2	24/6	4-4-4-3		Loose, brown Gravelly Silty SAND (Fill)		
			2D		2-4	24/6	3-12-14-14	2.0	Medium dense, brown SILT and SAND some gravel (Possible Fill)		
25											

Refusal at 4.1 feet
(Probable Boulder or Bedrock)

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B-6



BORING LOG

CLIENT: CMA Engineers
PROJECT: Proposed Athletic Fields and Transfer Station
LOCATION: , Portsmouth, NH

BORING NO.: B-7
SHEET: 1 of 1
PROJECT NO. 18-1170
DATE START: 11/15/2018
DATE FINISH: 11/15/2018

Drilling Information

LOCATION: See Exploration Location Plan ELEVATION (FT): 37' Estimated TOTAL DEPTH (FT): 17.0 LOGGED BY: Tyler Demers
DRILLING CO.: S.W. Cole Explorations, LLC DRILLER: Matt Leonard DRILLING METHOD: Hollow Stem Auger
RIG TYPE: Track Mounted Mobile Drill B-53 AUGER ID/OD: 2 1/4 in / 5 5/8 in SAMPLER: Standard Split-Spoon
HAMMER TYPE: Automatic HAMMER WEIGHT (lbs): 140 CASING ID/OD: N/A /N/A CORE BARREL: N/A
HAMMER EFFICIENCY FACTOR: HAMMER DROP (inch): 30
WATER LEVEL DEPTHS (ft): Soils appear saturated below 10 feet

GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level
▽ At time of Drilling D = Split Spoon Sample Pen. = Penetration Length WOR = Weight of Rods S_v = Field Vane Shear Strength, kips/sq.ft.
▽ At Completion of Drilling U = Thin Walled Tube Sample Rec. = Recovery Length WOH = Weight of Hammer q_u = Unconfined Compressive Strength, kips/sq.ft.
▽ After Drilling R = Rock Core Sample bpf = Blows per Foot RQD = Rock Quality Designation Ø = Friction Angle (Estimated)
V = Field Vane Shear mpf = Minute per Foot PID = Photoionization Detector N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H ₂ O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
35 5 30 10 25 15 20			1D		0-2	24/12	5-9-11-9		Medium dense, brown Gravelly Silty SAND with asphalt (Fill)		
			2D		2-4	24/12	5-11-8-14				
			3D		5-7	24/6	5-12-7-5		6.0 Medium dense, brown SILT and fine SAND		
			4D		10-12 11-	24/24	WOH- WOH- WOH- WOH	q _p =0.5 - 1.0 ksf	10.0 Medium, gray SILT and CLAY		
			5D		15-17 16-	24/24	WOH- WOH- WOH- WOH	q _p =0.5 - 1.0 ksf			

Bottom of Exploration at 17.0 feet

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B-7



BORING LOG

CLIENT: CMA Engineers
PROJECT: Proposed Athletic Fields and Transfer Station
LOCATION: , Portsmouth, NH

BORING NO.: B-8
SHEET: 1 of 1
PROJECT NO. 18-1170
DATE START: 11/15/2018
DATE FINISH: 11/15/2018

Drilling Information

LOCATION: See Exploration Location Plan ELEVATION (FT): 44.2' Surveyed TOTAL DEPTH (FT): 12.0 LOGGED BY: Tyler Demers
DRILLING CO.: S.W. Cole Explorations, LLC DRILLER: Matt Leonard DRILLING METHOD: Hollow Stem Auger
RIG TYPE: Track Mounted Mobile Drill B-53 AUGER ID/OD: 2 1/4 in / 5 5/8 in SAMPLER: Standard Split-Spoon
HAMMER TYPE: Automatic HAMMER WEIGHT (lbs): 140 CASING ID/OD: N/A /N/A CORE BARREL: N/A
HAMMER EFFICIENCY FACTOR: HAMMER DROP (inch): 30
WATER LEVEL DEPTHS (ft): Soils appear saturated below 5 feet

GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level
At time of Drilling
At Completion of Drilling
After Drilling
D = Split Spoon Sample
U = Thin Walled Tube Sample
R = Rock Core Sample
V = Field Vane Shear
Pen. = Penetration Length
Rec. = Recovery Length
bpf = Blows per Foot
mpf = Minute per Foot
WOR = Weight of Rods
WOH = Weight of Hammer
RQD = Rock Quality Designation
PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.
q_u = Unconfined Compressive Strength, kips/sq.ft.
Ø = Friction Angle (Estimated)
N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H ₂ O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
			1D		0-2	24/18	16-31-37-30		0.5 Very dense, dark brown-black Silty Gravelly SAND (Fill)		
			2D		2-4	24/16	19-23-31-20		Very dense, brown Silty SAND and GRAVEL (Fill)		
40	5		3D		5-5.4	5/1	50/5"		5.0 Very dense, brown Gravelly Silty SAND		
35	10		4D		10-12	24/12	4-5-8-21		10.0 Medium dense, gray SILT and fine SAND		

Bottom of Exploration at 12.0 feet

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B-8



TEST PIT LOGS

PROJECT NO.: 18-1170

LOGGED BY: Tony Hersh

CLIENT: CMA Engineers

PROJECT: Proposed Athletic Fields and Transfer Station

LOCATION: , Portsmouth, New Hampshire

CONTRACTOR:

William Spencer

EQUIPMENT:

TEST PIT TP-1

DATE: 11/26/2018 LOCATION: See Exploration Location Plan SURFACE ELEVATION (FT): 33.6' Surveyed COMPLETION DEPTH (FT): 6.0

WATER LEVEL DEPTHS (FT): Seepage at 2 feet +/-

Depth (feet)	Graphic Log	Stratum Description	H ₂ O Depth	Sample No.	Type	Sample Depth (ft)	Field / Lab Test Data
5		Topsoil					
	0.7	Brown silty SAND and GRAVEL with cobbles, boulders, apparent blast rock spoils, wood, roots (FILL)					

Refusal at 6.0 feet
Boulder

TEST PIT TP-2

DATE: 11/26/2018 LOCATION: See Exploration Location Plan SURFACE ELEVATION (FT): 30.4' Surveyed COMPLETION DEPTH (FT): 4.0

WATER LEVEL DEPTHS (FT): Seepage at 1.5 ft +/-

Depth (feet)	Graphic Log	Stratum Description	H ₂ O Depth	Sample No.	Type	Sample Depth (ft)	Field / Lab Test Data
		Topsoil					
	0.9	Brown silty gravelly SAND with roots (FILL)					
	1.8	Brown gravelly silty SAND with cobbles, boulders					

Bottom of Exploration at 4.0 feet
Refusal at 2'-4', Probable Bedrock

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

KEY TO NOTES AND SYMBOLS:

Water Level
▽ At time of Digging
▼ At Completion of Digging
▽ After Digging

q_p = Pocket Penetrometer Strength, kips/sq.ft.



TEST PIT LOGS

PROJECT NO.: 18-1170

LOGGED BY: Tony Hersh

CLIENT: CMA Engineers

PROJECT: Proposed Athletic Fields and Transfer Station

LOCATION: , Portsmouth, New Hampshire

CONTRACTOR:

William Spencer

EQUIPMENT:

TEST PIT TP-3

DATE: 11/26/2018 LOCATION: See Exploration Location Plan SURFACE ELEVATION (FT): 39.9' Surveyed COMPLETION DEPTH (FT): 7.0

WATER LEVEL DEPTHS (FT): Seepage at 4 ft +/-, soils moist 2.5 ft +/-

Depth (feet)	Graphic Log	Stratum Description	H ₂ O Depth	Sample No.	Type	Sample Depth (ft)	Field / Lab Test Data
5		0.3 Topsoil Brown gravelly silty SAND with cobbles, boulders, brick, roots (FILL)					
		4.0 Dark brown silty SAND with roots (APPARENT RELIC TOPSOIL)					
		5.0 Layers of gray silty SAND and clayey SILT					

Bottom of Exploration at 7.0 feet

TEST PIT TP-4

DATE: 11/26/2018 LOCATION: See Exploration Location Plan SURFACE ELEVATION (FT): 28.3' Surveyed COMPLETION DEPTH (FT): 7.0

WATER LEVEL DEPTHS (FT): Heavy seepage at 6.5 ft +/-

Depth (feet)	Graphic Log	Stratum Description	H ₂ O Depth	Sample No.	Type	Sample Depth (ft)	Field / Lab Test Data
5		Topsoil					
		0.5 Brown silty gravelly SAND with roots (FILL)					
		1.5 Red-brown silty SAND, some gravel (FILL)					
		2.5 Brown gravelly silty SAND with cobbles, brick, wood (FILL)					

Bottom of Exploration at 7.0 feet

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

KEY TO NOTES AND SYMBOLS:

Water Level
▽ At time of Digging
▼ At Completion of Digging
▽ After Digging

q_p = Pocket Penetrometer Strength, kips/sq.ft.

TEST PIT 18-1170 TEST PIT.GPJ SWCE TEMPLATE.GDT 1/16/19



TEST PIT LOGS

CLIENT: CMA Engineers
 PROJECT: Proposed Athletic Fields and Transfer Station
 LOCATION: , Portsmouth, New Hampshire

PROJECT NO.: 18-1170
 LOGGED BY: Tony Hersh
 CONTRACTOR: William Spencer
 EQUIPMENT:

TEST PIT TP-5

DATE: 11/26/2018 LOCATION: See Exploration Location Plan SURFACE ELEVATION (FT): 35.3' Surveyed COMPLETION DEPTH (FT): 5.0
 WATER LEVEL DEPTHS (FT): Soils moist below 3 ft +/-

Depth (feet)	Graphic Log	Stratum Description	H ₂ O Depth	Sample No.	Type	Sample Depth (ft)	Field / Lab Test Data
		Dark brown to brown silty SAND and GRAVEL with cobbles, boulders, brick, metal debris (FILL - Test pit excavated near base of filled bank)					
		2.5 Dark brown silty gravelly SAND with organics (FILL)					
		4.0 Brown gravelly silty SAND with cobbles					
5							

Refusal at 5.0 feet
 Probable Bedrock

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

KEY TO NOTES AND SYMBOLS:
 Water Level
 ▽ At time of Digging
 ▼ At Completion of Digging
 ▽ After Digging

q_p = Pocket Penetrometer Strength, kips/sq.ft.

KEY TO THE NOTES & SYMBOLS

Test Boring and Test Pit Explorations

All stratification lines represent the approximate boundary between soil types and the transition may be gradual.

Key to Symbols Used:

w	-	water content, percent (dry weight basis)
q _u	-	unconfined compressive strength, kips/sq. ft. - laboratory test
S _v	-	field vane shear strength, kips/sq. ft.
L _v	-	lab vane shear strength, kips/sq. ft.
q _p	-	unconfined compressive strength, kips/sq. ft. – pocket penetrometer test
O	-	organic content, percent (dry weight basis)
W _L	-	liquid limit - Atterberg test
W _P	-	plastic limit - Atterberg test
WOH	-	advance by weight of hammer
WOM	-	advance by weight of man
WOR	-	advance by weight of rods
HYD	-	advance by force of hydraulic piston on drill
RQD	-	Rock Quality Designator - an index of the quality of a rock mass.
γ _T	-	total soil weight
γ _B	-	buoyant soil weight

Description of Proportions:

Trace:	0 to 5%
Some:	5 to 12%
"Y"	12 to 35%
And	35+%
With	Undifferentiated

Description of Stratified Soils

Parting:	0 to 1/16" thickness
Seam:	1/16" to 1/2" thickness
Layer:	½" to 12" thickness
Varved:	Alternating seams or layers
Occasional:	one or less per foot of thickness
Frequent:	more than one per foot of thickness

REFUSAL: Test Boring Explorations - Refusal depth indicates that depth at which, in the drill foreman's opinion, sufficient resistance to the advance of the casing, auger, probe rod or sampler was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

REFUSAL: Test Pit Explorations - Refusal depth indicates that depth at which sufficient resistance to the advance of the backhoe bucket was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

Although refusal may indicate the encountering of the bedrock surface, it may indicate the striking of large cobbles, boulders, very dense or cemented soil, or other buried natural or man-made objects or it may indicate the encountering of a harder zone after penetrating a considerable depth through a weathered or disintegrated zone of the bedrock



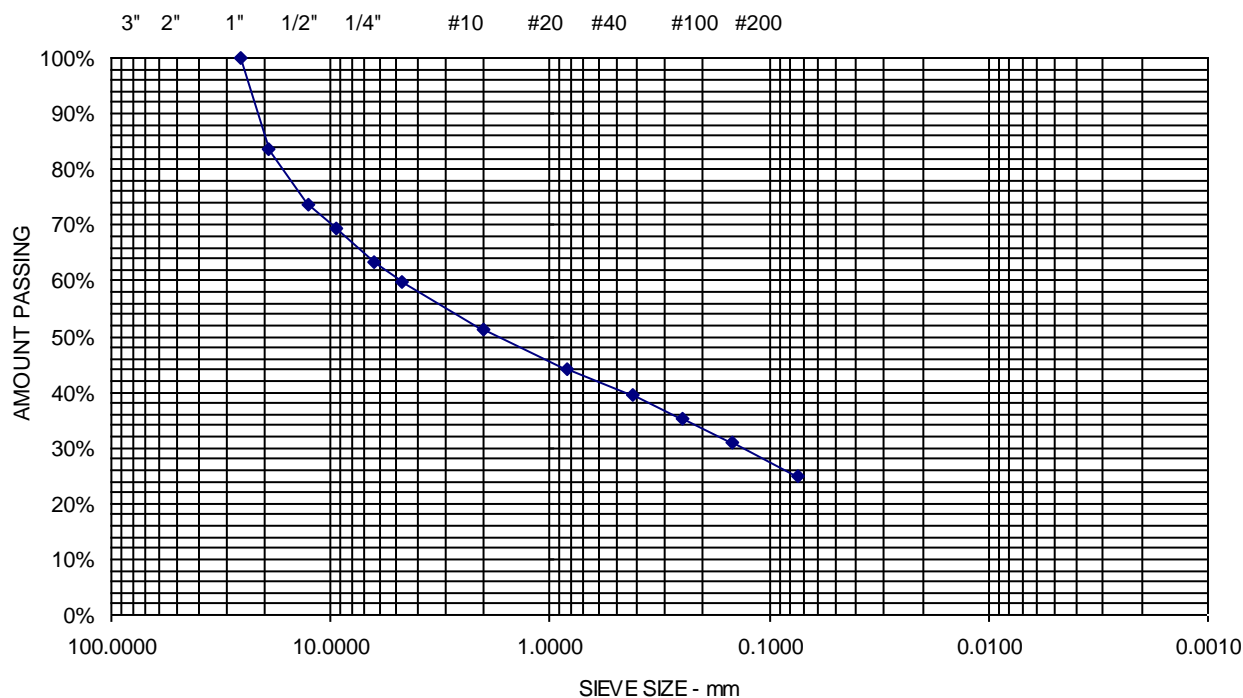
APPENDIX D

Laboratory Test Results

Project Name PORTSMOUTH NH - TRANSFER STATION AND ATHLETIC FIELD -
 GEOTECHNICAL ENGINEERING SERVICES
 Client CMA ENGINEERS
 Exploration **B-4**
 Material Source **3D, 5'-7'**

Project Number 18-1170
 Lab ID 17967S
 Date Received 12/28/2018
 Date Completed 1/7/2019
 Tested By BRADLEY GERSCHWILER

<u>STANDARD DESIGNATION (mm/μm)</u>	<u>SIEVE SIZE</u>	<u>AMOUNT PASSING (%)</u>	
25.0 mm	1"	100	
19.0 mm	3/4"	84	
12.5 mm	1/2"	74	
9.5 mm	3/8"	70	
6.3 mm	1/4"	63	
4.75 mm	No. 4	60	40.1% Gravel
2.00 mm	No. 10	51	
850 μm	No. 20	44	
425 μm	No. 40	39	34.9% Sand
250 μm	No. 60	35	
150 μm	No. 100	31	
75 μm	No. 200	25.0	25% Fines



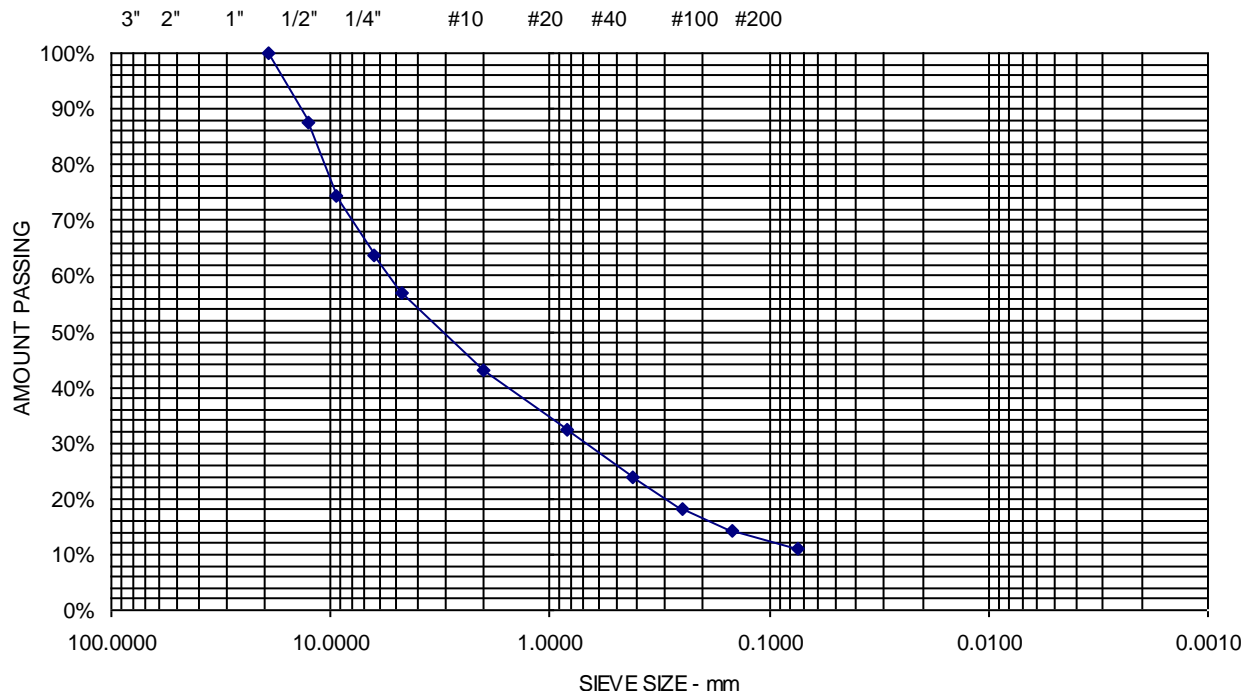
Comments: Moisture Content = 5.2%

Sheet

Project Name PORTSMOUTH NH - TRANSFER STATION AND ATHLETIC FIELD -
 GEOTECHNICAL ENGINEERING SERVICES
 Client CMA ENGINEERS
 Exploration **B-9**
 Material Source **2D, 2'-4'**

Project Number 18-1170
 Lab ID 17969S
 Date Received 12/28/2018
 Date Completed 1/7/2019
 Tested By BRADLEY GERSCHWILER

<u>STANDARD DESIGNATION (mm/μm)</u>	<u>SIEVE SIZE</u>	<u>AMOUNT PASSING (%)</u>	
19.0 mm	3/4"	100	
12.5 mm	1/2"	88	
9.5 mm	3/8"	75	
6.3 mm	1/4"	64	
4.75 mm	No. 4	57	42.9% Gravel
2.00 mm	No. 10	43	
850 μm	No. 20	32	
425 μm	No. 40	24	45.9% Sand
250 μm	No. 60	18	
150 μm	No. 100	14	
75 μm	No. 200	11.2	11.2% Fines



Comments: Moisture Content = 3.8%

Sheet

18-1170.1 S

August 28, 2019

CMA Engineers
Attention: Mr. Phillip A. Corbett, P.E.
35 Bow Street
Portsmouth, NH 03801

Subject: Letter Report
Test Pit Observation and Infiltration Testing Services
Proposed Athletic Fields
Portsmouth, New Hampshire

Dear Phil:

In accordance with our Agreement dated July 24, 2019, we have performed test pit observation and field infiltration testing services for the subject project. The findings are subject to the limitations included in Attachment A.

1.0 INTRODUCTION

1.1 Scope and Purpose

The purpose of our services was to coordinate and log test pit explorations, perform field infiltration testing on select test pits, and to report the results. Our scope of services has included 18 test pits, 8 field infiltration tests, and preparation of this letter report.

1.2 Project Understanding

We have previously undertaken subsurface exploration work and provided geotechnical engineering services pertaining to athletic field design and construction at the site, generally located on the southerly side of Banfield Road and northerly side of West Road. We understand the scope of work undertaken herein is for the use of CMA Engineers in further planning and design.

2.0 TEST PITS AND INFILTRATION TESTING

2.1 Test Pits

Eighteen test pits (TP-6 through TP-23) were made at the site from July 31, 2019 to August 2, 2019 by the City of Portsmouth NH. The test pit locations were selected by CMA Engineers and established in the field by S. W. Cole Engineering, Inc. (S.W.COLE) using a mapping grade GPS unit. The approximate exploration locations are shown on the "Test Pit Location Plan" in Attachment B provided by CMA Engineers. Logs of the test pits and a key to the notes and symbols used on the logs are attached in Attachment C.

2.2 Field Testing

S.W.COLE performed field infiltration testing at the site from July 31, 2019 to August 2, 2019. Test pit location and infiltration testing elevations were selected by CMA Engineers. The test was performed using a Guelph Permeameter in accordance with the NHDES analysis method. The following table depicts the testing results.

FIELD INFILTRATION TESTING RESULTS			
Location	Material	Depth (ft)	Rate (in/hour)
TP-6	Gravelly Loamy SAND(FILL)	0.5	0.5
TP-9	Very Gravelly Loamy SAND(FILL)	1.0	1.9
TP-13	Gravelly Loamy SAND with debris (FILL)	0.5	0.3
TP-14	Gravelly Loamy SAND with debris (FILL)	1.0	0.9
TP-17	Gravelly Loamy SAND with debris (FILL)	0.7	1.0
TP-21	Gravelly Loamy SAND with debris (FILL)	0.4	0.01
TP-22	Gravelly Loamy SAND with debris (FILL)	2.0	0.3
TP-23	Loamy SAND (FILL)	0.5	2.2

The results above are the direct value from the field testing and no safety factor has been applied.

3.0 SUBSURFACE CONDITIONS

3.1 Soil and Bedrock

With the exception of Test Pits TP-15, TP-16, and TP-19, the test pits encountered fills that were typically granular, but containing various amounts of construction debris and organics to the target depths requested by CMA Engineers or refusals. Test Pit TP-11 was terminated in stump fill at a depth of approximately 7.5 feet.

Test Pit TP-16 encountered native sand overlying silty clay that, in turn overlies glacial till at a depth of approximately 5.5 feet. Test pit TP-15 encountered a relatively thin layer of native gravelly sand.

Test Pits TP-6 through TP-9, TP-13, TP-15, TP-16 and TP-22 encountered refusals on what is likely bedrock at depths varying from about 1.6 to 6.2 feet. A bedrock outcrop was present in the TP-19 location.

Not all the strata were encountered at each exploration; refer to the logs in Attachment C for more detailed subsurface information.

3.2 Groundwater

The soils encountered at the test pits were moist to wet from the ground surface. Saturated soils and free water was encountered at depths varying from 3.9 to 6.2 feet. Several test pits did not encounter free water. Long term groundwater information is not available. It should be anticipated that groundwater levels will fluctuate, particularly in response to periods of snowmelt and precipitation, as well as changes in site use.

Due the fills present at the site seasonal high water table (SHWT) could not be estimated at most of the test pit locations. Redoximorphic features, indicating SHWT, were observed on TP-16 at a depth of 4.2 feet.

4.0 CLOSURE

We trust this letter report meets your current needs. If you have any questions, please do not hesitate to contact us.

Sincerely,

S. W. Cole Engineering, Inc.

Antonio J. Santiago
Geotechnical Engineer

Anthony Hersh

Anthony J. Hersh, P.E.
Senior Geotechnical Engineer

AJS:ajh



Attachment A

Limitations

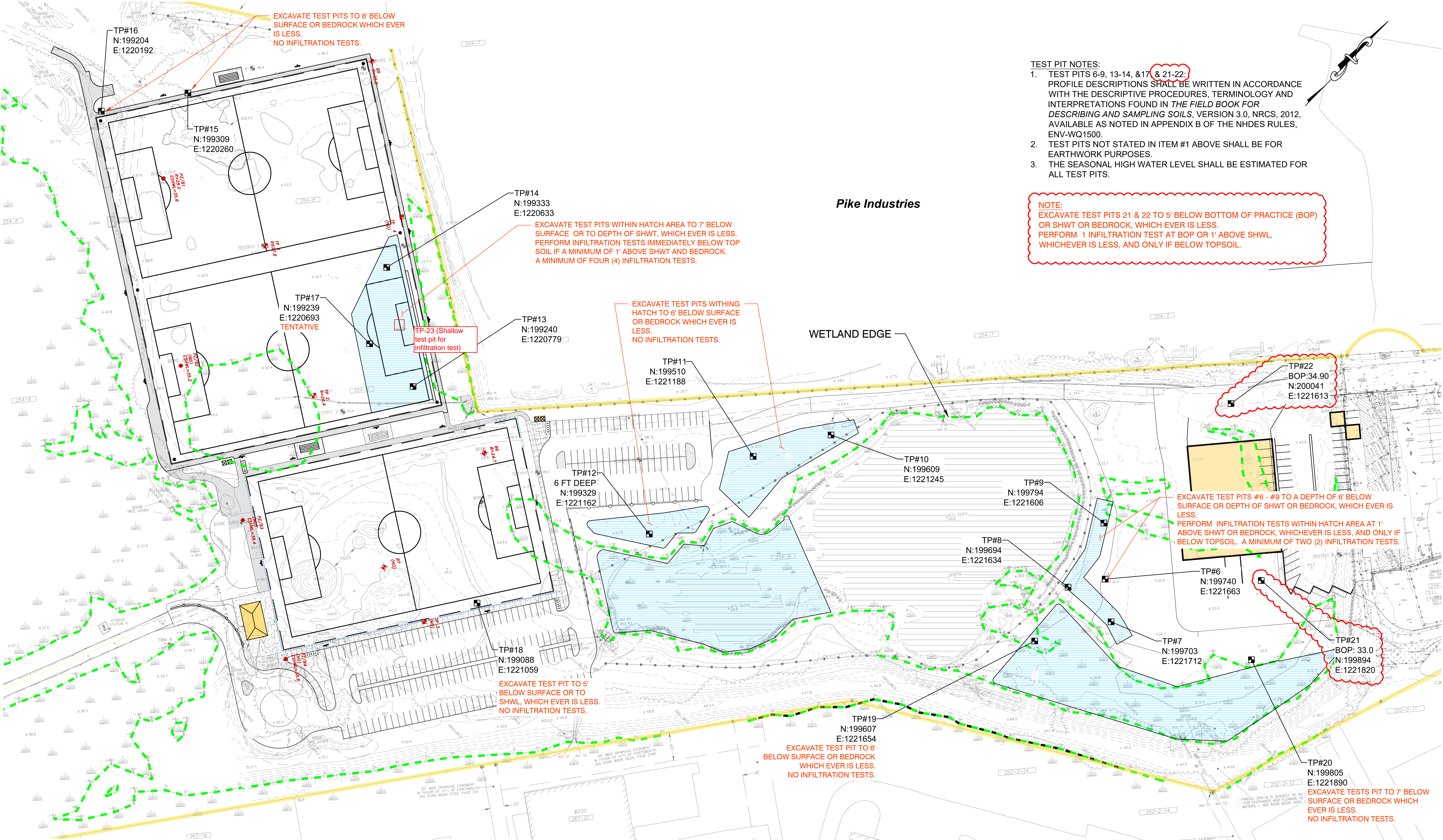
This report has been prepared for the exclusive use of CMA Engineers for specific application to the Proposed Athletic Fields in Portsmouth, New Hampshire. S. W. Cole Engineering, Inc. has endeavored to conduct the work in accordance with generally accepted soil engineering and testing practices. No warranty, expressed or implied, is made.

The soil profiles described in the report are intended to convey general trends in subsurface conditions. The boundaries between strata are approximate and are based upon interpretation of exploration data and samples.

The infiltration test results only represent the specific test location. Variations in subsurface conditions such as soil composition and density may occur between explorations and may not become evident until construction. If variations in subsurface conditions become evident after submission of this report, it may be necessary to evaluate their nature and provide supplemental infiltration testing to reflect the differing conditions.

S. W. Cole Engineering, Inc.'s scope of work was limited to conducting and providing field infiltration results. It is the responsibility of the design engineer to appropriately incorporate the test results into the design and follow applicable local and federal permitting and design regulations.

Attachment B
Test Pit Location Plan








- TEST PIT NOTES:
- TEST PITS 6-9, 13-14, &17 & 21-22: PROFILE DESCRIPTIONS SHALL BE WRITTEN IN ACCORDANCE WITH THE DESCRIPTIVE PROCEDURES, TERMINOLOGY AND INTERPRETATIONS FOUND IN *THE FIELD BOOK FOR DESCRIBING AND SAMPLING SOILS*, VERSION 3.0, NRCS, 2012, AVAILABLE AS NOTED IN APPENDIX B OF THE NHDES RULES, ENV-WQ1500.
 - TEST PITS NOT STATED IN ITEM #1 ABOVE SHALL BE FOR EARTHWORK PURPOSES.
 - THE SEASONAL HIGH WATER LEVEL SHALL BE ESTIMATED FOR ALL TEST PITS.

NOTE:
EXCAVATE TEST PITS 21 & 22 TO 5' BELOW BOTTOM OF PRACTICE (BOP) OR SHWT OR BEDROCK, WHICH EVER IS LESS.
PERFORM 1 INFILTRATION TEST AT BOP OR 1' ABOVE SHWL, WHICHEVER IS LESS, AND ONLY IF BELOW TOPSOIL.

Portsmouth Multi-purpose Recreation Fields Subsurface Investigation Plan

0 60 120

July 16, 2019
Revised 07/30/2019

	B#	Existing Boring		TP#	Proposed Test Pits (Starts at #6)
	PZ/B#	Existing Piezometer			Wetlands Boundary
	TP#	Existing Test Pit			

CMA
ENGINEERS

Weston & Sampson

Attachment C
Exploration Logs



TEST PIT LOGS

PROJECT NO.: 18-1170.1
LOGGED BY: Antonio Santiago
CONTRACTOR:
City of Portsmouth
EQUIPMENT:
CAT Backhoe

CLIENT: CMA Engineers
PROJECT: Proposed Athletic Fields
LOCATION: 680 Peverly Hill Rd, Portsmouth, New Hampshire

TEST PIT TP- 6

DATE: 7/31/2019 LOCATION: See Exploration Location Plan SURFACE ELEVATION (FT): 31' +/- COMPLETION DEPTH (FT): 1.6
WATER LEVEL DEPTHS (FT): No free water observed REMARKS:

Depth (feet)	Graphic Log	Stratum Description	H ₂ O Depth	Sample No.	Type	Sample Depth (ft)	Field / Lab Test Data
		Brown, Loamy SAND and Rootmat					
		0.5 Brown, Medium Gravelly Loamy SAND (Fill)					Field Saturated Hydraulic Conductivity = 0.5 in./hr.

Bucket Refusal at 1.6 feet
Probable Bedrock

TEST PIT TP- 7

DATE: 7/31/2019 LOCATION: See Exploration Location Plan SURFACE ELEVATION (FT): 31' +/- COMPLETION DEPTH (FT): 3.0
WATER LEVEL DEPTHS (FT): No free water observed REMARKS:

Depth (feet)	Graphic Log	Stratum Description	H ₂ O Depth	Sample No.	Type	Sample Depth (ft)	Field / Lab Test Data
		Topsoil and Rootmat					
		0.2 Brown, Gravelly Loamy SAND (Fill)					

Bucket Refusal at 3.0 feet
Probable Bedrock

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

KEY TO NOTES AND SYMBOLS:

Water Level
▽ At time of Digging
▼ At Completion of Digging
▽ After Digging

q_p = Pocket Penetrometer Strength, kips/sq.ft.

KEY TO NOTES & SYMBOLS

Test Boring and Test Pit Explorations

Stratification lines represent the approximate boundary between soil types and the transition may be gradual.

Key to Symbols Used:

w	-	water content, percent (dry weight basis)
q _u	-	unconfined compressive strength, kips/sq. ft. - laboratory test
S _v	-	field vane shear strength, kips/sq. ft.
L _v	-	lab vane shear strength, kips/sq. ft.
q _p	-	unconfined compressive strength, kips/sq. ft. – pocket penetrometer test
O	-	organic content, percent (dry weight basis)
W _L	-	liquid limit - Atterberg test
W _P	-	plastic limit - Atterberg test
WOH	-	advance by weight of hammer
WOM	-	advance by weight of man
WOR	-	advance by weight of rods
HYD	-	advance by force of hydraulic piston on drill
RQD	-	Rock Quality Designator - an index of the quality of a rock mass.
γ _T	-	total soil weight
γ _B	-	buoyant soil weight

Description of Proportions:

Trace:	0 to 5%
Some:	5 to 12%
"Y"	12 to 35%
And	35+%
With	Undifferentiated

Description of Stratified Soils

Parting:	0 to 1/16" thickness
Seam:	1/16" to 1/2" thickness
Layer:	½" to 12" thickness
Varved:	Alternating seams or layers
Occasional:	one or less per foot of thickness
Frequent:	more than one per foot of thickness

REFUSAL: Test Boring Explorations - Refusal depth indicates that depth at which, in the drill foreman's opinion, sufficient resistance to the advance of the casing, auger, probe rod or sampler was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

REFUSAL: Test Pit Explorations - Refusal depth indicates that depth at which sufficient resistance to the advance of the backhoe bucket was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

Although refusal may indicate the encountering of the bedrock surface, it may indicate the striking of large cobbles, boulders, very dense or cemented soil, or other buried natural or man-made objects or it may indicate the encountering of a harder zone after penetrating a considerable depth through a weathered or disintegrated zone of the bedrock.



TEST PIT LOGS

CLIENT: CMA Engineers
 PROJECT: Proposed Athletic Fields
 LOCATION: 680 Peverly Hill Rd, Portsmouth, New Hampshire

PROJECT NO.: 18-1170.1
 LOGGED BY: Antonio Santiago
 CONTRACTOR: City of Portsmouth
 EQUIPMENT: CAT Backhoe

TEST PIT TP- 8

DATE: 7/31/2019 LOCATION: See Exploration Location Plan SURFACE ELEVATION (FT): 31' +/- COMPLETION DEPTH (FT): 3.6
 WATER LEVEL DEPTHS (FT): No free water observed REMARKS:

Depth (feet)	Graphic Log	Stratum Description	H ₂ O Depth	Sample No.	Type	Sample Depth (ft)	Field / Lab Test Data
		Brown, Loamy SAND and Rootmat					
	0.6	Brown, Very Gravelly Loamy SAND (Fill)					

Bucket Refusal at 3.6 feet
 Probable Bedrock

TEST PIT TP- 9

DATE: 7/31/2019 LOCATION: See Exploration Location Plan SURFACE ELEVATION (FT): 31' +/- COMPLETION DEPTH (FT): 3.0
 WATER LEVEL DEPTHS (FT): No free water observed REMARKS:

Depth (feet)	Graphic Log	Stratum Description	H ₂ O Depth	Sample No.	Type	Sample Depth (ft)	Field / Lab Test Data
		Brown, Very Gravelly Loamy SAND (Fill)					

Field Saturated Hydraulic Conductivity = 1.9 in./hr.

Bucket Refusal at 3.0 feet
 Probable Bedrock

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

KEY TO NOTES AND SYMBOLS:

Water Level
 ▽ At time of Digging
 ▼ At Completion of Digging
 ▽ After Digging

q_p = Pocket Penetrometer Strength, kips/sq.ft.



TEST PIT LOGS

CLIENT: CMA Engineers
 PROJECT: Proposed Athletic Fields
 LOCATION: 680 Peverly Hill Rd, Portsmouth, New Hampshire

PROJECT NO.: 18-1170.1
 LOGGED BY: Tyler Demers
 CONTRACTOR: City of Portsmouth
 EQUIPMENT: CAT Backhoe

TEST PIT TP-10

DATE: 7/31/2019 LOCATION: See Exploration Location Plan SURFACE ELEVATION (FT): 27' +/- COMPLETION DEPTH (FT): 7.0
 WATER LEVEL DEPTHS (FT): 5 ft Free water at 5 feet REMARKS:

Depth (feet)	Graphic Log	Stratum Description	H ₂ O Depth	Sample No.	Type	Sample Depth (ft)	Field / Lab Test Data
		6 inches Topsoil					
		0.5 Brown-dark brown, Gravelly Silty SAND with metal (Fill)					
5		5.0 Gray, Clayey Sandy SILT	5				

Bottom of Exploration at 7.0 feet

TEST PIT TP-11

DATE: 7/31/2019 LOCATION: See Exploration Location Plan SURFACE ELEVATION (FT): 27' +/- COMPLETION DEPTH (FT): 7.5
 WATER LEVEL DEPTHS (FT): 4.5 ft Free water at 4.5 feet REMARKS:

Depth (feet)	Graphic Log	Stratum Description	H ₂ O Depth	Sample No.	Type	Sample Depth (ft)	Field / Lab Test Data
		4 inches Topsoil					
		0.3 Brown-dark brown, Gravelly Silty SAND with wires and wood (Fill)					
5		4.5 Gray, Gravelly SILT and fine SAND with brick (Fill)	4.5				
		7.0 Stump Fill					

Bottom of Exploration at 7.5 feet

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

KEY TO NOTES AND SYMBOLS:

Water Level
 ▽ At time of Digging
 ▽ At Completion of Digging
 ▽ After Digging

q_p = Pocket Penetrometer Strength, kips/sq.ft.



TEST PIT LOGS

CLIENT: CMA Engineers
 PROJECT: Proposed Athletic Fields
 LOCATION: 680 Peverly Hill Rd, Portsmouth, New Hampshire

PROJECT NO.: 18-1170.1
 LOGGED BY: Antonio Santiago
 CONTRACTOR: City of Portsmouth
 EQUIPMENT: CAT Backhoe

TEST PIT TP-12

DATE: 8/1/2019 LOCATION: See Exploration Location Plan SURFACE ELEVATION (FT): 28' +/- COMPLETION DEPTH (FT): 6.0
 WATER LEVEL DEPTHS (FT): 5 ft Seepage at 5 feet REMARKS:

Depth (feet)	Graphic Log	Stratum Description	H ₂ O Depth	Sample No.	Type	Sample Depth (ft)	Field / Lab Test Data
5		0.3 3 inches Topsoil Brown, gravelly SAND some silt frequent cobbles with organics various debris (Fill)	5				
		4.0 Gray, silty SAND some gravel with boulders cobbles and various debris (Fill)					

Bottom of Exploration at 6.0 feet

TEST PIT TP-13

DATE: 8/1/2019 LOCATION: See Exploration Location Plan SURFACE ELEVATION (FT): 30' +/- COMPLETION DEPTH (FT): 4.3
 WATER LEVEL DEPTHS (FT): 4 ft Free water observed at 4 feet REMARKS:

Depth (feet)	Graphic Log	Stratum Description	H ₂ O Depth	Sample No.	Type	Sample Depth (ft)	Field / Lab Test Data
		Brown, Loamy SAND and Rootmat	4				Field Saturated Hydraulic Conductivity = 0.3 in./hr.
		0.5 Brown, Gravelly Loamy SAND with Various Debris (Fill)					
		2.3 Gray, Silt LOAM (Fill)					
		2.8 Brown, Gravelly Loamy SAND with Various Debris (Fill)					

Bucket Refusal at 4.3 feet
 Probable Bedrock

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

KEY TO NOTES AND SYMBOLS:

Water Level
 ▽ At time of Digging
 ▽ At Completion of Digging
 ▽ After Digging

q_p = Pocket Penetrometer Strength, kips/sq.ft.



TEST PIT LOGS

CLIENT: CMA Engineers
 PROJECT: Proposed Athletic Fields
 LOCATION: 680 Peverly Hill Rd, Portsmouth, New Hampshire

PROJECT NO.: 18-1170.1
 LOGGED BY: Antonio Santiago
 CONTRACTOR: City of Portsmouth
 EQUIPMENT: CAT Backhoe

TEST PIT TP-14

DATE: 8/1/2019 LOCATION: See Exploration Location Plan SURFACE ELEVATION (FT): 30' +/- COMPLETION DEPTH (FT): 7.0
 WATER LEVEL DEPTHS (FT): ∇ 4 ft Free water observed at 4 feet REMARKS:

Depth (feet)	Graphic Log	Stratum Description	H ₂ O Depth	Sample No.	Type	Sample Depth (ft)	Field / Lab Test Data
5		Brown, Loamy SAND and Rootmat	∇ 4				Field Saturated Hydraulic Conductivity = 0.9 in./hr.
	0.5	Brown, Gravelly Loamy SAND with Various Debris (Fill)					

Bottom of Exploration at 7.0 feet

TEST PIT TP-15

DATE: 8/1/2019 LOCATION: See Exploration Location Plan SURFACE ELEVATION (FT): 39' +/- COMPLETION DEPTH (FT): 2.0
 WATER LEVEL DEPTHS (FT): No free water observed REMARKS:

Depth (feet)	Graphic Log	Stratum Description	H ₂ O Depth	Sample No.	Type	Sample Depth (ft)	Field / Lab Test Data
		3 inches Topsoil and Forest Duff					
	0.3	Brown, gravelly SAND some silt with cobbles					

Bucket Refusal at 2.0 feet
 Probable Bedrock

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

KEY TO NOTES AND SYMBOLS:

Water Level
 ∇ At time of Digging
 ▼ At Completion of Digging
 ▽ After Digging

q_p = Pocket Penetrometer Strength, kips/sq.ft.



TEST PIT LOGS

CLIENT: CMA Engineers
 PROJECT: Proposed Athletic Fields
 LOCATION: 680 Peverly Hill Rd, Portsmouth, New Hampshire

PROJECT NO.: 18-1170.1
 LOGGED BY: Antonio Santiago
 CONTRACTOR: City of Portsmouth
 EQUIPMENT: CAT Backhoe

TEST PIT TP-16

DATE: 8/1/2019 LOCATION: See Exploration Location Plan SURFACE ELEVATION (FT): 38' +/- COMPLETION DEPTH (FT): 6.2
 WATER LEVEL DEPTHS (FT): SHWT at 4.2 feet REMARKS:

Depth (feet)	Graphic Log	Stratum Description	H ₂ O Depth	Sample No.	Type	Sample Depth (ft)	Field / Lab Test Data
5		Topsoil and Forest Duff					
	0.4	Brown, SAND some silt some gravel					
	2.0	Varved, brown Silty CLAY and tan silty fine SAND					
	5.5	Tan, silty SAND some gravel (Till)					
Bucket Refusal at 6.2 feet Probable Bedrock							

TEST PIT TP-17

DATE: 8/1/2019 LOCATION: See Exploration Location Plan SURFACE ELEVATION (FT): 30' +/- COMPLETION DEPTH (FT): 4.0
 WATER LEVEL DEPTHS (FT): 3.9 ft Free water observed at 3.9 feet REMARKS:

Depth (feet)	Graphic Log	Stratum Description	H ₂ O Depth	Sample No.	Type	Sample Depth (ft)	Field / Lab Test Data
		Brown, Loamy SAND and Rootmat					Field Saturated Hydraulic Conductivity = 1 in./hr.
		0.8 Brown, Gravelly Loamy SAND with Various Debris (Fill)					
			▽ 3.9				

Bottom of Exploration at 4.0 feet

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

KEY TO NOTES AND SYMBOLS:

Water Level
 ▽ At time of Digging
 ▼ At Completion of Digging
 ▽ After Digging

q_p = Pocket Penetrometer Strength, kips/sq.ft.



TEST PIT LOGS

PROJECT NO.: 18-1170.1
LOGGED BY: Antonio Santiago
CONTRACTOR:
City of Portsmouth
EQUIPMENT:
CAT Backhoe

CLIENT: CMA Engineers
PROJECT: Proposed Athletic Fields
LOCATION: 680 Peverly Hill Rd, Portsmouth, New Hampshire

TEST PIT TP-18

DATE: 8/1/2019 LOCATION: See Exploration Location Plan SURFACE ELEVATION (FT): 36' +/- COMPLETION DEPTH (FT): 5.0
WATER LEVEL DEPTHS (FT): No free water observed REMARKS:

Depth (feet)	Graphic Log	Stratum Description	H ₂ O Depth	Sample No.	Type	Sample Depth (ft)	Field / Lab Test Data
		4 inches Topsoil					
		0.3 Brown, gravelly SAND some silt with organics and various debris (Fill)					
		3.0 Gray-brown, sandy SILT some gravel with organics and various debris (Fill)					
5		Bottom of Exploration at 5.0 feet					

TEST PIT TP-19

DATE: 7/31/2019 LOCATION: See Exploration Location Plan SURFACE ELEVATION (FT): 30' +/- COMPLETION DEPTH (FT): 0.0
WATER LEVEL DEPTHS (FT): No free water observed REMARKS:

Depth (feet)	Graphic Log	Stratum Description	H ₂ O Depth	Sample No.	Type	Sample Depth (ft)	Field / Lab Test Data
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Bedrock Outcrop
Bottom of Exploration at 0.0 feet
Bedrock Outcrop at surface

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

KEY TO NOTES AND SYMBOLS:

Water Level
▽ At time of Digging
▼ At Completion of Digging
▽ After Digging

q_p = Pocket Penetrometer Strength, kips/sq.ft.



TEST PIT LOGS

CLIENT: CMA Engineers
 PROJECT: Proposed Athletic Fields
 LOCATION: 680 Peverly Hill Rd, Portsmouth, New Hampshire

PROJECT NO.: 18-1170.1
 LOGGED BY: Antonio Santiago
 CONTRACTOR: City of Portsmouth
 EQUIPMENT: CAT Backhoe

TEST PIT TP-20

DATE: 7/31/2019 LOCATION: See Exploration Location Plan SURFACE ELEVATION (FT): 32' +/- COMPLETION DEPTH (FT): 7.0
 WATER LEVEL DEPTHS (FT): 6.2 ft Free water observed at 6.2 feet REMARKS:

Depth (feet)	Graphic Log	Stratum Description	H ₂ O Depth	Sample No.	Type	Sample Depth (ft)	Field / Lab Test Data
5		0.2 2 inches Topsoil and Rootmat Brown, silty SAND some gravel with organics, asphalt pieces, and various debris	6.2				
		2.5 Gray, silty SAND some gravel with various construction debris					

Bottom of Exploration at 7.0 feet
 Excavation Caving at 4 Feet

TEST PIT TP-21

DATE: 8/2/2019 LOCATION: See Exploration Location Plan SURFACE ELEVATION (FT): 33' +/- COMPLETION DEPTH (FT): 4.0
 WATER LEVEL DEPTHS (FT): 4 ft Free water observed at 4 feet REMARKS:

Depth (feet)	Graphic Log	Stratum Description	H ₂ O Depth	Sample No.	Type	Sample Depth (ft)	Field / Lab Test Data
		Brown, Loamy SAND and Rootmat	4				Field Saturated Hydraulic Conductivity = 0.01 in./hr.
		0.5 Brown, Gravelly Loamy SAND with Various Debris (Fill)					

Bottom of Exploration at 4.0 feet

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

KEY TO NOTES AND SYMBOLS:

Water Level
 ▽ At time of Digging
 ▽ At Completion of Digging
 ▽ After Digging

q_p = Pocket Penetrometer Strength, kips/sq.ft.



TEST PIT LOGS

PROJECT NO.: 18-1170.1
LOGGED BY: Antonio Santiago
CONTRACTOR:
City of Portsmouth
EQUIPMENT:
CAT Backhoe

CLIENT: CMA Engineers
PROJECT: Proposed Athletic Fields
LOCATION: 680 Peverly Hill Rd, Portsmouth, New Hampshire

TEST PIT TP-22

DATE: 8/2/2019 LOCATION: See Exploration Location Plan SURFACE ELEVATION (FT): 39' +/- COMPLETION DEPTH (FT): 6.0
WATER LEVEL DEPTHS (FT): No free water observed REMARKS:

Depth (feet)	Graphic Log	Stratum Description	H ₂ O Depth	Sample No.	Type	Sample Depth (ft)	Field / Lab Test Data
5		Brown, Loamy SAND and Rootmatt					Field Saturated Hydraulic Conductivity = 0.3 in./hr.
		0.5 Brown, Gravelly Loamy SAND with Various Debris (Fill)					

Bucket Refusal at 6.0 feet
Probable Bedrock

TEST PIT TP-23

DATE: 8/1/2029 LOCATION: See Exploration Location Plan SURFACE ELEVATION (FT): 31' +/- COMPLETION DEPTH (FT): 0.5
WATER LEVEL DEPTHS (FT): No free water observed REMARKS:

Depth (feet)	Graphic Log	Stratum Description	H ₂ O Depth	Sample No.	Type	Sample Depth (ft)	Field / Lab Test Data
		Brown, Loamy SAND and Rootmatt					Field Saturated Hydraulic Conductivity = 2.2 in./hr.
Bottom of Exploration at 0.5 feet							

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

KEY TO NOTES AND SYMBOLS:

Water Level
▽ At time of Digging
▼ At Completion of Digging
▽ After Digging

q_p = Pocket Penetrometer Strength, kips/sq.ft.

APPENDIX B

City of Portsmouth Blasting Ordinance



PUBLIC WORKS DEPARTMENT

CITY OF PORTSMOUTH

680 Peverly Hill Road

Portsmouth N.H. 03801

(603) 427-1530 FAX (603) 427-1539

CITY OF PORTSMOUTH BLASTING RULES AND PROCEDURES

1.0 General

All blasting work shall comply with the following regulations:

- City Ordinance Article VII: Section 5:02;
State of New Hampshire Department of Transportation Standard
- Specifications for Road and Bridge Construction – 1997
- Storage and Transportation of explosives shall be in accordance with State of New Hampshire Code of Administrative Rules: Chapter/Part 1600. in case of conflict, the more stringent regulation shall govern

2.0 Insurance

- 2.1 The blasting contractor shall procure and maintain \$5,000,000 of personal injury & property damage liability insurance covering the permitted blasting operations, or such an amount as may be determined necessary by extraordinary circumstances.
- 2.2 The Certificate shall name the City as an additional insured.

3.0 Permit Process

- 3.1 The blasting contractor shall apply in person at the Department of Public Works for a permit to perform blasting operations before commencing the pre-blast survey procedure.
- 3.2 At the time of application, the blasting Contractor shall provide the following items:
- a) Plan showing location and extent and purpose of proposed blasting operations
 - b) Copy of valid Use and Transportation License for the blasting company as required by Article VII, Section 5:702.
 - c) Copy of valid Insurance Certificate as required by Article VII, Section 5:702 and defined in Section 2 of these rules and procedures.

4.0 Pre-Blast Condition Surveys

- 4.1 Pre-blast surveys shall be performed as required in City Ordinance Article VII: Section 5:02 and the following procedures.
- 4.2 The pre-blast condition survey shall consist of a written description of the interior and exterior condition of each of the structures examined. Descriptions shall locate any existing cracks, damage or other defects and shall include such information so as to make it possible to determine the effect, if any, of the construction operations on the defect. Where significant cracks or damage exist, or for defects too complicated to describe in words, photographs shall be taken. A good quality videotape survey with appropriate audio description of locations, and conditions, and defects can be used.
- 4.3 The Pre-Blast Contractor shall send a pre-blast survey_ letter by regular mail to all abutters within a 500 foot radius of the blasting site, with copies of the letter sent also to:

Deputy Director of Public Works
680 Peverly Hill Rd.
Portsmouth, NH 03801

City Manager
1 Junkins Avenue
Portsmouth NH 03801

Fire Chief
170 Court Street
Portsmouth, NH 03801

Chief of Police
3 Junkins Avenue
Portsmouth NH 03801

Zoning Officer, Housing Code Inspector
City Hall, Legal Dept.
1 Junkins Avenue
Portsmouth, NH 03801

Chief Building Inspector
City Hall
1 Junkins Avenue
Portsmouth, NH 03801

- 4.4 The pre-blast survey company shall make at least three attempts over a minimum 1-week period to contact a property owner before that property is listed as non-respondent.
- 4.5 Copies Of the Pre-blast Condition .Survey shall be made available to the Department of Public Works and/or the property owner upon request. The blasting company shall maintain copies of all pre-blast survey records for a period of no less than one year from the completion of the blasting operations.
- 4.6 Before the issuance of a Blasting Permit, The blasting contractor shall submit to the Department of Public Works a list of all properties within the 500-foot radius of the blasting. The list shall include names, addresses, with tax map and lot numbers of all abutters within the 500-foot radius and the status of the survey, whether completed, refused or non-respondent.

5.0 Blasting Permit

- 5.1 The blasting contractor shall submit to the Engineering Division of the Public Works Department all items described in sections 2, 3 and 4 of these procedures. The blasting contractor will be authorized to proceed with the mailing blasting notification letter described in Article VII Section 5: 702 B upon approval of the submitted material.
- 5.2 A copy of the certified mail recipients of the blasting notification letter shall be submitted prior to issuance of the permit. Copies of the certified letter shall also be sent the Deputy Director of Public Works, Chief of Police, Building Inspector, and Fire Chief, indicating when the blasting is scheduled to begin.

6.0 Blasting Operations

- 6.1 All blasting operations shall be conducted in accordance with State of New Hampshire Department of Transportation Standard Specifications for Road and Bridge Construction- 1997.
- 6.2 All blasting operations shall require vibration measuring equipment meeting the following minimum requirements:
 - a) Measure, display, and provide a permanent record on a strip chart of particle velocity components.
 - b) Measure three mutually perpendicular components of particle velocity in directions vertical, radial, and perpendicular to the vibration source.
 - c) Have a velocity frequency response of 2Hz to 150 Hz and be capable of measuring Peak Particle Velocity (PPV) of up to 250 mm/s (10 in/s)
 - d) All seismographs. used shall display the date of the most recent calibration.
 - e) Calibration must *have* been performed within the last 12 months and must be performed to a standard traceable to the National Institute of Standards and Technology.
- 6.3 The blasting contractor shall maintain daily logs of all blasting activities. Those records, including seismic monitoring records shall be made available to the City of Portsmouth for a period of 5 Years.

**ARTICLE
BLASTING**

VII:

**Section 5:702
REQUIRED**

BLASTING PERMIT

No person shall perform or cause to be performed any blasting within the City limits unless a Blasting Permit is obtained from the City Engineer. This permit shall not be issued until the following terms and conditions have been satisfied by the applicant:

- A. All abutters within five hundred (500) feet of the area where the blasting will occur shall receive notice by certified mail two full business days (excluding Saturday> Sunday and holidays) in advance of the blasting. The term "abutter" shall be defined in the manner used for the notification of zoning abutters. (Amended 9/17/2001)
- B. That the City Engineer>s office as well as the Building inspector shall receive the same notice> also sent by certified mail> at least two full business days (excluding Saturday> Sunday and holidays) in advance of the blasting.
- C. The name and address of the blasting company be provided.
- D. The name of a company representative be provided and the twenty-four (24) hour telephone number of the representative; such representative being a person who IS capable of responding to claims and issues arising from the blasting performed.
- E. A pre-blast survey shall-be completed by the blasting company for an area within five hundred (500) feet of the proposed blasting. (Amended 9il7/2001)
- F. Any reports, measurements or video tapes made in connection with this· pre-blast survey or with the subsequent blasting shall be made available upon request to all abutters within five hundred (500) feet of the area.· (Amended 9/17/2001)
- G. That the cost of such a pre-blast survey shall be borne by the blasting company.
- H. The Use and Transport License of the hauler shall be designated.
- I. The route of removing blasting material shall be designated.
- J. The location of the blasting shall be designated.
- K. The blasting shall take place within the hours of 8:00 A.M. to 5:00 :P.M. Monday through Friday.
- L. An Insurance Certificate shall be posted with the City Engineer in an amount and type deemed appropriate by the City Engineer and the City Attorney. (Amended 9/20/93)
- M. The Public Works Director is hereby authorized to promulgate blasting rules consistent with the intent of this ordinance; such rules shall become effective on acceptance by the City Council. (Item M. adopted 9/17/2001)

APPENDIX C

- NHDES Wetlands Permit
- NHDES Alteration of Terrain Permit
- Army Corps of Engineers General Permit

NHDES Wetlands Permit



The State of New Hampshire
Department of Environmental Services

Robert R. Scott, Commissioner



December 06, 2019

CITY OF PORTSMOUTH
C/O PETER RICE, DEPT OF PUBLIC WORKS
1 JUNKINS AVE
PORTSMOUTH NH 03801

Re: NHDES File #2019-02298
Subject Property: 680 Peverly Hill Rd, Portsmouth, Tax Map #254, Lot #8

Dear Mr. Rice:

The New Hampshire Department of Environmental Services (NHDES) Wetlands Bureau has concluded its review of file #2019-02298. NHDES issues this approval notice for the application to:

Dredge and fill 57,512 square feet of palustrine emergent, previously excavated, wetland in order to construct three multi-purpose recreational fields and associated parking on an old quarry site. In addition, the project also includes reconstruction of the existing transfer station with associated parking and appurtenant structures. Compensatory mitigation includes a one-time payment into the Aquatic Resource Mitigation (ARM) Fund of \$198,157.86, a Declaration of Restrictive Covenants for Conservation Purposes and construction of two large regional stormwater treatment systems which will address a wide range of pollutants for Sagamore Creek.

The decision to approve this application was based on the following conditions being met:

1. All work shall be in accordance with the plans by CMA Engineers and Weston & Sampson, titled City of Portsmouth New Hampshire Department of Public Works Multi-Purpose Recreation Fields, dated July 2019 and revised through July 24, 2019, as received by the NH Department of Environmental Services (NHDES) on July 25, 2019.
2. This permit is not valid unless an Alteration of Terrain permit or other method of compliance with RSA 485-A:17 and New Hampshire Administrative Rule Chapter Env-Wq 1500 is achieved.
3. Not less than five state business days prior to starting work authorized by this permit, the permittee shall notify the NHDES Wetlands Bureau (Stefanie.giallongo@des.nh.gov) and the local conservation commission in writing of the date on which work under this permit is expected to start.
4. Prior to construction, all wetland and surface water boundaries adjacent to construction areas shall be clearly marked with orange construction fencing at the limits of construction to prevent unintentional encroachment on adjacent wetlands and surface waters.
5. No person undertaking any activity shall cause or contribute to, or allow the activity to cause or contribute to, any violations of the surface water quality standards in RSA 485-A and New Hampshire Administrative Rule Env-Wq 1700.
6. To prevent the introduction or export of invasive plant species to the site, the permittee's contractor(s) shall clean all soils and vegetation from construction equipment and matting before such equipment is moved to the site and prior to demobilization from the site.
7. Within three days of final grading or temporary suspension of work in an area that is in or adjacent to wetlands or surface waters, all exposed soil areas shall be stabilized by seeding and mulching during the growing season, or if not within the growing season, by mulching with tackifiers on slopes less than 3:1 or netting and pinning on slopes steeper than 3:1.

www.des.nh.gov

29 Hazen Drive • PO Box 95 • Concord, NH 03302-0095

NHDES Main Line: (603) 271-3503 • Subsurface Fax: (603) 271-6683 • Wetlands Fax: (603) 271-6588

TDD Access: Relay NH 1 (800) 735-2964

8. Where construction activities occur between November 30 and May 1, all exposed soil areas shall be stabilized within 1 day of establishing the grade that is final or that otherwise will exist for more than 5 days. Stabilization shall include placing 3-inches of base course gravels, or loaming and mulching with tack or netting and pinning on slopes steeper than 3:1.
9. Appropriate siltation, erosion and turbidity controls shall be in place prior to construction, shall be maintained during construction, and shall remain until the area is stabilized. Temporary controls shall be removed once the area has been stabilized.
10. Work shall be conducted in a manner so as to minimize turbidity and sedimentation to surface waters and wetlands.
11. All dredged and excavated material and construction-related debris shall be placed outside of the areas subject to RSA 482-A. Any spoil material deposited within 250 feet of any surface water shall comply with RSA-483-B.
12. The contractor responsible for completion of the work shall use techniques described in the New Hampshire Stormwater Manual, Volume 3, Erosion and Sediment Controls During Construction (December 2008).
13. Erosion control products shall be installed per manufacturers recommended specifications.
14. Construction equipment shall be inspected daily for leaking fuel, oil, and hydraulic fluid prior to entering surface waters or wetlands or operating in an area where such fluids could reach groundwater, surface waters, or wetlands.
15. The permittee's contractor shall maintain appropriate oil/diesel fuel spill kits on site that are readily accessible at all times during construction, and shall train each operator in the use of the kits.
16. All refueling of equipment shall occur outside of surface waters or wetlands during construction. Machinery shall be staged and refueled in upland areas only.
17. Faulty equipment shall be repaired immediately prior to entering areas that are subject to RSA 482-A jurisdiction

MITIGATION:

18. This approval is not valid until NHDES receives a one-time payment of \$198,157.86 to the NHDES ARM Fund. The applicant shall remit payment to NHDES. If NHDES does not receive payment within 120 days of the date of this approval letter, NHDES will deny the application.
19. The permittee shall properly construct, monitor, and manage the two large regional stormwater treatment systems in accordance with approved plans.
20. The regional stormwater treatment systems shall be monitored as specified in the monitoring plan prepared by the UNH Stormwater Center, dated October 30, 2019 and received by NHDES on November 01, 2019. Monitoring reports shall be submitted to the department within 60 days following each targeted sampling event.
21. This approval is not valid until the applicant/owner executes and records the Declaration of Restrictive Covenants for Conservation Purposes establishing a 75-foot buffer around two vernal pools as depicted on plans prepared by CMA Engineers Inc., titled Vernal Pool Buffer Deed Restriction, Exhibit A and received by NHDES on November 01, 2019.
22. Following permit issuance and prior to recording of the Declaration of Restrictive Covenants, the natural resources existing in the buffer areas shall not be removed, disturbed, or altered.
23. The Declaration of Restrictive Covenants to be placed on the buffer areas shall be written to run with the land, and both existing and all future property owners shall be subject to this restriction.
24. The plan noting the Declaration of Restrictive Covenants with a copy of the final language shall be recorded with the Rockingham County Registry of Deeds for the lot that is subject to the restriction. The permittee shall submit a copy of the recording from the Rockingham County Registry of Deeds to the NHDES Wetlands Bureau prior to the start of construction.
25. The buffer area shall be marked prior to construction.
26. Activities in contravention of the Declaration of Restrictive Covenants shall be deemed to be a violation of RSA 482-A, and shall be subject to enforcement under RSA 482-A.

The decision to approve this application was based on the following findings:

1. This is as a Major Project per Administrative Rule Env-Wt 303.02(c), as it proposes to alter greater than 20,000 square feet of nontidal wetlands in the aggregate.
2. The applicant has demonstrated by plan and example that each factor listed in New Hampshire Administrative Rule Env-Wt 302.04(a), Requirements for Application Evaluation, has been considered in the design of the project.
3. The applicant has provided evidence which demonstrates that this proposal is the alternative with the least adverse impact to areas and environments under the department's jurisdiction per New Hampshire Administrative Rule Env-Wt 302.03.
4. The applicant has provided a detailed off-site alternatives analysis which describes that this is the least impacting, practicable, alternative site for the proposed development.
5. In 2010, the City completed a detailed Recreational Needs Study which found that the City does not have adequate field space based on current usage, the City's growing population and the City's 2025 Master Plan goal to increase recreational opportunities to the public. The study recommended the construction of three multi-purpose fields.
6. The six wetland impact areas were previously excavated from prior quarry activities. Upon reclamation of the stormwater management basins of the quarry, these areas retained the minimum characteristics for wetland classification today.
7. The six wetland impact areas are presently mowed areas and/or comprised of predominantly invasive species.
8. The three additional wetland areas found on site are naturally occurring, provide greater function and value, and are being avoided by this project.
9. A vernal pool assessment was conducted on April 24, 2019. Two vernal pools were found on-site. Both will be avoided by this project and a 75-foot buffer will be established around these two vernal pools as depicted on plans prepared by CMA Engineers Inc., titled Vernal Pool Buffer Deed Restriction, Exhibit A and received by NHDES on November 01, 2019.
10. The City's transfer station facility is also being re-constructed (on the same parcel) to increase efficiencies to meet the current and projected demand for solid waste processing.
11. An NHDES Alteration of Terrain permit is required for this project.
12. NHDES Staff conducted a pre-application field inspection of the proposed project on March 29, 2019. The area is primarily currently mowed field and predominantly invasive plant species with relic features of the former quarry.
13. A Pre-Application Mitigation meeting was held at NHDES in Concord on April 30, 2019.
14. The Natural Heritage Bureau (NHB) report submitted with the application (NHB19-1128) cited potential impact to a nearby exemplary natural community.
15. In correspondence dated April 22, 2019, the NHB stated that, because the project will not direct drainage towards the higher value wetland areas or to the headwater wetlands of Pickering Brook, there are no concerns relative to the potential impact on the nearby exemplary natural community.
16. In correspondence from the NH Division of Historical Resources (NHDHR), dated June 06, 2019, it was found that no historic properties would be affected by the project, as proposed.
17. No comments of concern were received by NHDES from abutting property owners or the local conservation commission.
18. In accordance with New Hampshire Administrative Rule Env-Wt 304.04, in correspondence dated July 22, 2019, signed authorization was obtained from the abutting land owner whose property is located within 20 feet of the project area.
19. In accordance with RSA 482-A:8, NHDES finds that the requirements for a public hearing do not apply as the permitted project is not of substantial public interest, and will not have a significant impact on or adversely affect the values of the palustrine resource, as identified under RSA 482-A:1.
20. In accordance with RSA 482-A:3 IV(b), portions of a man-made stormwater detention system (from prior quarry activities) are being modified as necessary to preserve their usefulness.

21. Compensatory mitigation for the overall project includes a one-time payment into the Aquatic Resource Mitigation (ARM) Fund of \$198,157.86, a Declaration of Restrictive Covenants for Conservation Purposes establishing a 75-foot buffer around two vernal pools and two large regional stormwater treatment systems which will intercept flow from over 145 acres that currently flow with minimal treatment to surface waters on the site and will address a wide range of pollutants for Sagamore Creek.
22. Upper Sagamore Creek is on the 303D list, a list of impaired surface waters, for Aquatic Life Integrity, Fish Consumption, and shellfish consumption. Water quality measures proposed for the project may reduce pollutants entering Upper Sagamore Creek.
23. The Department decision is issued in letter form and, upon receipt of the ARM fund payment, the Department shall issue a posting permit in accordance with New Hampshire Administrative Rule Env-Wt 803.08(f).

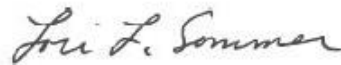
Any person aggrieved by this decision may appeal to the New Hampshire Wetlands Council (the Council) by filing an appeal that meets the requirements specified in RSA 482-A:10, RSA 21-O:14, and the rules adopted by the Council, Env-WtC 100-200. The appeal must be filed **directly with the Council within 30 days** of the date of this decision and must set forth fully **every ground** upon which it is claimed that the decision complained of is unlawful or unreasonable. Only those grounds set forth in the notice of appeal can be considered by the Council.

Information about the Council is available at <http://nhec.nh.gov/> or <http://nhec.nh.gov/wetlands/index.htm>. Copies of the rules are also available from the NHDES Public Information Center at (603) 271-2975.

This permit is contingent on receipt of a one-time payment of \$198,157.86 to the NHDES Aquatic Resource Mitigation (ARM) Fund. The payment should be received after the 30-day reconsideration period, or after January 05, 2020. If the payment is not received by NHDES by April 04, 2020, or 120 days from the approval decision, NHDES will deny the application. Please include a copy of this letter with the payment.

If you have any questions, please contact me at (603) 271-4059 or lori.sommer@des.nh.gov.

Sincerely,



Lori Sommer
Wetlands Mitigation Coordinator
Land Resources Management

cc: Portsmouth Municipal Clerk/Conservation Commission
Tracy Tarr, GZA Geoenvironmental Inc.
ec: David Allen, City of Portsmouth Department of Public Works
Peter Britz, City of Portsmouth Environmental Planner
Philip Corbett, CMA Engineers

NHDES Alteration of Terrain Permit



The State of New Hampshire
Department of Environmental Services



Robert R. Scott, Commissioner

February 7, 2020

City of Portsmouth
Department of Public Works
Attn: Peter Rice
680 Peverly Hill Road
Portsmouth, New Hampshire 03801

Re: Portsmouth Recreational Fields
680 Peverly Hill Road
Tax Map 254, Lot 8-1, Portsmouth, NH

Permit: AoT-1744

Dear Applicant:

Based upon the plans and application, approved on February 7, 2020, we are hereby issuing RSA 485-A:17 Alteration of Terrain Permit AoT-1744. This permit is subject to the following conditions:

PROJECT SPECIFIC CONDITIONS:

1. Plans by CMA Engineers, Inc., entitled "Multi-Purpose Recreation Fields – Phase 1" and "Multi-Purpose Recreation Fields – Phase 2", dated October 2019, latest revisions dated February 4, 2020, and supporting documentation in the permit file are a part of this approval, and include land disturbances associated with the construction of regional stormwater control and treatment facilities, identified as BMP-R1 and BMP-R3 on the referenced plans. Engineering analyses for the design of BMP-R1 and BMP-R3 were not within the scope of the permit application, nor were such analyses required by Alteration of Terrain regulations.
2. Construction of a proposed transfer station and associated parking and stormwater facilities, as shown on drawings entitled "Portsmouth Transfer Station", dated October 2019, are not part of this approval. A permit amendment to include said facilities is required prior to construction of these facilities.
3. **This permit expires on February 7, 2025.** No earth moving activities shall occur on the project after this expiration date unless the permit has been extended by the Department. If an extension is required, the request must be received by the department before the permit expires. The Amendment Request form is available at: <http://des.nh.gov/organization/divisions/water/aot/categories/forms.htm>

GENERAL CONDITIONS:

1. Activities shall not cause or contribute to any violations of the surface water quality standards established in Administrative Rule Env-Wq 1700.
2. You must submit revised plans for permit amendment prior to any changes in construction details or sequences. You must notify the Department in writing within ten days of a change in ownership.
3. You must notify the Department in writing prior to the start of construction and upon completion of construction. Forms can be submitted electronically at: <https://forms.nh.gov/onlineforms/>. Paper forms are available at that same web page or at: <http://des.nh.gov/organization/divisions/water/aot/categories/forms.htm>.
4. **Upon completion of construction, a written notice signed by the permit holder and a qualified engineer shall be submitted to the Department, in accordance with Env-Wq 1503.21(c)(1), stating that the project was completed in accordance with the approved plans and specifications.** If deviations were made, the permit holder shall review the requirements in Env-Wq 1503.21(c)(2).

www.des.nh.gov

29 Hazen Drive • PO Box 95 • Concord, NH 03302-0095
(603) 271-3503 • Fax: 271-2867 TDD Access: Relay NH 1-800-735-2964

5. **All stormwater practices shall be inspected and maintained in accordance with Env-Wq 1507.08 and the project Inspection and Maintenance (I&M) Manual.** All record keeping required by the I&M Manual shall be maintained by the identified responsible party, and be made available to the department upon request.
6. This permit does not relieve the applicant from the obligation to obtain other local, state or federal permits that may be required (e.g., from US EPA, US Army Corps of Engineers, etc.). Projects disturbing over 1 acre may require a federal stormwater permit from EPA. Information regarding this permitting process can be obtained at: <http://des.nh.gov/organization/divisions/water/stormwater/construction.htm>.
7. If applicable, no activity shall occur in wetland areas until a Wetlands Permit is obtained from the Department. Issuance of this permit does not obligate the Department to approve a Wetlands Permit for this project.
8. This project has been screened for potential impact to known occurrences of protected species and exemplary natural communities in the immediate area. Since many areas have never been surveyed, or only cursory surveys have been performed, unidentified sensitive species or communities may be present. This permit does not absolve the permittee from due diligence in regard to state, local or federal laws regarding such communities or species. This permit does not authorize in any way the take of threatened or endangered species, as defined by RSA 212-A:2, or of any protected species or exemplary natural communities, as defined in RSA 217-A:3

Sincerely,



Ridgely Mauck, P.E.
Alteration of Terrain Bureau

cc: Portsmouth Planning Board

cc: CMA Engineers, Inc.

Army Corp of Engineers General Permit



DEPARTMENT OF THE ARMY
NEW ENGLAND DISTRICT, CORPS OF ENGINEERS
696 VIRGINIA ROAD
CONCORD, MASSACHUSETTS 01742-2751

REPLY TO
ATTENTION OF

January 22, 2020

Regulatory Division
CENAE-R-PEC
Permit Number: NAE-2019-01105

City of Portsmouth
C/O Peter Rice, Dept of Public Works
1 Junkins Ave
Portsmouth, New Hampshire 03801

Dear Applicant:

This is to inform you that we have reviewed your application to conduct activities as described on the attached NH Permit No. **2019-02298** dated December 06, 2019.

Based on the information you provided to the New Hampshire Wetlands Bureau, we have determined that your project, which may include a discharge of dredged or fill material into waters or wetlands, will have only minimal individual or cumulative environmental impacts on waters of the United States, including wetlands. Therefore, this work is authorized under **General Permit No(s). 17** of the attached Federal permit known as the Department of the Army General Permits for the State of New Hampshire (GPs). This work must be performed in accordance with the terms and conditions of the GP and the following special condition:

1. No tree clearing shall occur from June 1 through July 31 to protect the Northern long-eared Bat.

You are responsible for complying with all of the GP's requirements. Please review the attached GPs carefully to familiarize yourself with its contents. You should ensure that whoever does the work fully understands the requirements and that a copy of the permit document is at the project site throughout the time the work is underway. Also, see a copy of the GPs at: <http://www.nae.usace.army.mil/Missions/Regulatory/StateGeneralPermits/NewHampshireGeneralPermit.aspx>

This authorization expires August 18, 2022, unless the GPs are modified, suspended, or revoked before that. You must complete the work authorized herein by that date. If you do not, you must contact this office to determine the need for further authorization before continuing the activity. We recommend that you contact us *before* this authorization expires to discuss a time extension or reissuance of the authorization.

If you change the plans or construction methods for work within our jurisdiction, please contact us immediately to discuss modification of this authorization. This office must approve any changes before you undertake them.

This authorization requires you to complete and return the enclosed Compliance Certification Form within one month following the completion of the authorized work.


This authorization presumes that the work as described above and as shown on your plans noted above is in waters of the U.S. Should you desire to appeal our jurisdiction, please submit a request for an approved jurisdictional determination in writing to this office.

This permit does not obviate the need to obtain other Federal, state or local authorizations required by law, including those listed in the GPs. Performing work not specifically authorized by this determination or failing to comply with all the terms and conditions of the GPs may subject you to the enforcement provisions of Corps regulations.

We continually strive to improve our customer service. In order for us to better serve you, we would appreciate your completing our Customer Service Survey located at http://www.nae.usace.army.mil/reg/Customer_Service_Survey.pdf.

If you have questions concerning this, please contact Richard Kristoff of my staff at (978) 318-8171, (978) 318-8335/8338, (800) 343-4789, or, if calling from within Massachusetts, (800) 362-4367.

Sincerely,


FRANK J. DEL GIUDICE
Chief, Permits & Enforcement Branch
Regulatory Division

Enclosures

Copies Furnished:

Mary Ann Tilton, NH DES, MaryAnn.Tilton@des.nh.gov

Sarah Richos, NH DES, Sarah.Richos@des.nh.gov

Tracy Tarr, GZA GeoEnvironmental, Inc., tracy.tarr@gza.com



The State of New Hampshire
Department of Environmental Services

Robert R. Scott, Commissioner



December 06, 2019

CITY OF PORTSMOUTH
C/O PETER RICE, DEPT OF PUBLIC WORKS
1 JUNKINS AVE
PORTSMOUTH NH 03801

Re: NHDES File #2019-02298
Subject Property: 680 Peverly Hill Rd, Portsmouth, Tax Map #254, Lot #8

Dear Mr. Rice:

The New Hampshire Department of Environmental Services (NHDES) Wetlands Bureau has concluded its review of file #2019-02298. NHDES issues this approval notice for the application to:

Dredge and fill 57,512 square feet of palustrine emergent, previously excavated, wetland in order to construct three multi-purpose recreational fields and associated parking on an old quarry site. In addition, the project also includes reconstruction of the existing transfer station with associated parking and appurtenant structures. Compensatory mitigation includes a one-time payment into the Aquatic Resource Mitigation (ARM) Fund of \$198,157.86, a Declaration of Restrictive Covenants for Conservation Purposes and construction of two large regional stormwater treatment systems which will address a wide range of pollutants for Sagamore Creek.

The decision to approve this application was based on the following conditions being met:

1. All work shall be in accordance with the plans by CMA Engineers and Weston & Sampson, titled City of Portsmouth New Hampshire Department of Public Works Multi-Purpose Recreation Fields, dated July 2019 and revised through July 24, 2019, as received by the NH Department of Environmental Services (NHDES) on July 25, 2019.
2. This permit is not valid unless an Alteration of Terrain permit or other method of compliance with RSA 485-A:17 and New Hampshire Administrative Rule Chapter Env-Wq 1500 is achieved.
3. Not less than five state business days prior to starting work authorized by this permit, the permittee shall notify the NHDES Wetlands Bureau (Stefanie.giallongo@des.nh.gov) and the local conservation commission in writing of the date on which work under this permit is expected to start.
4. Prior to construction, all wetland and surface water boundaries adjacent to construction areas shall be clearly marked with orange construction fencing at the limits of construction to prevent unintentional encroachment on adjacent wetlands and surface waters.
5. No person undertaking any activity shall cause or contribute to, or allow the activity to cause or contribute to, any violations of the surface water quality standards in RSA 485-A and New Hampshire Administrative Rule Env-Wq 1700.
6. To prevent the introduction or export of invasive plant species to the site, the permittee's contractor(s) shall clean all soils and vegetation from construction equipment and matting before such equipment is moved to the site and prior to demobilization from the site.
7. Within three days of final grading or temporary suspension of work in an area that is in or adjacent to wetlands or surface waters, all exposed soil areas shall be stabilized by seeding and mulching during the growing season, or if not within the growing season, by mulching with tackifiers on slopes less than 3:1 or netting and pinning on slopes steeper than 3:1.

8. Where construction activities occur between November 30 and May 1, all exposed soil areas shall be stabilized within 1 day of establishing the grade that is final or that otherwise will exist for more than 5 days. Stabilization shall include placing 3-inches of base course gravels, or loaming and mulching with tack or netting and pinning on slopes steeper than 3:1.
9. Appropriate siltation, erosion and turbidity controls shall be in place prior to construction, shall be maintained during construction, and shall remain until the area is stabilized. Temporary controls shall be removed once the area has been stabilized.
10. Work shall be conducted in a manner so as to minimize turbidity and sedimentation to surface waters and wetlands.
11. All dredged and excavated material and construction-related debris shall be placed outside of the areas subject to RSA 482-A. Any spoil material deposited within 250 feet of any surface water shall comply with RSA-483-B.
12. The contractor responsible for completion of the work shall use techniques described in the New Hampshire Stormwater Manual, Volume 3, Erosion and Sediment Controls During Construction (December 2008).
13. Erosion control products shall be installed per manufacturers recommended specifications.
14. Construction equipment shall be inspected daily for leaking fuel, oil, and hydraulic fluid prior to entering surface waters or wetlands or operating in an area where such fluids could reach groundwater, surface waters, or wetlands.
15. The permittee's contractor shall maintain appropriate oil/diesel fuel spill kits on site that are readily accessible at all times during construction, and shall train each operator in the use of the kits.
16. All refueling of equipment shall occur outside of surface waters or wetlands during construction. Machinery shall be staged and refueled in upland areas only.
17. Faulty equipment shall be repaired immediately prior to entering areas that are subject to RSA 482-A jurisdiction

MITIGATION:

18. This approval is not valid until NHDES receives a one-time payment of \$198,157.86 to the NHDES ARM Fund. The applicant shall remit payment to NHDES. If NHDES does not receive payment within 120 days of the date of this approval letter, NHDES will deny the application.
19. The permittee shall properly construct, monitor, and manage the two large regional stormwater treatment systems in accordance with approved plans.
20. The regional stormwater treatment systems shall be monitored as specified in the monitoring plan prepared by the UNH Stormwater Center, dated October 30, 2019 and received by NHDES on November 01, 2019. Monitoring reports shall be submitted to the department within 60 days following each targeted sampling event.
21. This approval is not valid until the applicant/owner executes and records the Declaration of Restrictive Covenants for Conservation Purposes establishing a 75-foot buffer around two vernal pools as depicted on plans prepared by CMA Engineers Inc., titled Vernal Pool Buffer Deed Restriction, Exhibit A and received by NHDES on November 01, 2019.
22. Following permit issuance and prior to recording of the Declaration of Restrictive Covenants, the natural resources existing in the buffer areas shall not be removed, disturbed, or altered.
23. The Declaration of Restrictive Covenants to be placed on the buffer areas shall be written to run with the land, and both existing and all future property owners shall be subject to this restriction.
24. The plan noting the Declaration of Restrictive Covenants with a copy of the final language shall be recorded with the Rockingham County Registry of Deeds for the lot that is subject to the restriction. The permittee shall submit a copy of the recording from the Rockingham County Registry of Deeds to the NHDES Wetlands Bureau prior to the start of construction.
25. The buffer area shall be marked prior to construction.
26. Activities in contravention of the Declaration of Restrictive Covenants shall be deemed to be a violation of RSA 482-A, and shall be subject to enforcement under RSA 482-A.

The decision to approve this application was based on the following findings:

1. This is as a Major Project per Administrative Rule Env-Wt 303.02(c), as it proposes to alter greater than 20,000 square feet of nontidal wetlands in the aggregate.
2. The applicant has demonstrated by plan and example that each factor listed in New Hampshire Administrative Rule Env-Wt 302.04(a), Requirements for Application Evaluation, has been considered in the design of the project.
3. The applicant has provided evidence which demonstrates that this proposal is the alternative with the least adverse impact to areas and environments under the department's jurisdiction per New Hampshire Administrative Rule Env-Wt 302.03.
4. The applicant has provided a detailed off-site alternatives analysis which describes that this is the least impacting, practicable, alternative site for the proposed development.
5. In 2010, the City completed a detailed Recreational Needs Study which found that the City does not have adequate field space based on current usage, the City's growing population and the City's 2025 Master Plan goal to increase recreational opportunities to the public. The study recommended the construction of three multi-purpose fields.
6. The six wetland impact areas were previously excavated from prior quarry activities. Upon reclamation of the stormwater management basins of the quarry, these areas retained the minimum characteristics for wetland classification today.
7. The six wetland impact areas are presently mowed areas and/or comprised of predominantly invasive species.
8. The three additional wetland areas found on site are naturally occurring, provide greater function and value, and are being avoided by this project.
9. A vernal pool assessment was conducted on April 24, 2019. Two vernal pools were found on-site. Both will be avoided by this project and a 75-foot buffer will be established around these two vernal pools as depicted on plans prepared by CMA Engineers Inc., titled Vernal Pool Buffer Deed Restriction, Exhibit A and received by NHDES on November 01, 2019.
10. The City's transfer station facility is also being re-constructed (on the same parcel) to increase efficiencies to meet the current and projected demand for solid waste processing.
11. An NHDES Alteration of Terrain permit is required for this project.
12. NHDES Staff conducted a pre-application field inspection of the proposed project on March 29, 2019. The area is primarily currently mowed field and predominantly invasive plant species with relic features of the former quarry.
13. A Pre-Application Mitigation meeting was held at NHDES in Concord on April 30, 2019.
14. The Natural Heritage Bureau (NHB) report submitted with the application (NHB19-1128) cited potential impact to a nearby exemplary natural community.
15. In correspondence dated April 22, 2019, the NHB stated that, because the project will not direct drainage towards the higher value wetland areas or to the headwater wetlands of Pickering Brook, there are no concerns relative to the potential impact on the nearby exemplary natural community.
16. In correspondence from the NH Division of Historical Resources (NHDHR), dated June 06, 2019, it was found that no historic properties would be affected by the project, as proposed.
17. No comments of concern were received by NHDES from abutting property owners or the local conservation commission.
18. In accordance with New Hampshire Administrative Rule Env-Wt 304.04, in correspondence dated July 22, 2019, signed authorization was obtained from the abutting land owner whose property is located within 20 feet of the project area.
19. In accordance with RSA 482-A:8, NHDES finds that the requirements for a public hearing do not apply as the permitted project is not of substantial public interest, and will not have a significant impact on or adversely affect the values of the palustrine resource, as identified under RSA 482-A:1.
20. In accordance with RSA 482-A:3 IV(b), portions of a man-made stormwater detention system (from prior quarry activities) are being modified as necessary to preserve their usefulness.

21. Compensatory mitigation for the overall project includes a one-time payment into the Aquatic Resource Mitigation (ARM) Fund of \$198,157.86, a Declaration of Restrictive Covenants for Conservation Purposes establishing a 75-foot buffer around two vernal pools and two large regional stormwater treatment systems which will intercept flow from over 145 acres that currently flow with minimal treatment to surface waters on the site and will address a wide range of pollutants for Sagamore Creek.
22. Upper Sagamore Creek is on the 303D list, a list of impaired surface waters, for Aquatic Life Integrity, Fish Consumption, and shellfish consumption. Water quality measures proposed for the project may reduce pollutants entering Upper Sagamore Creek.
23. The Department decision is issued in letter form and, upon receipt of the ARM fund payment, the Department shall issue a posting permit in accordance with New Hampshire Administrative Rule Env-Wt 803.08(f).

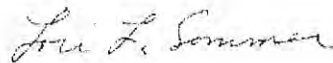
Any person aggrieved by this decision may appeal to the New Hampshire Wetlands Council (the Council) by filing an appeal that meets the requirements specified in RSA 482-A:10, RSA 21-O:14, and the rules adopted by the Council, Env-WtC 100-200. The appeal must be filed **directly with the Council within 30 days** of the date of this decision and must set forth fully **every ground** upon which it is claimed that the decision complained of is unlawful or unreasonable. Only those grounds set forth in the notice of appeal can be considered by the Council.

Information about the Council is available at <http://nhec.nh.gov/> or <http://nhec.nh.gov/wetlands/index.htm>. Copies of the rules are also available from the NHDES Public Information Center at (603) 271-2975.

This permit is contingent on receipt of a one-time payment of \$198,157.86 to the NHDES Aquatic Resource Mitigation (ARM) Fund. The payment should be received after the 30-day reconsideration period, or after January 05, 2020. If the payment is not received by NHDES by April 04, 2020, or 120 days from the approval decision, NHDES will deny the application. Please include a copy of this letter with the payment.

If you have any questions, please contact me at (603) 271-4059 or lori.sommer@des.nh.gov.

Sincerely,



Lori Sommer
Wetlands Mitigation Coordinator
Land Resources Management

cc: Portsmouth Municipal Clerk/Conservation Commission
Tracy Tarr, GZA Geoenvironmental Inc.
ec: David Allen, City of Portsmouth Department of Public Works
Peter Britz, City of Portsmouth Environmental Planner
Philip Corbett, CMA Engineers



**US Army Corps
of Engineers®**
New England District

Minimum Notice: Permittee must sign and return
notification within one month of the completion of work.)

COMPLIANCE CERTIFICATION FORM

Permit Number: NAE-2019-01105

Project Manager Richard Kristoff

Name of Permittee: Portsmouth

Permit Issuance Date: January 22, 2020

Please sign this certification and return it to the following address upon completion of the activity and any mitigation required by the permit. You must submit this after the mitigation is complete, but not the mitigation monitoring, which requires separate submittals.

* MAIL TO: U.S. Army Corps of Engineers, New England District *
* Permits and Enforcement Branch C *
* Regulatory Division *
* 696 Virginia Road *
* Concord, Massachusetts 01742-2751 *

Please note that your permitted activity is subject to a compliance inspection by an U.S. Army Corps of Engineers representative. If you fail to comply with this permit you are subject to permit suspension, modification, or revocation.

I hereby certify that the work authorized by the above referenced permit was completed in accordance with the terms and conditions of the above referenced permit, and any required mitigation was completed in accordance with the permit conditions.

Signature of Permittee

Date

Printed Name

Date of Work Completion

() _____
Telephone Number

() _____
Telephone Number

APPENDIX D

Pike Industries Access Agreement

SLOPE ACCESS AGREEMENT

This Access Agreement (“Agreement”), effective _____, is entered into by the City of Portsmouth, 1 Junkins Avenue, Portsmouth, New Hampshire (the “City”) and Pike Industries Inc. (“Company”). Company hereby grants City, its employees, contractors and agents access to Company’s property located at 650 Peverly Hill Road in the City of Portsmouth, County of Rockingham, and State of New Hampshire (the “Property”) for the purposes of allowing the City to perform work as described in this Agreement. The City and Company (collectively the “Parties”) agree as follows:

1. **ACCESS:** Company grants to the City non-exclusive access to the Property for the purpose of improving and restoring grading. The City warrants that no illegal activity will be conducted on the Property and that it shall only conduct its operations in the specific areas designed by this Agreement. Further, the City represents that it is aware of and will strictly adhere to all applicable safety laws, regulations, and policies related to the Property. The City shall not perform any work which it believes is unsafe.
2. **INSURANCE:** The City shall ensure that each of its contractors, consultants or agents performing work on behalf of the City procure and maintain insurance coverage sufficient to protect the interests of the Company. Company shall be listed as additional insureds on all liability policies.
3. **SCOPE OF WORK:** The City shall have the non-exclusive right to enter into the shaded area marked as “Temporary Slope Easement” on the attached Exhibit A. The City shall have the right to construct a berm and alter the grading and slope within the Temporary Slope Easement area, and the right to construct a chain link fence along the boundary line, as indicated on Exhibit A (collectively the “Work”). Following completion of the Work, the City shall restore and repair all damage to landscaping within the Temporary Slope Easement area. The Work shall be completed by the City at its sole cost and expense.
4. **FURTHER ASSURANCES:** If, as a result of the City’s work within the Temporary Slope Easement area, the City, its contractors, consultants or agents cause any damage to the Property, upon written notice to the City, the City shall cause the Property to be restored and in conformance with this Agreement and Exhibit A.
5. **ASSIGNABILITY:** The Parties agree that the Work shall be completed by a third party contractor (the “Contractor”). Company agrees that the Contractor shall have all the rights, duties and responsibilities of the City conferred under this Agreement.
6. **TERM:** The term of this Agreement shall commence upon the last date this Agreement is executed by the Parties (the “Effective Date”) and shall terminate automatically upon completion of the Work, but in any event no later than June 1, 2021.

The parties hereto have executed this Agreement effective as of the day and year noted above.

Company

City

By: _____

Printed: _____

Its: _____

By: _____

Printed: _____

Its: _____

MAP 254 LOT 7
PIKE INDUSTRIES, INC.
3 EASTGATE PARK ROAD
BELMONT, NH 03220

PROPOSED BERM

SLOPE LINE

PROPOSED CHAIN
LINK FENCE

TEMPORARY SLOPE EASEMENT
(TYP)

SLOPE LINE

SLOPE LINE

MAP 254 LOT 8
CITY OF PORTSMOUTH, NH
1 JUNKINS AVENUE
PORTSMOUTH, NH 03801

PHASE I
RECREATION
FIELDS

CMA
ENGINEERS

CIVIL/ENVIRONMENTAL/STRUCTURAL
Portsmouth, NH • Manchester, NH • Portland, ME
603/431-6196 • 603/627-0708 • 207/541-4223
cmaengineers.com

City of Portsmouth, New Hampshire
Department of Public Works
Multi-purpose Recreation Fields
680 Peverly Hill Road

Exhibit A

Scale: 1" = 40'-0"