
A D D E N D U M N O . 0 3

**LEDYARD HIGH SCHOOL TRACK AND FIELD
RENOVATION PROJECT**

Ledyard, CT
KBA #19016.00

Date: 10/7/19

Page: 1 of 2

The following changes to the Project Manual shall become a part of the Drawings, Specifications, Bidding Requirements and Contract Documents; superseding previously issued Drawings, Specifications, Bidding Requirements, Contract Documents and Addenda, to the extent modified by this Addendum.

BID DATES (per addenda #1)

- **BID OPENING:** Thursday, October 10, 2019, 11:00 a.m. (*October 3, 2019, 11:00 a.m.*) No bids will be accepted after said date and time
- **BIDDER INTERVIEWS:** Friday October 11, 2019 and Monday October 14, Time TBD

CLARIFICATIONS

Q: Does notary sign the bond form? Or a principal/Owner?

A: *Principal Owner signs the bond form with a witness from the same company.
The form must be notarized.*

CHANGES TO SPECIFICATIONS:

Add the following required bid forms to the previously distributed project manual:

Non Collusion Affidavit Dated October 7, 2019

EEO statement Dated October 7, 2019

AIA 101 (Draft Owner-Contractor Contract): Omit paragraph 5.1.3. in full and substitute with the following:

Contractor payments shall be made within 30 days of approval by Permanent Municipal Building Committee at the next regularly scheduled meeting. Submit payments at least 2 weeks prior to scheduled meeting for Architects Review.

Add the following specification sections to the previously distributed specification:

Section 05 52 13	Pipe and Tube Railings dated October 7, 2019
Section 22 11 13	Facility Water Distribution Piping dated October 7, 2019
Section 26 05 43	Underground Ducts and Raceways for Electrical Systems dated October 7, 2019
Section 33 41 00	Storm Utility Drainage Piping dated October 7, 2019

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Disregard the following specification sections dated September 6, 2019 and substitute with the following specification sections of the same name dated October 7, 2019

Section 31 10 00	Site Clearing dated October 7, 2019
Section 31 23 19	Dewatering dated October 7, 2019
Section 31 25 13	Erosion and Sedimentation Control dated October 7, 2019
Section 32 12 16	Asphalt Paving dated October 7, 2019

CHANGES TO DRAWINGS

None at this time

ATTACHMENTS

- Specification Sections as noted above.

END ADDENDUM #3

EQUAL EMPLOYMENT OPPORTUNITY STATEMENT:

The supplier, vendor, contractor, and/or bidder agrees: To incorporate Equal Opportunity Employment as described by State and Federal Statue

A). He will not discriminate against any employee or applicant for employment because of race, color, sex, creed, national origin or ancestry. He will take affirmative action to insure that applicants are employed and that employees are treated during employment without regard to race, color, sex, creed, national origin or ancestry. Such action shall include, but not be limited to the following:

B). Employment, upgrading, demotion or transfer, recruitment or recurrent advertising; layoff or termination; rates of pay or other forms of compensation, and selection for training, including apprenticeship. He further agrees to post in conspicuous places available to employees and applicants for employment, notices to be provided by the Town setting forth the provisions of this non-discrimination clause.

C). The supplier, vendor, contractor and/or bidder will, in it solicitations for employees, agrees that all qualified applicants will receive consideration for employment without regard to race, color, sex, creed, national origin or ancestry.

D). The supplier, vendor, contractor and/or bidder agrees to cooperate fully with the Town of Ledyard and/or any of its agencies to insure that the purposes of the non-discrimination clause are being carried out.

Legal Name of Proposer

(signature)

Proposer's Representative, Duly
Authorized

Name of Proposer's Authorized
Representative

Subscribed and sworn to before me this _____ day of _____, 2019.

Notary Public

My Commission Expires:

PROPOSER'S NON COLLUSION AFFIDAVIT FORM

The undersigned proposer, having fully informed himself/herself/itself regarding the accuracy of the statements made herein, certifies that:

- (1) the proposer developed the proposal independently and submitted it without collusion with, and without any agreement, understanding, communication or planned common course of action with, any other person or entity designed to limit independent competition;
- (2) the proposer, its employees and agents have not communicated the contents of the proposal to any person not an employee or agent of the proposer and will not communicate the proposal to any such person prior to the official opening of the proposal; and
- (3) no elected or appointed official or other officer or employee of the Town of Ledyard is directly or indirectly interested in the proposer's proposal, or in the supplies, materials, equipment, work or labor to which it relates, or in any of the profits thereof.

The undersigned proposer further certifies that this affidavit is executed for the purpose of full disclosure to the Town of Ledyard to consider its proposal and make an award in accordance therewith.

Legal Name of Proposer

(signature)
Proposer's Representative, Duly
Authorized

Name of Proposer's Authorized
Representative

Title of Proposer's Authorized
Representative

Subscribed and sworn to before me this _____ day of _____, 2019.

Notary Public
My Commission Expires:

SECTION 22 11 13 - FACILITY WATER DISTRIBUTION PIPING

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. This Section includes water-distribution piping and related components outside the building for water service.
- B. Work under this section covers furnishing and installation of water mains, valves, fittings and appurtenances as indicated on the drawings, for a complete and properly installed and functioning water system. This Section sets forth the minimum requirements for furnishing functional water service connections.

1.3 DEFINITIONS

- A. EPDM: Ethylene propylene diene terpolymer rubber.

1.4 ACTION SUBMITTALS

- A. Submit manufacturer's data sheets and certification of compliance with specifications for all pipes, valves, fittings and appurtenances.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.
- B. Record drawings for all water facilities installed under this Contract.

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
 - 2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.

- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
 - 1. Comply with NSF 61 Annex G for materials for water-service piping and specialties for domestic water.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
 - 1. Ensure that valves are dry and internally protected against rust and corrosion.
 - 2. Protect valves against damage to threaded ends and flange faces.
 - 3. Set valves in best position for handling. Set valves closed to prevent rattling.
- B. During Storage: Use precautions for valves, including fire hydrants, according to the following:
 - 1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
 - 2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
- D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- F. Protect flanges, fittings, and specialties from moisture and dirt.
- G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.8 COORDINATION

- A. Coordinate connection to water main with utility company. Contractor to provide Owner with 72 hours' notice (minimum) to coordinate for connection to existing water mains. Contractor shall not operate any valves or disturb existing water mains without prior coordination with, and supervision by Owner.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. Soft Copper Tube: ASTM B88, Type K, water tube, annealed temper.
- B. Hard Copper Tube: ASTM B88, Type L, water tube, drawn temper.

- C. Copper, Brass or Bronze, Pressure-Seal-Joint Fittings:
 - 1. Fittings shall be by Mueller Industries, Inc. or equal.
 - 2. Fittings: Cast-brass, cast-bronze, or wrought-copper with EPDM O-ring seal in each end.
 - 3. Minimum 200-psig working-pressure rating at 250 deg F.

2.2 CORPORATION VALVES AND CURB VALVES

- A. Manufacturers:
 - 1. Corporation and curb stops shall be by Mueller Industries, Inc. or equal.
- B. Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.
 - 1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
 - 2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.
- C. Curb Valves: Comply with AWWA C800. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material. Curb valves shall include stop-and-waste components.
- D. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches in diameter.
 - 1. Shutoff Rods: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.
- E. Ball valves shall include stop-and-waste components. Ball valves shall meet the requirements of NSF 61.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Refer to Section 312001 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.
- B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

- C. Do not use flanges or unions for underground piping.
- D. Underground water-service piping shall be:
 - 1. Soft copper tube, ASTM B88, Type K; copper, pressure-seal fittings; and pressure-sealed joints.
- E. Aboveground Water-Service Piping shall be the following:
 - 1. Hard copper tube, ASTM B88, Type L; wrought-copper, solder-joint fittings; and brazed or copper, pressure-seal fittings; and pressure-sealed joints.

3.3 VALVE APPLICATIONS

- A. General Application: Use compression end joints for underground installation.

3.4 PIPING INSTALLATION

- A. Water-Main Connection: Arrange with Owner for tap of size and in location indicated in water main.
- B. Make connections with tapping machine according to the following:
 - 1. Install tapping saddle and corporation valve according to MSS SP-60.
 - 2. Install tapping sleeve on pipe to be tapped.
 - 3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
- C. Install water-service piping according to AWWA C600 and AWWA M41.
- D. Bury piping with depth of cover over top at least 48 inches.
- E. A minimum of 18" shall be maintained between the outer edges of any newly installed water main/water services and existing or proposed sanitary sewers and storm drains. At sanitary sewer and storm drain crossings, the water pipe shall be centered on the crossing so both joints of the water pipe will be as far from the sewer as possible. If the minimum separating distance cannot be maintained, then at least one of the utilities shall be encased in concrete.
- F. Proper implements, tools and facilities shall be provided and used by the Contractor for the safe and convenient performance of the work. All pipe, fittings and valves shall be lowered into the trench with a suitable device that will not damage protective coatings and lining. Under no circumstances shall water main material be dropped or dumped into the trench. Any damaged lining, coating or wrapping shall be satisfactorily repaired or replaced.
- G. Every precaution shall be taken to prevent foreign matter from entering the pipe while it is being placed in the line. If the pipe laying crew cannot put the pipe into the trench and in place without allowing earth into it, the Engineer may require that before lowering the pipe into the trench, a heavy, tightly woven canvas bag of suitable size by placed over each end and left there until the connection is to be made to the adjacent pipe. At times when work is

not in progress, open ends of pipe and fittings shall be securely closed so that no trench water, earth or other substances will enter the pipe or fittings. If necessary, the line shall be swabbed or flushed out to remove all foreign matter prior to testing.

- H. Before joining lengths or push-on joint pipe, the inside of the bell and the outside of the spigot shall be thoroughly cleaned to remove oil, grit excess coating and other foreign matter. No pipe joints shall be covered in any way until the joints have been inspected.
- I. Pipe shall be laid with bell ends being in the direction of laying unless otherwise directed by the Engineer. When pipe is laid on a grade of 10 percent or greater, laying shall start at the bottom and shall proceed upward with the bell ends of the pipe upgrade.
- J. The cutting of pipe for installing valves, fittings or closure pieces shall be done in a neat manner without damage to the pipe or cement lining and so as to leave a smooth end at right angles to the axis of the pipe.
- K. All bolts, nuts, rods, and miscellaneous connecting pieces not provided with an approval factory coating shall be given two (2) coats of bitumastic 50 after installation.

3.5 JOINT CONSTRUCTION

- A. Make pipe joints according to the following:
 - 1. Copper-Tubing, Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools and procedures recommended by pressure-seal-fitting manufacturer. Leave insertion marks on pipe after assembly.

3.6 VALVE INSTALLATION

- A. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

3.7 CONNECTIONS

- A. Coordinate piping installations and specialty arrangements with schematics on Drawings and with requirements specified in piping systems.
- B. Connect water-distribution piping to existing water main. Use tapping sleeve and tapping valve.
- C. Connect water-distribution piping to interior domestic water and fire-suppression piping.
- D. Where connections are to be made between new water mains and existing water mains, the Contractor shall take all precautions to prevent contamination when making connections to existing potable water lines. No trench water, mud or other contaminating substances shall be permitted to enter the pipeline. Per the requirements of Section 19-13-B38b of the State of Connecticut Public Health Code, "An air gap will be required between all potable water lines and equipment or systems which may be subject to contamination". Connections of new work to existing appurtenances shall be provided in accordance with the printed recommendations of

the respective manufacturers. No connections shall be made without prior coordination with, written approval of, and supervision by the Owner.

3.8 FIELD QUALITY CONTROL

- A. The Contractor shall provide at no additional cost appropriate facilities for testing, flushing and disinfection the water mains. Such facilities may include, but are not be limited to corporation stops, copper tubing, caps, plugs and thrust restraint. Corporation stops shall be manufactured of solid bronze and all pipe threads shall be in conformance with AWWA C800. All corporation stops shall be compression type as manufactured by Ford, Mueller or approved equal. Any of these facilities which are of a temporary nature shall be removed by the Contractor after use.
- B. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- C. Hydrostatic Tests: Pressure testing and leakage testing shall be carried out in accordance with the appropriate paragraphs of Section 4 of ANSI/AWWA C600 with the following clarifications and qualifications.
 - 1. Unless otherwise permitted the testing shall be performed after either backfilling or partially backfilling the completed pipelines or sections thereof. Before testing, the Contractor shall submit, in writing, to the Engineer, the proposed method of testing the completed pipeline. Testing shall begin only after approval by the Engineer of the proposed methods. Testing of water mains shall be performed by the Contractor at his expense as witnessed by the Owner for approval. Any required coordination with the Owner shall be the responsibility of the Contractor.
 - 2. All new sections of water main shall be hydrostatically tested at a pressure of 200 pounds per square inch for a period of at least two hours. "Pressurization" and "air removal" shall be accomplished as specified in Section 4.1.2 and 4.1.3 of ANSI/AWWA C600. After the test pressure is applied, any defective pipe, fitting, valve or hydrant discovered in consequence of this pressure test shall become the property of the Contractor and shall be removed from the job site and replaced at the Contractor's expense with sound material. The test shall be repeated until satisfactory to the Owner.
 - 3. A leakage test shall be conducted concurrently with the pressure test. The Contractor shall furnish the gage, pump, connections and all other necessary apparatus and shall furnish the necessary assistance to conduct the test.
 - 4. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.

5. No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{SD\sqrt{P}}{133,200}$$

Where: L=Allowable leakage in gallons/hour

S=Length of pipe tested in feet

D=Normal pipe diameter in inches

P=Average test pressure during leakage test in pounds per square inch, gauge

6. When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gal/hour/inch nominal valve size will be allowed.
7. When hydrants are in the test section, the test shall be made against the closed hydrant valve.
8. If any test of pipe laid discloses leakage greater than that specified above, the Contractor shall, at his own expense, locate and repair the defective materials until the leakage is within the specified allowance.
9. All visible leaks shall be repaired regardless of the amount of leakage.
10. Any temporary thrust restraint required for testing sections of completed water main installation and later removed as directed by the Engineer shall be provided by the Contractor at no additional cost to the Owner.

- D. Prepare reports of testing activities.

3.9 IDENTIFICATION

- A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 312001 "Earth Moving."

3.10 CLEANING

- A. Clean and disinfect water-distribution piping as follows:
1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
 2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 and as follows:
 - a. Disinfection shall be carried out in accordance with ANSI/AWWA C65I under the direction of the Owner, using the continuous feed method described in Section 5.2 of this standard. Where appropriate, the Contractor shall follow the disinfection procedures of Section 9. Use of calcium hypochlorite granules prior to flushing will not be required.
 - b. The Contractor shall submit, to the Owner and the Engineer, for prior approval, the type of chlorine to be used, the disinfection experience of the workers, and the procedures and equipment to be used by the Contractor. The Contractor shall be warned that water main disinfection should be only accomplished by specially

trained personnel and that the project's water mains are vital to the safety and wellbeing of the municipality.

- c. Mains shall be completely flushed after the hydrostatic test until all evidence of sediment is removed. A hypochlorite solution shall be applied, with a proper regulating device at the beginning of the pipe section to be disinfected, through a corporation stop in the newly laid pipe. Hypochlorites utilized in this work shall meet the requirements of AWWA B300.
- d. Water from the existing distribution system entering the newly laid pipe through a 2" backflow preventer shall be controlled to flow slowly during the application of hypochlorite. The rate of hypochlorite application shall be in such proportion to the rate of water flowing through the pipe that the treated water entering the newly laid pipe will have a concentration of chlorine residual of 25 parts per million.

- B. The Contractor shall take samples and test for a minimum of the following items:

- Total Coliforms
 - Volatile Organics (EPA 501-502)

- C. Prepare reports of purging and disinfecting activities.

END OF SECTION 22 11 13

SECTION 26 05 43 - UNDERGROUND DUCTS AND RACEWAYS 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.
- B. All conductors and/or cables shall be as specified elsewhere in the contract documents, and shall meet the requirements of the system manufacturers.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal conduits and fittings, including GRC and PVC-coated steel conduit.
 - 2. Rigid nonmetallic duct.
 - 3. Duct accessories.

1.3 DEFINITIONS

- A. Direct Buried: Duct or a duct bank that is buried in the ground, without any additional casing materials such as concrete.
- B. Duct: A single duct or multiple ducts. Duct may be either installed singly or as component of a duct bank.
- C. Duct Bank:
 - 1. Two or more ducts installed in parallel, with or without additional casing materials.
 - 2. Multiple duct banks.
- D. GRC: Galvanized rigid (steel) conduit.
- E. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include duct-bank materials, including spacers and miscellaneous components.
 - 2. Include duct, conduits, and their accessories, including elbows, end bells, bends, fittings, and solvent cement.

3. Include accessories for manholes, handholes, and boxes.
4. Include underground-line warning tape.

B. Shop Drawings:

1. Precast or Factory-Fabricated Underground Utility Structures:
 - a. Include plans, elevations, sections, details, attachments to other work, and accessories.
 - b. Include duct entry provisions, including locations and duct sizes.
 - c. Include reinforcement details.
 - d. Include frame and cover design and manhole chimneys.
 - e. Include grounding details.
 - f. Include dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
 - g. Include joint details.

1.5 FIELD CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions, and then only after arranging to provide temporary electrical service according to requirements indicated:
 1. Notify Owner no fewer than two days in advance of proposed interruption of electrical service.
 2. Do not proceed with interruption of electrical service without Owner's written permission.
- B. Ground Water: Assume ground-water level is at grade level unless a lower water table is noted on Drawings.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND FITTINGS

- A. GRC: Comply with ANSI C80.1 and UL 6.
- B. Coated Steel Conduit: PVC-coated GRC.
 1. Comply with NEMA RN 1.
 2. Coating Thickness: 0.040 inch, minimum.
- C. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

2.2 RIGID NONMETALLIC DUCT

- A. Underground Plastic Utilities Duct: Type EPC-40-PVC RNC, complying with NEMA TC 2 and UL 651, with matching fittings complying with NEMA TC 3 by same manufacturer as duct.
- B. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.
- C. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 DUCT ACCESSORIES

- A. Duct Spacers: Factory-fabricated, rigid, PVC interlocking spacers; sized for type and size of duct with which used, and selected to provide minimum duct spacing indicated while supporting duct during concreting or backfilling.
- B. Underground-Line Warning Tape: Comply with requirements for underground-line warning tape specified in Section 312001 "Earth Moving."

2.4 HANDHOLES AND BOXES

- A. Description: Factory-fabricated, enclosures as shown on the "L" series drawings.

2.5 UTILITY STRUCTURE ACCESSORIES

- A. Accessories for Utility Structures: Utility equipment and accessory items used for utility structure access and utility support, listed and labeled for intended use and application.
- B. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F. Capable of withstanding temperature of 300 deg F without slump and adhering to clean surfaces of plastic ducts, metallic conduit, conduit and duct coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate layout and installation of duct, duct bank, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Architect if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.
- B. Coordinate elevations of duct and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of duct and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations

as required to suit field conditions and to ensure that duct and duct bank will drain to manholes and handholes, and as approved by Architect.

- C. Clear and grub vegetation to be removed, and protect vegetation to remain according to Section 311000 "Site Clearing." Remove and stockpile topsoil for reapplication according to Section 311000 "Site Clearing."

3.2 UNDERGROUND DUCT APPLICATION

- A. Duct for Electrical Cables More Than 600 V: Type EPC-40-PVC RNC, concrete-encased unless otherwise indicated.
- B. Duct for Electrical Feeders 600 V and Less: Type EPC-40-PVC RNC, direct-buried unless otherwise indicated.
- C. Underground Ducts Crossing Walks and Driveways: Type EPC-40 PVC RNC, concrete-encased unless otherwise indicated.
- D. Stub-ups: Concrete-encased GRC.

3.3 UNDERGROUND ENCLOSURE APPLICATION

- A. Handholes and Boxes for 600 V and Less:
 - 1. Precast concrete. AASHTO HB 17, H-20 structural load rating.

3.4 EARTHWORK

- A. Excavation and Backfill: Comply with Section 312001 "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.
- B. Restoration: Replace area after construction vehicle traffic in immediate area is complete.
- C. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- D. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Section 329200 "Turf and Grasses" and Section 329300 "Plants."

3.5 DUCT AND DUCT-BANK INSTALLATION

- A. Where indicated on Drawings, install duct, spacers, and accessories into the duct-bank configuration shown. Duct installation requirements in this Section also apply to duct bank.
- B. Install duct according to NEMA TCB 2.

- C. Slope: Pitch duct a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope duct from a high point between two manholes, to drain in both directions.
- D. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations unless otherwise indicated.
 - 1. Duct shall have maximum of two 90 degree bends or the total of all bends shall be no more 180 degrees between pull points.
- E. Joints: Use solvent-cemented joints in duct and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent duct do not lie in same plane.
- F. End Bell Entrances to Concrete Handholes: Use end bells, spaced approximately 10 o.c. for 5-inch duct, and vary proportionately for other duct sizes.
 - 1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell, without reducing duct slope and without forming a trap in the line.
 - 2. Expansion and Deflection Fittings: Install an expansion and deflection fitting in each duct in the area of disturbed earth adjacent to manhole or handhole. Install an expansion fitting near the center of all straight line direct-buried duct with calculated expansion of more than 3/4 inch.
 - 3. Grout end bells into structure walls from both sides to provide watertight entrances.
- G. Building Wall Penetrations: Make a transition from underground duct to GRC at least 10 feet outside the building wall, without reducing duct line slope away from the building and without forming a trap in the line. Use fittings manufactured for RNC-to-GRC transition. Install GRC penetrations of building walls as specified in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."
- H. Sealing: Provide temporary closure at terminations of duct with pulled cables. Seal spare duct at terminations. Use sealing compound and plugs to withstand at least 15-psig (1.03-MPa) hydrostatic pressure.
- I. Pulling Cord: Install 200-lbf- test nylon cord in empty ducts.
- J. Direct-Buried Duct and Duct Bank:
 - 1. Excavate trench bottom to provide firm and uniform support for duct. Comply with requirements in Section 312001 "Earth Moving" for preparation of trench bottoms for pipes less than 6 inches in nominal diameter.
 - 2. Width: Excavate trench 12 inches wider than duct on each side.
 - 3. Depth: Install top of duct at least 36 inches below finished grade unless otherwise indicated.
 - 4. Set elevation of bottom of duct bank below frost line.
 - 5. Support ducts on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.

6. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than four spacers per 20 feet of duct. Place spacers within 24 inches of duct ends. Stagger spacers approximately 6 inches between tiers. Secure spacers to earth and to duct to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
7. Install duct with a minimum of 3 inches between ducts for like services and 6 inches between power and communications duct.
8. Install manufactured GRC elbows for stub-ups, at building entrances, and at changes of direction in duct.
 - a. Couple RNC duct to GRC with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
 - b. Stub-ups to Outdoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.
 - 1) Stub-ups shall be minimum 4 inches above finished floor and minimum 3 inches from conduit side to edge of slab.
9. After installing first tier of duct, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inches over duct and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction. Comply with requirements in Section 312000 "Earth Moving" for installation of backfill materials.
 - a. Place minimum 3 inches of sand as a bed for duct. Place sand to a minimum of 6 inches above top level of duct.
- K. Underground-Line Warning Tape: Bury conducting underground line specified in Section 312001 "Earth Moving" no less than 12 inches above all concrete-encased duct and duct banks[and approximately 12 inches below grade. Align tape parallel to and within 3 inches of centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

3.6 INSTALLATION OF HANDHOLES AND BOXES

A. Handhole Installation:

1. Comply with ASTM C 891 unless otherwise indicated.
2. Install units level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances.
3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

- B. Hardware: Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.

3.7 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Demonstrate capability and compliance with requirements on completion of installation of underground duct, duct bank, and utility structures.
 - 2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 12-inch- long mandrel equal to duct size minus 1/4 inch. If obstructions are indicated, remove obstructions and retest.
 - 3. Test handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Correct deficiencies and retest as specified above to demonstrate compliance.
- C. Prepare test and inspection reports.

3.8 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of duct until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. Clean internal surfaces of manholes, including sump.
 - 1. Sweep floor, removing dirt and debris.
 - 2. Remove foreign material.

END OF SECTION 26 05 43

SECTION 31 10 00 - SITE CLEARING

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. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Stripping and stockpiling rock.
6. Removing above- and below-grade site improvements.
7. Disconnecting, capping or sealing, and removing site utilities or abandoning site utilities in place.
8. Temporary erosion and sedimentation control.

- B. Related Requirements:

1. Section 312513 "Erosion and Sedimentation Controls" for temporary erosion- and sedimentation-control measures.
2. Sediment and erosion control plan included in the Contract Drawings.

1.3 DEFINITIONS

- A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.
- B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.
- C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than 2 inches in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.
- D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 MATERIAL OWNERSHIP

- A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.6 INFORMATIONAL SUBMITTALS

- A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
 - 1. Use sufficiently detailed photographs or video recordings.
 - 2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.
- B. Topsoil stripping and stockpiling program.
- C. Rock stockpiling program.
- D. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.7 QUALITY ASSURANCE

- A. Topsoil Stripping and Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.
- B. Rock Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

1.8 FIELD CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.

- B. Utility Locator Service: Notify "Call Before You Dig" at 1-800-922-4455 at least 48 hours prior to site clearing.
- C. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.
- D. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312001 "Earth Moving."
 - 1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Verify that trees, shrubs, and other vegetation to remain have been flagged.
- C. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties, roadways, and drains, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.
- B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 EXISTING UTILITIES

- A. Contractor shall arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing.
 - 1. Verify that utilities have been disconnected and capped before proceeding with site clearing.
- B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed.
 - 1. Arrange with utility companies to shut off indicated utilities.
- C. Locate, identify, and disconnect utilities indicated to be abandoned in place.
- D. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Owner not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Owner's written permission.
- E. Excavate for and remove underground utilities indicated to be removed.

3.4 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
 - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 - 2. Grind down stumps and remove roots larger than 2 inches in diameter, obstructions, and debris to a depth of 18 inches below exposed subgrade outside of proposed pavement limits. Grub all stumps and roots within proposed pavement limits.
 - 3. Chip removed trees and tree branches and dispose of off-site.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
 - 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches and compact each layer to a density equal to adjacent original ground.

3.5 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to subsoil layer in a manner to prevent intermingling with underlying subsoil or other waste materials.
 - 1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

- C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Seed with rye grass to prevent windblown dust and erosion by water.
 - 1. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.6 STOCKPILING ROCK

- A. Remove from construction area naturally formed rocks that measure more than 1 foot across in least dimension. Do not include excavated or crushed rock.
 - 1. Separate or wash off non-rock materials from rocks, including soil, clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.
- B. Stockpile rock away from edge of excavations without intermixing with other materials. Cover to prevent windblown debris from accumulating among rocks.
 - 1. Dispose of surplus rock. Surplus rock is that which exceeds quantity indicated to be stockpiled or reused.

3.7 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
 - 2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
- B. Excess soil materials shall be retained on the site and used as general fill where suitable, or placed, graded and stabilized outside of proposed paved areas.
- C. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 31 10 00

SECTION 31 20 01 - EARTH MOVING

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.
- B. This Section applies to earthwork and compaction requirements outside of the building footprint.

1.2 SOIL MANAGEMENT

A. UNFORESEEN CONTAMINATED MATERIALS

- 1. In the event that unforeseen contaminated materials are encountered during the course of the work, permit the Engineer sufficient time to devise an appropriate course of action based upon the conditions present.
 - a. Until such appropriate course of action is devised, Contractor shall secure the work area in question such that it does not pose a health and safety risk.
 - b. Engineer will provide Contractor with a scope of work and performance requirements for the collection, consolidation, removal or excavation of unforeseen contaminated material. Contractor shall then undertake contaminated material remediation with equipment and techniques established by Contractor in accordance with said scope of work and performance requirements.
- 2. Contaminated material remediation shall be performed in accordance with scope of work outlined in Item 1.2.B.1.b. and in accordance with this specification.

1.3 SUMMARY

A. Section Includes:

- 1. Excavating and filling for rough grading the Site.
- 2. Preparing subgrades for walks, pavements, turf and grasses, and plants.
- 3. Subbase course for concrete walks.
- 4. Subbase course and base course for asphalt paving.
- 5. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Requirements:

- 1. "State of Connecticut Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction", Form 817, including all supplements and revisions.
- 2. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
- 3. Section 312319 "Dewatering" for lowering and disposing of ground water during construction.

4. Safety and Health Regulations of the U.S. Department of Labor, 29 CFR Part 1926.

1.4 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.
- C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect or Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions.
 2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect or Engineer. Unauthorized excavation, as well as remedial work directed by Architect or Engineer, shall be without additional compensation.
- F. Fill: Soil materials used to raise existing grades.
- G. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. that cannot be removed by excavating equipment, without systematic drilling, ram hammering, ripping, or blasting, when permitted.
- H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- I. Rough Grade: Rough grade shall mean the completed surface of excavations or fills which forms a plane parallel to that of the finished grade within indicated tolerances. Rough grade may exist prior to fine grading or the placement of topsoil, sub base or other materials.
- J. Fine Grade shall mean the completed surface of excavations or fills within a 3/4 inch tolerance.
- K. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

- L. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- M. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct preexcavation conference at Project site.
 - 1. Review methods and procedures related to earthmoving, including, but not limited to, the following:
 - a. Personnel and equipment needed to make progress and avoid delays.
 - b. Coordination of Work with utility locator service.
 - c. Coordination of Work and equipment movement with the locations of tree- and plant-protection zones.
 - d. Excavation support system meeting OSHA requirements.
 - e. Field quality control.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of the following manufactured products required:
 - 1. Geotextiles.
 - 2. Controlled low-strength material, including design mixture.
 - 3. Warning tapes.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
 - 1. Borrow earth fill, bedding material, gravel base materials, structural fill material, all stone and other soil products to be used in construction shall be sampled conforming to ASTM D75 Practice for Sampling Aggregates. Sieve Analysis shall conform to ASTM C-136-84a Standard Method for Sieve Analysis of Fine and Coarse Aggregates and or ASTM C117 where applicable.
 - 2. Laboratory compaction curve according to ASTM D 1557.
- C. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth moving begins.

1.8 QUALITY ASSURANCE

- A. Compaction testing shall be completed in accordance with the requirements of this Section and results shall be provided to the Engineer for approval.
- B. Contractor shall retain a ½ cubic foot labeled sample of approved materials at the on-site field office until acceptance of the site work.
- C. Materials that are not approved as evidenced by sieve analysis and as determined by the Engineer shall be immediately removed from the site at the Contractor's expense.
- D. The Contractor shall employ a qualified independent soils testing laboratory to provide testing services during earthwork construction operations if required.
- E. The Contractor shall perform earthwork operations in conformance with all applicable Federal, State and Local codes and regulations.
- F. The excavation support system shall be of sufficient strength and be provided with adequate bracing to support all loads to which it will be subjected. The excavation support system shall be designed to prevent any movement of earth that would diminish the width of the excavation or damage or endanger adjacent structures.

1.9 FIELD CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. The Contractor shall verify the location of existing utilities in the areas of work of this section. The Contractor shall contact "Call Before You Dig" (800) 922-4455 to obtain additional data concerning the locations of existing utilities and to obtain a permit. Call a minimum of forty-eight (48) hours (working days) in advance of commencing excavation work.
- C. When existing utilities are encountered that are to remain, provide all means of support and protection necessary to prevent damage during earthwork operations.
- D. Should uncharted or miss-charted utilities, subsurface conditions or piping be encountered discontinue work in the affected area and consult utility owner and Engineer immediately for instructions. Repair damaged utilities to the satisfaction of the utility owner.
- E. Do not interrupt existing utility services without prior coordination with Owner and utility owner. The Contractor shall provide temporary utility services as required to preserve the operations of occupied facilities on or off site.
- F. The Contractor shall be aware that no warranties are implied concerning the accuracy of subsurface conditions shown on the plans. The Contractor is responsible for all conclusions or

assumptions made from this data. The Contractor may request additional subsurface testing, at the Contractor's expense, subject to the written approval of the Engineer.

- G. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 311000 "Site Clearing" are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

- B. EARTH FILL:

- 1. Earth fill materials shall be free of frozen matter, debris, organic matter and shall contain less than 20% by weight of material which would pass a #200 sieve and no stones larger than 6-inches.
- 2. On site materials and borrow used as fill shall conform to Sections 02.07.01, 02.07.02, and 02.07.03 of Form 816.
- 3. Unsuitable and unapproved materials shall be promptly relocated outside of proposed paved areas.

- C. BANK RUN GRAVEL:

- 1. Bank run gravel shall conform to Sections M.02.02-1, M.02.03 and requirements of material grading A as defined in M.02.06 of CT Form 817.

- D. BEDDING MATERIAL:

- 1. Sand Bedding material shall conform to M.08.01- 21 as defined in Form 817.
- 2. Stone Bedding material shall conform to M.02.02-2 of Form 817: 3/4 inch size.

- E. BROKEN STONE:

- 1. Broken Stone: shall conform to M.02.01-1 of Form 817.

- F. PROCESSED AGGREGATE:

- 1. Processed aggregate shall conform to M.05.01-1 and M05.01-2 of Form 817.

- G. SAND FILL:

- 1. Sand shall conform to: M.08.03 and M.03.01-2 of Form 817.
- 2. Sand shall be washed free of silt, clay, organic material and topsoil.

- H. TOPSOIL:

- 1. Topsoil shall conform to M13.01-1 of Form 817.

- I. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

- A. Filter fabric shall conform to Sections 7.55.01, 7.55.02, and M.08.01-26 of Form 817.
- B. Filter fabric shall be Mirafi 140N as manufactured by Tencate Mirafi, Pendergrass, GA (706) 693-2226 or approved equal.

2.3 ACCESSORIES

- A. Warning tape shall be Manufactured by Line Tec, Inc., PO Box 67, Glen Ellyn, Illinois, or approved equal. Provide the appropriate color as indicated in Section 1.05.15 of Form 816.

2.4 EXCAVATION SUPPORT

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

PART 3 - EXECUTION

3.1 PREPARATION

- A. Contractor is responsible for and shall protect land monuments and survey benchmarks from disturbance. If this is not possible, benchmarks shall be moved by a licensed land surveyor.
- B. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.
- C. Protect and maintain erosion and sedimentation controls during earth-moving operations.
- D. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 SUPPORT OF EXCAVATION

- A. Work shall not be started until all materials and equipment necessary for their construction are either on the site of the work or satisfactorily available for immediate use as required.
- B. The sheeting shall be securely and satisfactorily braced to withstand all pressures to which it may be subjected and be sufficiently tight to minimize lowering of the groundwater level outside the excavation, as required in Section 312319, Dewatering.

- C. The sheeting shall be driven by approved means to the design elevation. No sheeting may be left so as to create a possible hazard to safety of the public or a hindrance to traffic of any kind.
- D. If boulders or very dense soils are encountered, making it impractical to drive a section to the desired depth, the section shall, as directed, be cut off.
- E. The sheeting may be left in place or salvaged at the option of the Contractor. Steel or wood sheeting permanently left in place shall be cut off at a depth of not less than two feet below finish grade unless otherwise directed.
- F. All cut-off will become the property of the Contractor and shall be removed by him from the site.
- G. Responsibility for the satisfactory construction and maintenance of the excavation support system, complete in place, shall rest with the Contractor. Any work done, including incidental construction, which is not acceptable for the intended purpose shall be either repaired or removed and reconstructed by the Contractor at his expense.
- H. The Contractor shall be solely responsible for repairing all damage associated with installation, performance, and removal of the excavation support system.

3.3 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.4 EXPLOSIVES

- A. Explosives: Do not use explosives.

3.5 EXCAVATION, GENERAL

- A. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Engineer.
 - 1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; and soil, boulders, and other materials not classified as rock or unauthorized excavation.
 - a. Intermittent drilling; ram hammering; or ripping of material not classified as rock excavation is earth excavation.

2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Trench excavation includes excavation for all utility structures, utilities and other miscellaneous footings as required by the drawings and site conditions. Excavate trenches as required to allow for efficient installation of materials and inspection. Excavate to the depth required to support pipe or conduit on a foundation as specified and to conform to the indicated slope, invert or elevation. Slope walls of excavation or erect shoring as required to prevent cave-in. Excavate for structures to the widths and depths shown on drawings or as specified.
- B. Furnish all shoring, bracing and water removal equipment necessary for the completion of the work. Keep excavations dry. Do not excavate to full depth in freezing temperature unless pipes, structures, and footings are to be installed immediately.
- C. Conform to Sections 02.05.01 and 02.05.03 of Form 816.
- D. Where over excavation or unsuitable bearing material such as boulders, ledge rock or muck are encountered at the depth of installation or within 6" of the pipe bottom, notify Engineer immediately. Additional excavation may be required to provide an adequate pipe foundation. Backfill with concrete or approved bedding material as required by the Engineer, up to the required grade for bottom of pipe.
- E. Excavation Protection and Maintenance:
 1. Pipe Trenching: Grade bottom of trenches evenly and insure even bearing of pipe over the full length. Excavate a minimum of 6" below all pipes. Hand trim trenches for bell and spigot pipe joints. Bell ends of pipe shall be fully bedded.
 2. Contractor shall keep trenches free of water at all times. Trenches shall not be used for drainage purposes.
 3. Structure excavation: Conform to Specification Section 2.03 of Form 816.

3.8 SUBGRADE INSPECTION

- A. Notify Engineer when excavations have reached required subgrade.
- B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.9 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.
- B. Excess and Unacceptable materials shall be promptly relocated outside of proposed pavement limits.

3.10 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, subdrainage.
 - 2. Surveying locations of underground utilities for Record Documents.
 - 3. Testing and inspecting underground utilities.
 - 4. Removing concrete formwork.
 - 5. Removing trash and debris.
 - 6. Removing temporary shoring, bracing, and sheeting.
 - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Backfill voids with satisfactory soil while removing shoring and bracing.
- D. Bedding material shall be sand or sandy soil conforming to M.08.01-21 of Form 816 or No. 6 crushed stone conforming to M.02.02-2 of Form 816. Install all pipes in bedding material with a thickness directly under the pipe of minimum 6 inches and preshaped to a height of 10% of total height of pipe for pipes 12 inches or larger. Install pipe and backfill trench with bedding material to a height of the total height of the pipe or as shown on the construction details. Remaining backfill to subgrade outside of paved areas may be existing material provided that no unsuitable material as listed herein is used. Within paved areas trench shall be backfilled with suitable existing soils as determined by sieve analysis, or bank run gravel, to the bottom of the roadway subbase. Conform to Form 816, Section 10.01.03.
- E. Backfill in compacted lifts not exceeding 8 inches in depth. Do not backfill against any pipe, structure or footing until permission is given by the Owner or Engineer.

- F. Concrete foundations may be required by the Engineer to insure a firm foundation for pipes where soils of poor bearing qualities are found. Bed concrete foundation with 6 inches of sand tamped in place as directed, to provide a uniform bearing for the pipe between joints.
- G. Install cut-off dams within bedding material where shown on the drawings or as required by the Engineer as conditions dictate.
- H. Compact all backfill to subgrade to 95% Modified AASHTO laboratory density (ASTM D-1557, Method C).
- I. If pipes or structures are over fill areas, fill 12 inches higher than the top of pipe invert and compact to density required. Trench to required elevation. Extend fill and compaction at least 2 feet laterally on both sides of proposed pipe or structure.
- J. Warning Tape: Install warning tape directly above utilities, 12 inches below finished grade.

3.12 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use satisfactory soil material.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.13 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry density.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 12 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers. Trench backfill shall be placed in layers no more than 8 inches in loose depth.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

- C. Compact soil materials to not less than the following percentages of maximum dry density according to ASTM D 1557:
 - 1. Under structures, walks and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
 - 2. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
 - 3. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

3.15 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - 1. Provide a smooth transition between adjacent existing grades and new grades.
 - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:
 - 1. Turf or Unpaved Areas: Plus or minus 1 inch.
 - 2. Walks: Plus or minus 1/2 inch.
 - 3. Pavements: Plus or minus 1/2 inch.

3.16 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
 - 1. Shape subbase course and base course to required crown elevations and cross-slope grades.
 - 2. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
 - 3. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 - 4. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry density according to ASTM D 1557.

3.17 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
 2. Determine that fill material classification and maximum lift thickness comply with requirements.
 3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.
- B. Testing Agency: Contractor will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2937, and ASTM D 6938, as applicable. Tests will be performed at the following locations and frequencies:
1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab but in no case fewer than three tests.
 2. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length but no fewer than two tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.18 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.19 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus waste materials, including trash, and debris, and legally dispose of them off Owner's property.
- B. Surplus soil materials shall remain on site and be utilized as fill material, if suitable, or placed, graded, and stabilized outside of proposed pavement limits.

END OF SECTION 31 20 01

SECTION 31 23 19 - DEWATERING

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 construction dewatering.
- B. Related Requirements:
 - 1. Section 312001 "Earth Moving" for excavating, backfilling, site grading, and controlling surface-water runoff and ponding.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Verify availability of Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review condition of site to be dewatered including coordination with temporary erosion-control measures and temporary controls and protections.
 - 3. Review geotechnical report.
 - 4. Review proposed site clearing and excavations.
 - 5. Review existing utilities and subsurface conditions.
 - 6. Review observation and monitoring of dewatering system.

1.4 ACTION SUBMITTALS

- A. Contractor shall submit six copies of a plan indicating how they intend to control the discharge from any dewatering operations on the project, whether it is discharge of groundwater from excavations or stormwater runoff during the life of the project. Include written plan for dewatering operations including sequence of well and well-point placement coordinated with excavation shoring and bracings and control procedures to be adopted if dewatering problems arise.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer that has specialized in dewatering work.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. The Contractor is responsible for the adequacy of the dewatering systems.
- B. The dewatering systems shall be capable of effectively reducing the hydrostatic pressure and lowering the groundwater levels to a minimum of 2 feet below excavation bottom, unless otherwise directed by the Engineer, so that all excavation bottoms are firm and dry.
- C. The dewatering system shall be capable of maintaining a dry and stable subgrade until the structures, pipes and appurtenances to be built therein have been completed to the extent that they will not be floated or otherwise damaged.
- D. The dewatering system and excavation support (see Section 312001, Earth Moving) shall be designed so that lowering of the groundwater level outside the excavation does not adversely affect adjacent structures, utilities or wells.
- E. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with water- and debris-disposal regulations of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
 - 1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site or surrounding area.
 - 2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
- B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Provide temporary grading to facilitate dewatering and control of surface water.
- D. Protect and maintain temporary erosion and sedimentation controls, which are specified in Section 312513 "Erosion and Sedimentation Control" during dewatering operations.

3.2 INSTALLATION

- A. Install dewatering system utilizing sumps and sump pumps, wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
 - 1. Space well points or wells at intervals required to provide sufficient dewatering.
 - 2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.
- B. Place dewatering system into operation to lower water to specified levels before excavating below ground-water level.
- C. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.
- D. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails.

3.3 OPERATION

- A. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.
- B. Operate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
- C. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.
- D. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.

3.4 FIELD QUALITY CONTROL

- A. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.
- B. Prepare reports of observations.

3.5 PROTECTION

- A. Protect and maintain dewatering system during dewatering operations.
- B. Promptly repair damages to adjacent facilities caused by dewatering.

END OF SECTION 31 23 19

SECTION 31 25 13 – EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. The work required under this Section includes furnishing all labor, equipment, supplies, and materials, and performing all operations required for providing erosion and sedimentation controls during the performance of the work.
- B. The Contractor shall implement and maintain sediment and erosion control measures in accordance with, but not necessarily limited to, the Contract Drawings and specification herein.
- C. The Contractor shall implement additional temporary stormwater run-on/run-off control measures deemed appropriate or as shown on the Contract Drawings.
- D. Prevent the release of airborne dust from exposed soil surfaces by wetting with water or other method approved by the Engineer.
- E. Streets shall be kept free from dirt, dust, or other building materials. If such materials are deposited, spilled, or spread on a public street, such material shall be removed and properly disposed of within eight hours or at the end of each working day at no additional cost to the Owner.
- F. Minimum erosion and sedimentation control features are indicated on the Contract Drawings. These measures include sediment fence and anti-tracking pad, and other methods as may be required to prevent erosion and sedimentation. Additional erosion and sedimentation control measures shall be developed and implemented by the Contractor as required or as directed by the Engineer. The erosion and sediment control measures shall be installed in accordance with the 2002 Connecticut Guidelines for Soil Erosion and Sediment Control, latest edition; such measures shall be installed immediately after demolition operations are implemented.
- G. All erosion and sedimentation controls shall be constructed in accordance with the State of Connecticut Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction, Form 817, (CT DOT Standard Specifications), latest revision, and the details shown on the Contract Drawings.

1.2 RELATED DOCUMENTS AND SECTIONS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specifications Sections, apply to this Section.
- B. Erosion and Sediment Control Plan included in the Contract Drawings.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. The materials shall be consistent with the requirements set forth herein and in accordance with the Contract Drawings. All materials shall conform to sedimentation control systems in accordance with Section 2.19 of the CT DOT Standard Specifications.

- B. Sediment fence used for erosion control shall be at least thirty (30) inches high with spacing between posts not to exceed ten (10) feet.
- C. Hay bales (if required) shall be staked with a minimum of two 2" x 2" x 3' wood stakes per bale.
- D. Anti-tracking pad stone shall be tough, durable broken stone, reasonably free from soft, thin friable, micaceous or disintegrated pieces, mud, vegetation, or other deleterious materials. Stones shall be uniform 2".

PART 3 - EXECUTION

3.1 CONSTRUCTION METHODS

- A. Installation of erosion and sedimentation controls shall, to the greatest extent practical, commence prior to any excavation and regrading activities. Erosion and sedimentation control measures shall be maintained in place until final stabilization of the site has been achieved, or when paving is initiated, at which time all accumulated sediments shall be collected and disposed of by the Contractor.
- B. Install sediment fence as described on the Contract Drawings. Fencing shall be a minimum of 30-inches high. Post spacing and embedment shall be in accordance with the fabric filter manufacturer's requirements, but no more than 10 feet.
- C. Install and maintain all erosion control measures in accordance with the State of Connecticut "2002 Connecticut Guidelines for Soil Erosion and Sediment Control" by the Connecticut Council on Soil and Water conservation in cooperation with the Connecticut Department of Environmental Protection, DEP Bulletin 34.
- D. Install additional erosion control measures as necessary if directed by the Engineer.
- E. Install anti-tracking pad for excavation activities. Maintain anti-tracking pad in accordance to Construction Entrances as specified in the On-Site Mitigation for Construction Activities by the CT DOT Environmental Planning Division 1994.
- F. In areas of concentrated vehicular traffic such as the site entry/egress points, truck/equipment traffic areas, vehicle storage, or staging areas, exposed soil surfaces shall be wetted with water, as necessary, to prevent the release of airborne dust. Such watering shall be undertaken to the extent required to prevent dusting of adjacent properties and public streets.

END OF SECTION 312513

SECTION 32 12 16 - ASPHALT PAVING

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. Hot-mix asphalt paving.
 - 2. Asphalt curbs.
- B. Related Requirements:
 - 1. Section 312001 "Earth Moving" for subgrade preparation, fill material, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
 - a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
 - b. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include technical data and tested physical and performance properties.
 - 2. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
 - 3. Job-Mix Designs: For each job mix proposed for the Work.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer and testing agency.
- B. Material Certificates: For each paving material.

- C. Material Test Reports: For each paving material, by a qualified testing agency.
- D. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by CT DOT.
- B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.
- C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of CT DOT for asphalt paving work.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
 - 1. Tack Coat: Minimum surface temperature of 60 deg F.
 - 2. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
 - 3. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

PART 2 - PRODUCTS

2.1 BANK RUN GRAVEL SUBBASE

- A. Bank run gravel to be sound, durable particles of gravel, free from thin shale, clay, loam, or vegetable matter.
- B. Conform to Articles M.02.02 Gradation "B" of the ConnDOT Standard Specifications Form 817.

2.2 PROCESSED GRAVEL BASE

- A. Processed gravel base course to be processed stone consisting of sound, tough, durable particles of crushed gravel or trap rock and bank-run sand, free from thin shale, clay, loam or vegetable matter.
- B. Processed gravel base shall conform to M.02.03, Gradation "C" of the ConnDOT Standard Specifications Form 817.

2.3 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations. All materials shall conform to the requirements of CT DOT Form 817 M.04.01.

2.4 ASPHALT MATERIALS

- A. All materials shall conform to the requirements of CT DOT Form 817 M.04.01.
- B. Water: Potable.

2.5 AUXILIARY MATERIALS

- A. Joint Sealant: AASHTO M 324, Type I, hot-applied, single-component, polymer-modified bituminous sealant.

2.6 MIXES

- A. Binder course to conform to M.04.02 Class 1 of the CT DOT Standard Specifications Form 816 to a depth as noted on the plans.
- B. Top course to conform to M.04.02 Class 2 of the CT DOT Standard Specifications Form 816 to a depth as noted on the plans.

PART 3 - EXECUTION

3.1 BANK RUN GRAVEL SUBBASE

- A. Furnish and install bank run gravel subbase to the compacted depth, line, and subgrade shown on the drawings and where noted or required in other parts of the Contract Documents.
- B. Place bank run gravel subbase on prepared and approved subgrade as specified.
- C. Compact subgrade and subbase uniformly to 95% of Modified density (ASTMD-1557, Method C).
- D. Place gravel in 6-inch lifts maximum and compact uniformly to 95% of Modified AASHTO laboratory density (ASTMD-1557, Method C).

3.2 PROCESSED GRAVEL BASE

- A. Furnish and install processed gravel base under pavements to the depth, line, and subgrade as shown on the Contract Drawings or as otherwise directed by the Engineer. Conform to the plans and compacted depths as shown on the details.

- B. Place and compact uniformly with a roller or vibratory compactor, to 95% of Modified AASHTO laboratory density (ASMTD-1157, Method C).
- C. Place within a finished subgrade tolerance of 0.75 inches in 10 feet.
- D. The base course shall be applied over the subbase and shall consist of processed gravel with no stones larger than 1½ inches. The base course shall be eight inches thick. The base course shall be compacted to no less than 95% of the dry density as determined by the Standard Proctor method. Prior to the placing of pavement, the base course shall be treated with calcium chloride at a rate of 0.75 gallon per square yard.

3.3 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to begin paving.
- B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 - 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
 - 2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
 - 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.

3.4 PATCHING

- A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.05 to 0.15 gal./sq. yd.
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- C. Placing Patch Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.
- D. Placing Patch Material: Partially fill excavated pavements with hot-mix asphalt base mix if required due to existing pavement thickness and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.5 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
- B. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.6 ADJUSTING OF UTILITY STRUCTURES

- A. Existing water, sewer, and drainage structures to remain which are located in proposed roadway areas shall be made to conform to the newly proposed final grade.

3.7 PLACING HOT-MIX ASPHALT

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 - 1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
 - 2. Place hot-mix asphalt surface course in single lift.
 - 3. Spread mix at a minimum temperature of 250 deg F.
 - 4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
 - 5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
 - 1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches from strip to strip to ensure proper compaction of mix along longitudinal joints.
 - 2. Complete a section of asphalt base course before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.8 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints as indicated in CT DOT Form 816 4.06.
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.9 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
 1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 1. Average Density: 96 percent of reference laboratory density according to ASTM D 6927 or AASHTO T 245, but not less than 94 percent or greater than 100 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.10 ASPHALT CURBS

- A. Construct hot-mix asphalt curbs over compacted pavement surfaces. Apply a light tack coat unless pavement surface is still tacky and free from dust. Spread mix at a minimum temperature of 250 deg F.

1. Asphalt Mix: Curb Mix in accordance with CT DOT Form 817 M.04.
- B. Place hot-mix asphalt to curb cross section indicated or, if not indicated, to local standard shapes, by machine. Tamp hand-placed materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.

3.11 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 1. Base Course: Plus or minus 1/2 inch.
 2. Surface Course: Plus 1/4 inch, no minus.
- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
 1. Base Course: 1/4 inch.
 2. Surface Course: 1/8 inch.
 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.12 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor will engage a qualified testing agency to perform tests and inspections.
- B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
- C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D979 or AASHTO T168.
 1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D2041, and compacted according to job-mix specifications.
 2. In-place density of compacted pavement will be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726. One test shall be completed for every 2,500 square feet of asphalt paving.
- E. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.13 WASTE HANDLING

- A. Asphalt-paving waste shall be disposed of off-site at a location authorized to receive the waste.

END OF SECTION 32 12 16

SECTION 33 41 00 - STORM UTILITY DRAINAGE PIPING

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. Pipe and fittings.
2. Nonpressure transition couplings.
3. Backwater valves.
4. Drains.
5. Manholes.
6. Catch basins.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
 1. Manholes: Include plans, elevations, sections, details, frames, and covers.
 2. Catch basins. Include plans, elevations, sections, details, frames, covers, and grates.
 3. Piping systems: Include plans, elevations, sections, details.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic pipe and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle manholes according to manufacturer's written rigging instructions.
- D. Handle catch basins according to manufacturer's written rigging instructions.

1.5 PROJECT CONDITIONS

- A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
1. Notify Engineer no fewer than two days in advance of proposed interruption of service.
 2. Do not proceed with interruption of service without Engineer's written permission.

PART 2 - PRODUCTS

2.1 PE PIPE AND FITTINGS

- A. Corrugated PE Pipe and Fittings shall be smooth interior, high density polyethylene corrugated exterior pipe. Pipe Material shall meet ASTM D1248 Type III, Category 4, Grade P33, Class C; or ASTM D3350 Cell Classification 324420C.
- B. Four (4) through ten (10) inch diameter pipe shall meet all the requirements of AASHTO M252 with the addition that the pipe have a smooth interior liner.
- C. Twelve (12) to twenty four (24) inch diameter pipe shall conform to AASHTO M294 Type S.
- D. 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).
- E. Pipe fittings shall conform to AASHTO M252 or AASHTO M294 or approved equal.

2.2 PVC PIPE AND FITTINGS

- A. PVC Type PSM Sewer Piping:
1. Pipe: ASTM D 3034, SDR 35, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
 2. Fittings: ASTM D 3034, PVC with bell ends.
 3. Gaskets: ASTM F 477, elastomeric seals.

2.3 PANEL DRAIN PIPE

- A. Panel Drain Pipe:
1. Panel drain pipe shall be oblong corrugated pipe and have annular interior and exterior corrugations. Minimum flow rate of the pipe shall be 21 GPM.
 2. Panel drain pipe shall meet ASTM D7001.

3. Panel drain pipe shall have internal bracing adjoining each long wall to prevent crushing under typical loading.
4. Panel drain pipe shall be made available with an external geotextile wrap meeting the requirements of Class B Geocomposite as defined in ASTM D7001.
5. All pipe and fittings shall be made of polyethylene with a minimum cell classification of 424420C as defined and described in the latest version of ASTM D3350.
6. Panel drain pipe shall be AdvanEdge by ADS, Inc., or equal.

B. Perforations:

Nominal Pipe Size, in	12
Slot Length (avg), in	1.125
Slot Width (avg), in	0.125
Water Inlet Area (approx.), in ² /ft	15

C. Filter Fabric:

Fabric Properties	Test Method	Minimum Average Roll Values
Grab Tensile Strength (lbs.) (weakest principle direction)	ASTM D4632	112
Grab Elongation (%) (weakest principle direction)	ASTM D4632	50
Trapezoidal Tear (lbs.) (weakest principle direction)	ASTM D4533	40
Puncture (lbs.)	ASTMD4833	40
Permittivity (sec-1)	ASTM D4491	0.5
AOS (U.S. Sieve Size)	ASTM D4751	60
U.V. Resistance	ASTM D4355	50

2.4 NONPRESSURE TRANSITION COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials:
 1. For Concrete Pipes: ASTM C 443, rubber.
 2. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 3. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- C. Unshielded, Flexible Couplings:
 1. Flexible couplings shall be manufactured by Fernco, Inc. or approved equal.
 2. Description: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

2.5 MANHOLES

A. Standard Precast Concrete Manholes:

1. Shall conform to Article M.08.02-4 of CT DOT Form 817 and ASTM C478.
2. Reinforcement shall conform to M.06.01 of CT DOT Form 817.

B. All Precast structures except dry wells shall be bituminous coated with asphalt emulsion.

1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
5. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
9. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

C. Manhole Frames and Covers:

1. Description: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange and 26-inch diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER." All castings shall be traffic rated.
2. Material: ASTM A 536, Grade 60-40-18 ductile iron unless otherwise indicated.

D. PVC Drain Basins:

1. PVC drain basins and their reducing cones shall be manufactured from PVC pipe stock, utilizing a thermoforming process to reform the pipe stock to the specified configuration. The raw material used to manufacture the pipe stock that is used to manufacture the main body and pipe stubs of the surface drainage inlets shall conform to ASTM D1784 cell class 12454.
2. Gaskets shall be made from material meeting the requirements of ASTM F477.
3. Ductile iron used in the manufacture of the castings shall conform to ASTM A536 grade 70-50-05. Frames and covers shall be provided painted black.
4. The drainage pipe connection stubs shall be manufactured from PVC pipe stock and formed to provide a watertight connection with the specified pipe system. This joint tightness shall conform to ASTM D3212 for joints for drain and sewer plastic pipe using flexible elastomeric seals..
5. PVC Drain Basins shall be by Nyloplast, or equal.

2.6 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:
1. Cement: ASTM C 150, Type II.
 2. Fine Aggregate: ASTM C 33, sand.
 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 4. Water: Potable.
- B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
 2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.
- C. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.
1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
 2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

2.7 CATCH BASINS

- A. Standard Precast Concrete Catch Basins:
1. Shall conform to Article M.08.02-4 of CT DOT Form 817 and ASTM C478.
 2. Reinforcement shall conform to M.06.01 of CT DOT Form 817.
- B. All Precast structures except dry wells shall be bituminous coated with asphalt emulsion.
1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
 2. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
 3. Riser Sections: 4-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
 4. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
 5. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
 6. Grade Rings: Provide concrete rings as required to set catch basin top at appropriate grade.
- C. Connecticut Standard Catch Basin Frames and Grates:
1. Shall conform to "Connecticut Department of Transportation Bureau of Highways, Standard Details" Standard detail no's 228-f, 228-E, 507-D, 507-E, 507-H, as shown on the drawings. Shall conform to Articles M.08.02-4 and M.08.02-5 of CT Form 816.

2. Shall conform to the type shown on plan. Catch basins curb-backs shall match to the type and shape of curbs abutting the proposed basin.

D. ADA Compliant Catch Basin Frames and Grates:

1. Shall conform to the requirements of the Americans with Disabilities Act and shall be AASHTO load rated.

2.8 CATCH BASIN OIL DEBRIS TRAP DEVICE AT OUTLET

- A. SNOUT® oil debris trap as manufactured by Best Management Products, Inc., Lyme, CT (800-504-8008) or approved equal.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. Install gravity-flow, nonpressure drainage piping according to the following:
 1. Install piping pitched down in direction of flow.
 2. Install piping with 24-inch minimum cover.
 3. Install PE corrugated sewer piping according to ASTM D 2321.
 4. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
 5. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.3 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure drainage piping according to the following:
 - 1. Join corrugated PE piping according to ASTM D 3212 for push-on joints.
 - 2. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasketed joints.
 - 3. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
 - 4. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.4 MANHOLE INSTALLATION

- A. General: Install manholes, complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants according to ASTM C 891.
- C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.
- D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.

3.5 CATCH BASIN INSTALLATION

- A. Construct catch basins to sizes and shapes indicated.
- B. Set frames and grates to elevations indicated.

3.6 STORMWATER OUTLET INSTALLATION

- A. Construct riprap of broken stone, as indicated.
- B. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.
- C. Construct energy dissipaters at outlets, as indicated.

3.7 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318.

3.8 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Section 221413 "Facility Storm Drainage Piping."
- B. Make connections to existing piping and underground manholes.

1. Remove existing drainage structure and one section of pipe in each direction. Install new drainage structure and new section of pipe in each direction. Pipe type and size to match existing pipe. Connect to existing pipe at bell or spigot. Provide sleeve type coupling and encase joint in 6" of 3000 psi concrete for 12" in each direction if connection cannot be made to factory bell or spigot.
 2. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.
- C. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
 - a. Flexible couplings for same or minor difference OD pipes.
 - b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.

3.9 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

- A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
1. Close open ends of piping with at least 8-inch thick, brick masonry bulkheads.
 2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
- B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:
1. Remove manhole or structure and close open ends of remaining piping.
 2. Remove top of manhole or structure down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.
- C. Backfill to grade according to Section 312000 "Earth Moving."

3.10 IDENTIFICATION

- A. Materials and their installation are specified in Section 312000 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
1. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.11 FIELD QUALITY CONTROL

- A. Inspect interior of piping by CCTV methods to determine whether line displacement or other damage has occurred. Inspect after backfill is in place, before final paving.
 - 1. Submit separate reports for each system inspection.
 - 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
 - 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 - 4. Reinspect and repeat procedure until results are satisfactory.

3.12 CLEANING

- A. Clean interior of piping of dirt and superfluous materials. Flush with potable water. Collect and properly dispose of all debris prior to entering the public storm drainage system.
- B. Existing drainage system that remains in service following construction shall be cleaned in accordance with applicable State and Federal regulations.

END OF SECTION 33 41 00