WESTERN CONNECTICUT STATE UNIVERSITY

Western Connecticut State University

Volume 1 of 1

Project Manual

Western Connecticut State University Oil Tank Removal at Plaza Between VPAC & West Side Campus Center Danbury, CT

Project No.: CF-RD 309

Prepared By:
Macchi Engineers, LLC
44 Gillett Street
Hartford, Connecticut
06105

BETA Group, Inc.
1010 Wethersfield Avenue
Hartford, CT
06114

Western Connecticut State University
Planning and Engineering
181 White Street,
Danbury, CT
06810

100% Construction Documents
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MAINTENANCE AND PROTECTION OF TRAFFIC

PART 1 - GENERAL

1.1 RELATED DOCUMENT

A. Drawings and general provisions of Contract, including General Supplementary Conditions, and Division 1 Specification sections, apply to this section.

1.2 SUMMARY

A. Provide all labor, materials, necessary equipment and services to complete the work called for in this Section or as shown on the plans, including but not necessarily limited to the following:

1. All proposed construction signs and support posts required.
2. Barricades, traffic cones, warning lights and protective safety fence as required to establish roadway closing and to protect open trenches.
3. Protect pedestrian and vehicular traffic at all times on and off site. The Contractor shall be responsible to provide police and or campus police provisions and flagmen as required at no additional cost to the owner.
4. Scheduling of activities and deliveries to minimize impact to traffic. Access to site for construction and deliveries should be coordinated with school officials to avoid beginning and ending of school time periods.
5. Installation of impact attenuation systems if necessary.

B. Related Work: The following sections contain requirements that may apply to this section:

1. Section 02 41 13 - “Site Preparation and Demolition”
2. Section 31 11 00 - “Site Utility Preparation and Demolition”
3. Section 32 12 16 - "Bituminous Asphalt Concrete Paving"
4. Section 31 23 00 - “Excavation and Fill”
5. Section 31 23 33 - “Trenching and Backfilling”
6. Section 33 41 00 - "Storm Utility Drainage Piping"

PART 2 – PRODUCTS

2.1 MATERIALS

A. All materials, barricades, cones, etc. shall conform to the requirements described in the State of Connecticut Department of Transportation Form 817 and standard D.O.T. procedures.

PART 3 – EXECUTION

3.1 GENERAL

A. Protect from vehicular and pedestrian traffic during all operations. Construct all barricades, cones, and safety fence as shown on the drawings or as directed by the Owner's Representative.

B. All construction signs shall be constructed of aluminum with a minimum thickness of 0.100 mils. All colors shall be reflectorized and shall conform to State of Connecticut Department of Transportation Form 817, Section 12.20.

C. Sign post installation shall be per Connecticut Department of Transportation standard sheet number TR-1208_02, “Metal Sign Posts and Sign Mounting Details.”

D. Sign supports shall be 4 lbs./ft. and shall conform to Standard Connecticut Department of Transportation Form 817, Section 12.20.

E. Construction barricades shall conform to State of Connecticut Department of Transportation Form 817, Section 9.79. Traffic cones and drums shall conform to Sections 9.77 and 9.78 of Form 817.

F. The locating and or stockpiling of demolition material, construction material, construction equipment, machinery, supplies, vehicles, and materials, within any means of egress (exterior or interior) or any fire lane shall be PROHIBITED, no matter how temporary, without consultation with the Fire Marshal’s office.

G. The Fire Marshal's office reserves the right to require the posting of fire lanes upon the premises in accordance with State regulations.

H. Provide all signs, barricades, warning lights, and other appurtenances required to maintain traffic and access to parking areas as shown on the Plans.

END OF SECTION 02 10 00

SITE PREPARATION AND DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Supplementary Conditions, and Division 1 Specification sections, apply to this section.

1.2 DESCRIPTION OF WORK

A. Provide all labor, materials and equipment required to perform the work called for in this section of the Specification, or as shown on the drawings, including but not limited to the following:

1 Removal of all existing concrete and bituminous concrete from within the contract limit line or as directed.

2 Removal of pavers and base material.

3 Removal and storage of concrete planters.

4 Sawcutting of materials to remain at limits of construction and as noted on the plans.

5 The clearing of the ground of trees, stumps, brush, rubbish, and all objectionable material within the excavation, embankments and fill areas as indicated on the plans, or as directed.

6 Clear site of plant life and grass as indicated on the Drawings and as necessary to complete the work.

7 Stripping and stockpiling of topsoil.

8 Remove root systems of trees and shrubs in areas cleared.

9 Removal and disposal of site walls.

10 Removal of curb.

11 Removal and storage of light poles and fixtures. Removal and disposal of concrete light pole bases.

12 Removal of fences, signs and any additional items as shown on the plan, or as directed.

13 Installation of construction entrance pad.

14 Protection of all site elements to remain including but not limited to trees, fences, lights, signs and all other items identified on the drawings.

15 Layout of all site improvements.

16 Installation and relocation of tempoirary construction fencing and gates.

B. Related work:

1. Division 31 Section “Site Utility Preparation and Demolition”
2. Division 31 Section "Excavation and Fill"
3. Division 31 Section “Erosion and Sediment Control
4. Division 32 Section "Bituminous Asphalt Concrete Paving"

1.3 SUBMITTALS

A. The Contractor shall submit for review a detailed Sequence of Construction Plan for all construction that differs from the guidelines set forth in the Contract Documents or if not completely defined in the Contract Documents to allow for Contractor flexibility. Sequence of Construction Plan shall include provisions for Emergency Operations due to weather, or any other site emergency. The Plan shall also include the location of temporary fencing, access gates and building egress routes. No work shall be allowed until Sequence of Operations plan is approved by the Owner’s Representative and the Engineer.

1.4 REGULATORY RE UIREMENTS

A. Conform to applicable local, state and federal regulations for disposal of debris.

B. Burning of debris will not be allowed.

C. Disposal of stumps on site will not be allowed.

D. The Contractor shall provide written documentation of compliance with all disposal regulations.

1.5 JOB CONDITIONS

A. Peripheral areas outside of the Contract Limits shall not be disturbed or used for storing materials without authorization of the Owner’s Representative.

B. Any damage to existing plant material or other improvements is the responsibility of the Contractor and shall be repaired or replaced immediately.

C. Topsoil stockpile areas must be approved by the Owner’s Representative prior to placement of topsoil stockpiles.

D. Utilities:

1. Refer to Division 31 Section “Site Utility Preparation and Demolition”.
2. Arrange and pay for disconnecting, removing, capping and plugging utility services. Disconnect and stub off. Notify the affected utility companies in advance and obtain approval before starting this work.
3. Place markers to indicate location of disconnected services. Identify service lines and capping locations on Project Record Documents.

PART 2 – PRODUCTS

2.1 TEMPORARY CHAINLINK FENCE

A. Unless otherwise indicated, type of temporary chain link fencing shall be Contractor's option. Following types are acceptable:

1. New materials or previously used salvaged chain link fencing in good condition.
2. Posts: Galvanized steel pipe of diameter to provide rigidity. Post shall be suitable for setting in concrete footings, driving into ground, anchoring with base plates, or inserting in precast concrete blocks.
3. Fabric: Woven galvanized steel wire mesh. Provide in continuous lengths to be wire tied to fence posts or prefabricated into modular pipe-framed fence panels.

B. Gates: Provide personnel and vehicle gates of the quantity and size indicated on the Drawings or required for functional access to site.

1. Fabricate of same material as used for fencing.
2. Vehicle gates:
   a. Minimum width: 20 feet to allow access for emergency vehicles.
   b. Capable of manual operation by one person.

PART 3 - EXECUTION

3.1 GENERAL

A. Conduct site clearing, demolition and preparation to ensure minimum interference with roads and adjacent property owners and as required by the Owner.

B. Refer to Construction Documents for Construction Phasing and requirements and limitations on site clearing and grubbing.

C. All sedimentation control devices as shown on the plans, or as directed, shall be installed prior to any excavation activities or stump removal. Construction methods shall conform to article 2.19.03 of the Form 817.

3.2 PREPARATION

A. Verify that existing plant life designated to remain is tagged or identified.

B. Flag limits of clearing for review by the Engineer prior to the start of any construction.

C. Identify required lines, levels, contours, and datum.

D. Identify known underground utilities. Stake and flag locations.

E. Identify and flag surface and aerial utilities.

F. Notify the appropriate utility authority to remove and relocate utilities.

G. Maintain and protect existing utilities remaining which pass through work area.

3.3 PROTECTION

A. Identify and protect utilities that are to remain.

B. Protect plant growth and features remaining as final landscaping. Minimum protection includes the installation of orange construction fencing at the limits of the canopy of existing trees. Other measures shall be as directed by the Owner.

C. Protect control points, benchmarks, and existing work from damage or displacement.

D. Any and all measures taken to protect the existing site features, either described in these documents and Contract Drawings or as directed by the Owner, shall be included in the cost of the work

E. Protect above and below grade utilities which are to remain.

F. Repair immediately any damage done to tree crowns or root systems.

G. Prevent movement or settlement of adjacent structures. Provide and place bracing, shoring and underpinning and be responsible for safety and support of structures. Assume liability for such movement, settlement, damage, or injury. Provide services of registered Structural Engineer to design bracing, shoring and/or underpinning if this work is required.

H. Cease operations and notify The Owner's Representative and/or the Engineer immediately if safety of adjacent structures appears to be endangered. Take precautions to properly support structures. Do not resume operations until safety is restored.

I. Prevent movement, settlement or collapse of adjacent services, sidewalks, driveways and trees. Assume liability for such movement, settlement or collapse. Promptly repair damage at no cost to the Owner.

J. Provide, erect and maintain street boardings, sidewalk sheds, barricades, lighting and guardrails as required to protect general public, workers, and adjoining property.

3.4 CLEARING AND GRUBBING

A. Install erosion controls prior to any stump removal. Completely remove stumps, roots, and other debris protruding through ground surface.

B. Clear areas required for access to site and execution of the work.

1. Limits of Clearing and Grubbing shall be restricted as indicated on the drawings and as required by regulatory agencies.

C. Remove trees and shrubs within marked areas and as shown on the Drawings. Grub out stumps, roots and surface rock to a depth of 3 feet below any subgrade.

1. Use only hand methods for grubbing inside drip line of trees indicated to remain.

D. Clear undergrowth and deadwood, without disturbing subsoil.

1. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.

3.5 REMOVAL AND DISPOSAL

A. All debris, trees, shrubs, brush, stumps, roots, and grass cleared and grubbed shall be removed and disposed of in accordance with all local, State and Federal regulations.

B. Burning and/or burial of cleared and grubbed material on the site shall not be permitted.

C. Contractor shall provide written documentation of proper disposal of all cleared and grubbed material and compliance with all applicable regulations.

3.6 "CALL BEFORE YOU DIG"

A. Contractor shall notify "Call Before You Dig" (800) 922-4455 a minimum 48 hours prior to start of construction and every 30 days thereafter for the duration of the project.

3.7 STRIPPING AND STOCKPILING TOPSOIL

A. Topsoil is defined as friable loam surface soil. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones and other objects over 2 inches in diameter, without weeds, roots and other objectionable material.

B. Contractor shall confirm the approximate quantity to be stripped and overall quality of topsoil to be stripped and shall review with the Owner's Representative prior to proceeding with work.

1. Topsoil test results on topsoil to be stripped shall be delivered to the Owner's Representative to determine acceptability of topsoil for reuse. See Section 329119 Planting Soil and Fine Grading for specific testing requirements.

C. Strip topsoil to full depths encountered in a manner to prevent intermingling with the underlying subsoil or other objectionable material.

1. Prepare the areas of existing loam so as to provide clump free topsoil. Use a sod cutting rototiller or other approved method.

2. Where trees are indicated to be left standing, hold topsoil stripping a sufficient distance away to prevent damage to the root system.

D. Stockpile topsoil in storage piles constructed to freely drain surface water. Generally, topsoil is to be stockpiled as indicated on the Drawings.

E. Topsoil stockpiles shall be immediately seeded with 3 pounds of perennial ryegrass per 1,000 square feet to prevent erosion.

F. Upon completion of the job, any excess topsoil, present, shall remain the property of the Owner. The Contractor shall haul all excess topsoil to a location designated by the Owner, at no additional cost to the Owner.

3.8 FIELD UALITY CONTROL AND ENGINEERING

A. All subgrades must be observed and approved by the Engineer prior to fill placement. Sufficient time must be given to the Engineer to observe and perform any necessary tests on the subgrade.

B. The Contractor shall provide all offsets and other construction reference points necessary to establish and maintain location and elevation of all proposed improvements as shown on the Drawings and as field approved by the Owner's Representative during construction.

C. The Contractor, at his own expense, shall do all engineering required for establishing grades, lines, levels, dimensions and reference points for all trades; shall be responsible for maintaining bench marks and other survey marks, and shall replace as directed, any bench marks which have been disturbed or destroyed.

D. The Contractor shall compare all grades, lines, levels and dimensions as shown on the Drawings and actual site conditions, and shall promptly report to the Owner, before commencing work, any inconsistencies he may discover.

3. REMOVAL OF BITUMINOUS AND CONCRETE SURFACES

A. Sawcut existing bituminous asphalt pavements to the lines indicated on the Contract Drawings. Edges shall be neat and straight. Contractor shall sawcut and remove the surface course of pavement to provide a 1-foot overlap.

B. Sawcut existing concrete surfaces as indicated on the drawings. Sawcuts shall be made at the next nearest joint.

C. Protect existing utilities, manhole covers, valve box covers, lighting, clean-outs, handholes, drainage structure tops, etc. to remain. Contractor shall provide all necessary shoring and bracing as may be required to protect and support the existing utilities to remain. Contractor shall replace at his own expense any utilities damaged as a result to this work.

3.10 STRUCTURES TO BE ABANDONNED IN PLACE

A. Remove top of structure (wall) to 1.5 feet below finished grade.

B. Sawcut and remove all reinforcing.

C. Note on record drawings location of abandoned structure.

3.11 SALVAGED MATERIALS

A. Granite curbing called for removal on the drawings shall be cleaned of all dirt, debris and concrete and delivered to a site at either the WCSU Downtown Campus or WCSU Western Campus as directed by the Owner's representative.

3.12 DISPOSAL OF WASTE MATERIALS

A. Burning and Burial: Burning and burial are not permitted on Owner's property.

B. Clean up: Remove materials and debris from site preparation work as it accumulates.

1. Do not place or store materials and debris within the limits of any existing street, public right-of-way or roadway.

2. Parking, loading, and operation of trucks, dumpsters, etc. on existing highway and streets shall be governed by existing laws, ordinances, and regulations.

C. Disposal of Debris: Remove waste materials and unsuitable and excess topsoil from Owner's property and dispose of off site legally and in a manner satisfactory to State, County, or local authorities having jurisdiction.

3.13 HA ARDOUS MATERIAL AND WASTE CONTROL

A. Excavation and disposal of contaminated, polluted or “environmentally compromised” materials shall be conducted in conformance with the environmental and abatement specifications. The handling of contaminated polluted or “environmentally compromised” water to be discharged as a result of dewatering shall be performed in accordance with the environmental and abatement specifications. Refer to the appropriate specification.

END OF SECTION 02 41 13

UNDERGROUND STORAGE TANK REMOVAL

PART 1 - GENERAL

1.1 RELATED DOCUMENT

A. Drawings and general provisions of Contract, including General Supplementary Conditions, and Division 1 Specification sections, apply to this section.

1.2 SUMMARY

A. Section Includes:

1. Removing and disposal of underground storage tank (UST) liquid contents.
2. Removing, cleaning, and disposing UST.
3. Testing and removing contaminated soils.
4. Backfilling and restoring excavation areas.

B. Related Work: The following sections contain requirements that may apply to this section:

1. Section 31 11 00 - ñSite Utility Preparation and Demolitionò
2. Section 31 23 19 - ñDewateringò
3. Section 31 23 33 - ñTrenching and Backfillingò
4. Section 31 23 00 - ñExcavation and Fillò

1.3 PRICE AND PAYMENT PROCEDURES

A. Differing Site Conditions: Extent of excavation and restoration for UST removal indicated on drawings and extent of additional soils sampling and testing specified in this section are estimated. Variations less than 5 percent change are not cause for contract price and time adjustments. Additional work will be paid by unit prices as provided in the Project Manual.

1.4 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. American Petroleum Institute (API):

1. 1604-96 (R2010) - Closure of Underground Petroleum Storage Tanks.
2. 2217A-09 - Safe Work in Inert Confined Spaces in the Petroleum and Petrochemical Industries.

3. 2015-14 - Safe Entry and Cleaning of Petroleum Storage Tanks.

C. Code of Federal Regulations (CFR):

1. 40 CFR Part 280 - Underground Storage Tanks; Technical Requirements.
2. 49 CFR Part 178 - Specifications for Packagingõs.

D. United States Environmental Protection Agency (EPA):

1. SW-846 - Evaluating Solid Waste: Physical/Chemical Methods.

1. 5 PRE-REMOVAL MEETINGS

A. Conduct pre-removal meeting at project site 5 days (or sooner) before beginning work of this section.

1. Required Participants:
   a. Owner.
   b. Architect/Engineer.
   c. Inspection and Testing Agency.
   d. Contractor.
   e. UST removal contractor.
2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
   a. Removal schedule.
   b. Removal sequence.
   c. Preparatory work.
   d. Contaminated material containment and disposal.
   e. Removal.
   f. Inspecting and testing.
   g. Other items affecting successful completion.
3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1. 6 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, Shop Drawings, Product Data, and Samples.

B. Notice of intent to close UST.

C. Test Reports: Submit testing laboratory reports.
   1. UST liquid contents analysis.
   2. UST interior environment analysis.
   3. Soil sample analysis.

D. Qualifications: Substantiate qualifications comply with specifications.
   1. UST removal contractor.
   2. Testing laboratory.
   3. Liquid disposal facility.
   4. UST disposal facility.
   5. Soils disposal facility.

E. UST removal plan.

F. Record documents:
   1. Six copies of Final Closure Report.
   2. Record Documents:
      a. Soil sample locations.
      b. Detailed plan view.
      c. Piping removal diagrams.
      d. Control removal diagrams.
      e. Component diagrams including tank removal procedure.
      f. Detailed sequence of procedure.
   3. Photographs of work in progress showing UST removal plan compliance.
   4. Chain-of-custody documentation.
   5. Disposal facility receipts and disposition reports.

1.7 UALITY ASSURANCE

A. UST Removal Contactor: Experienced contractor, registered or licensed by applicable state agency regulating UST removal.

B. Testing Laboratory: State certified independent testing laboratory experienced in hazardous waste liquid and soil testing.

C. Liquid Disposal Facility: State certified disposal facility qualified to receive and dispose UST liquid contents.

D. UST Disposal Facility: State certified disposal facility qualified to receive and dispose UST.

E. Soils Disposal Facility: State certified disposal facility qualified to receive and dispose contaminated soils.

F. UST Removal Plan: Describe detailed procedures for:

1. Removing and disposing UST liquid content.
2. Removing, ventilating, cleaning, and disposing UST.
3. Soil sampling and testing.
4. Removing and disposing contaminated soils.

G. UST Final Closure Report: Assemble work progress documentation showing removal plan compliance, including:

1. Sample test records.
2. State Agency requirements.
3. Hazardous material plan for local VA management.

1.8 FIELD CONDITIONS

A. Do not close or obstruct streets, sidewalks, or drives without Engineerôs approval.

1. Submit closure request minimum 30 days before starting work.

1. WARRANTY

A. Construction Warranty: FAR clause 52.246-21, ñWarranty of Construction.ò

1.10 PERMITS

A. Contractor shall be responsible for obtaining all necessary Connecticut Department of Energy and Environmental Protection (CT DEEP) permits and fees.

PART 2 – PRODUCTS

2.1 ACCESSORIES

A. Waste Collection Drums: 49 CFR Part 178; Type 1A2, steel, removable head, 200 L (55 gal.) capacity, capable of containing waste without loss.

PART 3 – EXECUTION

3.1 PREPARATION

A. Coordinate demolition specified in Section 31 11 00, Demolition required to access UST site.

3.2 UST SE UENCE

A. Notify applicable State Agency minimum 30 days before UST closure.

B. Determine if contamination from UST is present.

C. When contamination exists, notify the Engineer and cooperate to record site with applicable State Agency and EPA.

D. Remove UST liquid contents, UST, and associated facilities.

E. Remove contaminated soil.

F. Backfill excavated area.

G. Restore excavation surfaces.

3.3 UST CLOSURE

A. Conform to API 1604, 40 CFR Part 280, 29 CFR Part 1910, and 29 CFR Part 1926.

3.4 UST LI UID CONTENTS REMOVAL

A. Collect, test, and analyze UST liquid content samples.

1. Identify individual constituents and concentrations.

2. Identify lower explosive limits for constituents in gaseous form.

3. Identify disposal facilities qualified to receive and process UST liquid contents.

B. Remove UST liquid contents before removing UST.

1. Record liquid volume removed from UST.

C. Deliver UST liquid contents to disposal facility.

1. Obtain signed receipt including date, time, total liquid volume, and description of materials received

2. Obtain final report of UST liquid contents disposition after disposal completion.

3.5 UST REMOVAL

A. Excavate overburden and soils immediately surrounding UST as specified in Section 31 20 00, Excavation and Backfill.

1. Contain excavated materials to prevent loss and mixing with other materials until completion of initial soils testing.

B. Remove UST from excavation.

C. Place UST on ground adjacent to removal location.

D. Secure UST before cleaning.

3.6 UST CLEANING

A. Measure combustible gas and oxygen concentrations within UST.

B. Ventilate UST interior to reduce combustible gas concentrations to maximum 10 percent of lower explosive limit and to provide 19.5 to 23.5 percent oxygen concentration.

1. Test UST interior atmosphere confirming gas concentrations.

2. Complete required ventilation before cleaning.

C. Cut ports in UST wall facilitating cleaning access. Comply with API Standard 2217A and API Standard 2015 for UST entry.

D. Clean surface contaminates from UST and access port interior wall surfaces.

1. Contain removed materials without producing further contamination.

2. Collect removed materials in waste collection drums. Seal drums to prevent material loss.

E. Request UST inspection by State Agency certifying completed UST cleaning.

F. Dismantle UST as required for transport to disposal facility.

G. Deliver UST, removed access ports, and waste collection drums to disposal facility.

1. Obtain signed receipt including date, time, quantity, and description of materials received.

2. Obtain final report of materials disposition after disposal completion.

3.7 SOIL TESTING

A. Collect five (5) initial soil samples from UST excavation area after tank removal.

B. Take one sample from both UST sidewalls, one sample from both UST endwalls, and one sample from UST base.

1. Containerize samples to prevent sample loss and preserve sample condition until tested.

2. Test and analyze samples according to EPA SW-846 for total petroleum hydrocarbon (TPH) concentrations.

C. When soil testing reveals evidence of hydrocarbons at concentrations greater than permitted by applicable State Agency for uncontaminated soil used as fill material, collect six (6) additional soil samples 20 feet from UST walls.

1. Take two (2) samples from both UST sidewalls and one sample from both UST end walls.

2. Test and analyze samples as specified for initial samples.

3. Notify the Engineer when additional samples are contaminated.

4. The base price for volume between the final tank volume of material for the enclosure and the enclosure shall not to exceed 100 cubic yards of soil removed. Any work beyond 100 cubic yards and more than 6 test locations shall be considered extra and shall be based on unit pricing.

D. Perform additional soil sampling and testing around UST as directed by the Engineer until contamination concentration is less than permitted by applicable State Agency for uncontaminated soil used as fill material.

3.8 CONTAMINATED SOIL REMOVAL

A. Excavate contaminated materials as specified in Section 31 23 00, Excavation and Fill.

B. Remove contaminated soil from site according to applicable State Agency requirements.

C. Deliver contaminated soils to disposal facility.

1. Obtain signed receipt including date, time, quantity, and description of materials received.

2. Obtain final report of materials disposition after disposal completion.

3. CONTAMINATED SOIL REMOVAL

A. Backfill excavation with fill materials and compact as specified in Section 31 23 24, SITE BACKFILL.

B. Restore pavements, sidewalks, and curbs matching adjacent materials as specified in Section 32 13 13, Concrete Paving, Section 32 12 16, Bituminous Asphalt Concrete Paving.

C. Restore landscaped areas and grass areas to match adjacent materials as specified in Landscaping Specifications.

3.10 FIELD UALITY CONTROL

A. Field Tests: Performed by testing laboratory specified in Section 01 45 23, TESTING LABORATORY SERVICES.

B. Perform sampling and testing for the following:

1. UST liquid contents.

2. UST interior environment.

3. Soils contamination.

C. Record chain of custody for samples until disposal.

3.11 PROTECTION

A. Protect restored areas from traffic and construction operations.

B. Repair damage.

END OF SECTION 02 65 00

CONCRETE REINFORCING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. All applicable provisions of the General Conditions and the Special Conditions shall apply to the work of this Section.

B. Scope: Provide all labor, materials, necessary equipment and services to complete the concrete reinforcement work as indicated on the drawings, specified herein, or both. Work shall, in general, consist of, but not necessarily be limited to the following major items of work.

1. Welded wire fabric (W.W.F.)

1.2 RELATED DOCUMENTS

A. Cast-in-Place Concrete, Section 033000.

1.3 UALITY ASSURANCE

A. All work of this section shall be provided in accordance with the latest edition of the following standards that are considered to be a part of this specification the same as if fully set forth herein.

1. The State of Connecticut Department of Transportation Standard Specifications for Road and Bridge Construction (FORM 817).

PART 2 - PRODUCTS

2.1 MATERIALS

A. Material shall conform to the latest requirements of the ASTM Standard Specifications and manufactured in the United States.

1. Welded wire fabric (W.W.F.): Sub article M.06.01-3, DOT Specifications.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All reinforcement shall be installed in accordance with ACI 318, ACI 301 and the Connecticut Building Code.
B. Reinforcing shall be delivered and stored at the site in a manner that will protect material from damage.

END OF SECTION 03 20 00

CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. All applicable provisions of the General Conditions and the Special Conditions shall apply to the work of this Section.

B. Scope: Provide all labor, materials, necessary equipment and services to complete the concrete formwork and cast-in-place concrete work as indicated on the drawings, specified herein or both. Work shall consist of, but not necessarily be limited to the following major items of work.

1. Forms for sidewalks, curbs, light pole and bollard bases and any other concrete as shown on the drawings, or specified herein.

2. Furnishing, placing and finishing of cast-in-place concrete for sidewalks, curbs light pole and bollard bases and any other concrete as shown on the drawings or specified herein.

3. Placing of cast-in-items such as anchor bolts, and any other items shown on the drawings or as furnished under this and other sections.

1.2 RELATED DOCUMENTS

A. Concrete Reinforcement, Section 032000

1.3 SUBMITTALS

A. Submit sand and coarse aggregate source and physical properties.

B. Submit laboratories trial mix designs proposed in accordance with Method 1, ACI 301 or one copy each of 30 consecutive test results and the mix design used from a record of past performance in accordance with ACI 301, Method 2.

C. The Contractor shall submit the mix designs for approval at least ten (10) days before commencing any concrete operations.

D. Submit catalog cuts and/or appropriate descriptive material and test results for non-shrink grout.

1.4 UALITY ASSURANCE

A. All work of this section shall be provided in accordance with the latest edition of the following standards which are considered to be a part of this specification the same as if fully set forth herein:

1. The State of Connecticut Department of Transportation Standard Specifications for Road and Bridge Construction (Form 817).

B. It is the intent of this specification to secure for every part of the work, concrete of homogeneous nature which, when hardened, will have the required strength, resistance to weathering, and such other qualities as the type of structure or its location may require.

C. Concrete installer shall hold current ACI flatwork certification.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Cement shall be Portland Cement, Type I or II conforming to ASTM C150. Cement used in the work shall correspond to that upon which the selection of concrete proportions was based. Shall conform to Article M.03.01, CTDOT From 817.

B. Hi-early cement shall be used only with prior approval from the Engineer

C. Concrete admixtures: provide admixtures produced and serviced by established, reputable manufacturer's recommendations.

D. Air-entraining admixtures shall conform to ASTM C260. Water-reducing, set-controlling admixture shall conform to ASTM C494, Type A (water-reducing), Type D (water-reducing and retarding) and Type E (water-reducing, accelerating), Type F or G (high range water-reducing, superplasticizer).

E. Admixtures containing calcium chloride or Thiocyanate shall not be used.

F. Field Service: a qualified concrete technician employed by the manufacturer shall be available to assist in proportioning concrete materials for optimum use, to advise on proper use of the admixture and adjustment of concrete mix proportions to meet job site and climatic conditions.

G. Aggregate:

1. Fine aggregate shall conform to ASTM C33 and be clean, sharp, natural sand, free from loam, clay lumps, or other deleterious substance, within allowable standards.

2. Coarse aggregate shall conform to ASTM C33 for normal weight concrete. All aggregate shall be clean, uncoated, graded aggregate, containing no clay, mud, loam, or foreign matter.

H. Water shall be fresh, clean, and drinkable.

I. Non-Shrink Grout:

1. Grout under light poles after they are set to true levels with a pre-mixed, 5000 psi (after 3 days), grout meeting ASTM C1107

2. Install in accordance with manufacturer's recommendations.

J. Welded Steel Wire Fabric: Section 032000 and Sub article M.06.01-3, CTDOT From 817.

K. Reinforcement: Sub article M.06.01-1, CTDOT Form 817.

L. Expansion joints shall utilize a full depth asphaltic saturated cellulosic fiber strip. Steel diamond shape load plates shall be utilized at all expansion joints in lieu of round dowels with the exception of areas where sidewalk ties into existing walks. Load plates, dowels and expansion joints shall be utilized at all locations where concrete is poured up against stationary objects

M. Joint sealant shall be a one component polyurethane sealant meeting Federal Specification TT-S-00230C, Type 1, Class A and ASTM C-920, Type S, Grade P, Class 25.

PART 3 - EXECUTION

3.1 PROPORTIONING OF CONCRETE

A. Concrete shall be composed of Portland cement, fine aggregate, coarse aggregate, water, a water-reducing admixture, and an air-entraining admixture.

B. Proportions of ingredients shall produce concrete, which will work readily into corners and angles of forms, and bond to reinforcement without segregation or excessive bleed water forming on the surface. Proportioning of materials shall be in accordance with ACI 211.1.

C. Required Average Strength: Determinations of required average strength (f'c) above specified strength shall be in accordance with ACI 318 and evaluations of compressive strength results of field concrete shall be in accordance with ACI 214.

3.2 RE UIRED CONCRETE UALITIES

A. Specified Compressive Strength at 28 days shall be 4,500 psi with a maximum water-cement ratio of 0.45.

B. Concrete subject to exposure shall be air-entrained. Total air content required (air-entrained and entrapped air) shall be 6% +/- 1.5%.

C. Concrete shall be proportioned and produced to have a maximum slump of 4 inches unless a superplasticizer is used. A maximum slump of 6" shall be allowed if a superplasticizer is used. Consolidation shall be by means of vibrators.

D. Maximum size of coarse aggregate shall not exceed 3/4" for all concrete types.

E. Concrete shall be adjusted to produce the required rate of hardening for varied climatic and job site conditions.

1. Under 50^{o} F. ambient temperature - Accelerate (approval in writing required from the Engineer) (Type E admixture - ASTM C494).

2. Over 80^{o} F. ambient temperature - Retard (Type D admixture ASTM C494).

3. Between 50^{o} F. and 80^{o} F. - Normal Rate of Hardening (Type A admixture - ASTM C494).

3.3 FORMWORK PREPARATION

A. Forms shall be used to confine and shape concrete to required dimensions. Forms shall have sufficient strength to withstand forces from placement and vibration of the concrete, and sufficient rigidity to maintain specified tolerances.

B. Design, engineering, and construction of the formwork shall be the responsibility of the Contractor.

C. Work shall be designed for loads, lateral pressure and allowable stresses in accordance with ACI 347, "Recommended Practice for Concrete Formwork."

D. All tolerances, preparation of form surfaces, removal of forms etc. shall be in accordance with Chapter 4 of ACI 301.

3.4 CONCRETE PLACEMENT

A. Formwork shall have been completed and all snow, ice, water, and debris removed from within forms.

B. Anchors and all embedded items shall have been positioned.

C. Concrete shall utilize 6-inch square wire mesh, wire mesh shall have a minimum twelve-inch overlap. Wire mesh shall be placed on chairs spaced no more than eighteen inches on center.

D. Subgrade shall be sprinkled sufficiently to eliminate water loss from the concrete.

E. Concrete shall not be placed on frozen ground.

F. Concrete shall be ready-mixed, batched, mixed and transported in accordance with ASTM C94.

G. Preparations: Contractor shall provide access for delivery and provide sufficient equipment and manpower to rapidly place all concrete.

H. Conveying: Concrete shall be handled from mixer to final deposit rapidly by methods, which will prevent segregation, or loss of ingredients to maintain required quality of concrete. It shall be placed in the forms or on grade as near as practicable to its final position and shall be prohibited from free falling more than 4 feet.

I. Concrete shall be deposited continuously. Concrete shall be placed as nearly as possible to its final position. Avoid re-handling or flowing.

J. Cold Weather Concrete:

1. Temperature of concrete delivered at the job site shall comply with the requirements of ACI 306R, "Cold Weather Concreting."

2. Concrete temperature shall be maintained during cold weather for the recommended period of time specified in Table 1.4.2 in A.C.I. 306R.

3. Special attention shall be given to the corners and edges of concrete during cold weather to prevent damage.

4. Provisions shall be made to retain heat by using insulating blankets or by an outside heat source.

K. Hot Weather Concrete:

1. Temperature of concrete delivered at the job site shall comply with the requirements of ACI 305R, "Hot Weather Concreting."

2. Curing and Protection: Immediately following placement, concrete shall be protected from premature drying, hot and cold temperatures, rain, flowing water and mechanical injury. Materials and method of curing shall be approved by the Engineer.

L. Sidewalks and pedestrian, ramps shall be floated to a smooth, dense uniform, broom textured finish with ¼ inch tooled joints and edging. Tooling shall be completed after the surface finish. No additional water shall be added to the surface to aid in finishing. If finishing aid is required, it shall be similar to Eucobar. During floating, while surface is still soft, check surface for flatness using a straightedge. Correct high spots by cutting down and correct low spots by filling in with material of same composition as floor finish. Remove any surface projections and re-float to a uniform texture.

M. Repair of Surface Defects: All surface defects shall be repaired immediately after form removal according to Chapter 9 of the ACI 301.

N. Do not place concrete when weather conditions prevent proper placement and consolidation, or when concrete has attained its initial set, or has contained its water or cement content for more than 1-1/2 hours.

O. Concrete for sidewalks and ramps shall be placed between April 15th and October 15th unless previously requested and approved by the University.

P. Expansion and contraction joints shall be as shown on the drawings.

Q. Contraction Joints shall be ¼ of the overall depth of the concrete pour to ensure contraction of the material takes place at these locations.

R. Concrete sidewalk wet cure shall commence immediately after finishing and continue uninterrupted for a period of 7 days, 5 days minimum. Wet cure shall utilize a non-marking curing paper or other curing cover similar to Hydra Cure Cover S16. Upon approval the contractor shall utilize a dissipating curing compound only if moisture curing is not feasible. Upon proper curing concrete sidewalks shall have joints filled with self-leveling sealer that matches the color of the concrete. Sidewalks shall be treated with salt guard sealer in accordance with manufactures instructions. Placement shall be witnessed by the Owner's Representative and/or the Engineer.

3.5 TESTING AND INSPECTION

A. Materials and operations shall be tested and inspected as work progresses. Failure to detect defective work shall not prevent rejections when defect is discovered.

B. The following testing services shall be performed by the testing laboratory selected and paid for by the Owner:

1. Test specimens in accordance with "Method of Test for Compressive Strength of Molded Concrete Cylinders," ASTM C39. Two specimens shall be tested at 28 days for acceptance and one shall be tested at 7 days for information. An additional cylinder shall be made as an extra in case a 56-day break is required.

2. Make one strength test for each 50 cu. yds. or fraction thereof, of each mix design of concrete placed in any one day. (One test consists of 4 cylinders.)

3. Determine slump, air content and temperature for each strength test and whenever consistency of concrete appears to vary.

4. All sampling of pumped concrete shall be done at the discharge end of the pump lines.

C. To facilitate testing and inspection, the Contractor shall furnish necessary labor to assist testing agency in obtaining and handling samples at the job site.

D. Owner agrees to pay for the above tests with the exception of work that is found to be defective. Subsequent tests shall be taken and paid for by the Contractor.

E. Placement of concrete shall not be approved until test results have been forwarded to the Engineer and accepted.

END OF SECTION 03 30 00

SITE UTILITY PREPARATION AND DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Supplementary Conditions, and Division 1 Specification sections, apply to this section.

1.2 SUMMARY

A. Provide all labor, materials and equipment required to perform the work called for in this section of the Specification, or as shown on the drawings, including but not necessarily limited to the following:

1. Removal of all existing concrete and bituminous concrete from within the limits of trench excavation as indicated on the plans, or as directed.
2. Removal of existing utilities as indicated on the drawings. If permitted abandonment of existing utilities as indicated on the drawings.
3. Protection of all site elements to remain including but not limited to sidewalks, site lighting, utilities, landscaping and all other items identified on the drawings.
4. Provide temporary utility services as indicated on the drawings and/or as directed by the Owner's Representative.
5. Provide temporary surface treatments such as pavement and walkways as shown on the drawings and/or as directed by the Owners Representative.

B. Related work: The following sections contain requirements that may apply to this section:

1. Section 02 10 00 - “Maintenance and Protection of Traffic”
2. Section 31 23 33 - "Trenching and Backfilling"
3. Section 31 25 00 - "Storm Water Pollution and Control Plan"
4. Section 32 12 16 - "Bituminous Asphalt Concrete Paving"

1.3 SUBMITTALS

A. Schedule:

1. Submit two copies of proposed methods and plan of operations for demolition of existing utilities to the Owners Representative for review prior to the start of work. Include in the plan the coordination for shut-off, capping, and continuation of utility services as required.

2. Submit copies of all permits required for utility demolition work and transporting debris including certificates for severance of utility service.

B. The Contractor shall submit for review a detailed **S n C n n P an** for all construction that differs from the guidelines set forth in the Contract Documents or if not completely defined in the Contract Documents to allow for Contractor flexibility. Sequence of Construction Plan shall include provisions for Emergency Operations due to weather, or any other site emergency. No work shall be allowed until Sequence of Operations plan is approved by the Owner's Representative and the Engineer.

1.4 UALITY ASSURANCE

A. Codes and Regulations: Work shall be performed in strict accordance with the terms and conditions of all current Federal, State, and Municipal statutes including OSHA. It shall be the Contractor's responsibility to determine all such statutes, codes, and regulations that are applicable or otherwise govern the performance of the work.

B. The Contractor shall obtain, file, and pay for all permits, fees, and licenses required to perform the work.

1.5 JOB CONDITIONS

A. Protection:

1. Prevent movement or settlement of adjacent structures. Provide and place bracing, shoring and underpinning and be responsible for safety and support of structures. Assume liability for such movement, settlement, damage, or injury. Provide services of Connecticut registered Structural Engineer to design bracing, shoring, and/or underpinning if this work is required.

2. Cease operations and notify Architect/Engineer immediately if safety of adjacent structures appears to be endangered. Take precautions to properly support structures. Do not resume operations until safety is restored.

3. Prevent movement, settlement, or collapse of adjacent services, sidewalks, driveways, and trees. Assume liability for such movement, settlement, or collapse. Promptly repair damage at no cost to the Owner.

4. Provide, erect, and maintain street boardings, sidewalk, barricades, lighting, and guiderails as required to protect general public, workers, and adjoining properties.

B. Utilities:

1. Arrange and pay for disconnecting, removing, capping, and plugging utility services. Disconnect and stub off. Notify the affected utility companies in advance and obtain approval before starting this work.

2. Place markers to indicate location of disconnected services. Identify service lines and capping locations on Project Record Documents.

C. Maintaining Traffic:

1. Conduct demolition operations and the removal of debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.
2. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

D. Explosives: The use of explosives will not be permitted.

PART 2 - PRODUCTS – Not used.

PART 3 – EXECUTION

3.1 GENERAL

A. Conduct site utility demolition and preparation to ensure minimum interference with roads and adjacent property owners and as required by the Owner.

B. Refer to Construction Documents for Construction Phasing and requirements and limitations on site clearing and grubbing.

C. Prior to any excavation, the Contractor shall notify all affected utilities in accordance with Public Act 77-350 ("Call Before You Dig": 811). In the event Call Before You Dig is unable to locate the utilities, the Contractor shall hire a private utility marking company at no additional cost to the owner.

D. All sedimentation control devices as shown on the plans, or as directed, shall be installed prior to any excavation activities or stump removal. Construction methods shall conform to Article 2.19.03 of the Form 817. See Section 312500 of the specifications.

E. Disposal of excavated material shall be in accordance with Federal, State and local regulations.

F. Excavate material, as required.

G. Existing trees that are to remain shall be adequately protected to ensure that they are not damaged.

H No burning of material will be allowed.

I. Existing bituminous and concrete pavement to remain shall be saw-cut in a neat line.

J. Contractor shall secure site at the end of each day and at the end of each week. No open trenches, excavations shall be allowed. At the end of each week the Owner's Representative shall complete an inspection of the site including security, erosion controls, and any other construction feature. The Contractor shall make any required modifications at no cost to the Owner and to the satisfaction of the Owner's Representative.

K. During the progress of the work, keep all adjacent sidewalks, drives, and streets clean and free of dirt and debris.

3.2 HA ARDOUS MATERIAL AND WASTE CONTROL

A. Excavation and disposal of contaminated, polluted, or "environmentally compromised" materials shall be conducted in conformance with the environmental and abatement specifications. The handling of contaminated polluted or "environmentally compromised" water to be discharged as a result of dewatering shall be performed in accordance with the environmental and abatement specifications.

END OF SECTION 31 11 00

SITE UTILITY PREPARATION AND DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Supplementary Conditions, and Division 1 Specification sections, apply to this section.

1.2 SUMMARY

A. Provide all labor, materials and equipment required to perform the work called for in this section of the Specification, or as shown on the drawings, including but not necessarily limited to the following:

1. Removal of all existing concrete and bituminous concrete from within the limits of trench excavation as indicated on the plans, or as directed.
2. Removal of existing utilities as indicated on the drawings. If permitted abandonment of existing utilities as indicated on the drawings.
3. Protection of all site elements to remain including but not limited to sidewalks, site lighting, utilities, landscaping and all other items identified on the drawings.
4. Provide temporary utility services as indicated on the drawings and/or as directed by the Owner's Representative.
5. Provide temporary surface treatments such as pavement and walkways as shown on the drawings and/or as directed by the Owners Representative.

B. Related work: The following sections contain requirements that may apply to this section:

1. Section 02 10 00 - “Maintenance and Protection of Traffic”
2. Section 31 23 33 - "Trenching and Backfilling"
3. Section 31 25 00 - "Storm Water Pollution and Control Plan"
4. Section 32 12 16 - "Bituminous Asphalt Concrete Paving"

1.3 SUBMITTALS

A. Schedule:

1. Submit two copies of proposed methods and plan of operations for demolition of existing utilities to the Owners Representative for review prior to the start of work. Include in the plan the coordination for shut-off, capping, and continuation of utility services as required.

2. Submit copies of all permits required for utility demolition work and transporting debris including certificates for severance of utility service.

B. The Contractor shall submit for review a detailed **S n C n n P an** for all construction that differs from the guidelines set forth in the Contract Documents or if not completely defined in the Contract Documents to allow for Contractor flexibility. Sequence of Construction Plan shall include provisions for Emergency Operations due to weather, or any other site emergency. No work shall be allowed until Sequence of Operations plan is approved by the Owner's Representative and the Engineer.

1.4 UALITY ASSURANCE

A. Codes and Regulations: Work shall be performed in strict accordance with the terms and conditions of all current Federal, State, and Municipal statutes including OSHA. It shall be the Contractor's responsibility to determine all such statutes, codes, and regulations that are applicable or otherwise govern the performance of the work.

B. The Contractor shall obtain, file, and pay for all permits, fees, and licenses required to perform the work.

1.5 JOB CONDITIONS

A. Protection:

1. Prevent movement or settlement of adjacent structures. Provide and place bracing, shoring and underpinning and be responsible for safety and support of structures. Assume liability for such movement, settlement, damage, or injury. Provide services of Connecticut registered Structural Engineer to design bracing, shoring, and/or underpinning if this work is required.

2. Cease operations and notify Architect/Engineer immediately if safety of adjacent structures appears to be endangered. Take precautions to properly support structures. Do not resume operations until safety is restored.

3. Prevent movement, settlement, or collapse of adjacent services, sidewalks, driveways, and trees. Assume liability for such movement, settlement, or collapse. Promptly repair damage at no cost to the Owner.

4. Provide, erect, and maintain street boardings, sidewalk, barricades, lighting, and guiderails as required to protect general public, workers, and adjoining properties.

B. Utilities:

1. Arrange and pay for disconnecting, removing, capping, and plugging utility services. Disconnect and stub off. Notify the affected utility companies in advance and obtain approval before starting this work.

2. Place markers to indicate location of disconnected services. Identify service lines and capping locations on Project Record Documents.

C. Maintaining Traffic:

1. Conduct demolition operations and the removal of debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.
2. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

D. Explosives: The use of explosives will not be permitted.

PART 2 - PRODUCTS – Not used.

PART 3 – EXECUTION

3.1 GENERAL

A. Conduct site utility demolition and preparation to ensure minimum interference with roads and adjacent property owners and as required by the Owner.

B. Refer to Construction Documents for Construction Phasing and requirements and limitations on site clearing and grubbing.

C. Prior to any excavation, the Contractor shall notify all affected utilities in accordance with Public Act 77-350 ("Call Before You Dig": 811). In the event Call Before You Dig is unable to locate the utilities, the Contractor shall hire a private utility marking company at no additional cost to the owner.

D. All sedimentation control devices as shown on the plans, or as directed, shall be installed prior to any excavation activities or stump removal. Construction methods shall conform to Article 2.19.03 of the Form 817. See Section 312500 of the specifications.

E. Disposal of excavated material shall be in accordance with Federal, State and local regulations.

F. Excavate material, as required.

G. Existing trees that are to remain shall be adequately protected to ensure that they are not damaged.

H No burning of material will be allowed.

I. Existing bituminous and concrete pavement to remain shall be saw-cut in a neat line.

J. Contractor shall secure site at the end of each day and at the end of each week. No open trenches, excavations shall be allowed. At the end of each week the Owner's Representative shall complete an inspection of the site including security, erosion controls, and any other construction feature. The Contractor shall make any required modifications at no cost to the Owner and to the satisfaction of the Owner's Representative.

K. During the progress of the work, keep all adjacent sidewalks, drives, and streets clean and free of dirt and debris.

3.2 HA ARDOUS MATERIAL AND WASTE CONTROL

A. Excavation and disposal of contaminated, polluted, or "environmentally compromised" materials shall be conducted in conformance with the environmental and abatement specifications. The handling of contaminated polluted or "environmentally compromised" water to be discharged as a result of dewatering shall be performed in accordance with the environmental and abatement specifications.

END OF SECTION 31 11 00

SITE UTILITY PREPARATION AND DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Supplementary Conditions, and Division 1 Specification sections, apply to this section.

1.2 SUMMARY

A. Provide all labor, materials and equipment required to perform the work called for in this section of the Specification, or as shown on the drawings, including but not necessarily limited to the following:

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4. Provide temporary utility services as indicated on the drawings and/or as directed by the Owner's Representative.
5. Provide temporary surface treatments such as pavement and walkways as shown on the drawings and/or as directed by the Owners Representative.

B. Related work: The following sections contain requirements that may apply to this section:

1. Section 02 10 00 - “Maintenance and Protection of Traffic”
2. Section 31 23 33 - "Trenching and Backfilling"
3. Section 31 25 00 - "Storm Water Pollution and Control Plan"
4. Section 32 12 16 - "Bituminous Asphalt Concrete Paving"

1.3 SUBMITTALS

A. Schedule:

1. Submit two copies of proposed methods and plan of operations for demolition of existing utilities to the Owners Representative for review prior to the start of work. Include in the plan the coordination for shut-off, capping, and continuation of utility services as required.

2. Submit copies of all permits required for utility demolition work and transporting debris including certificates for severance of utility service.

B. The Contractor shall submit for review a detailed **S n C n n P an** for all construction that differs from the guidelines set forth in the Contract Documents or if not completely defined in the Contract Documents to allow for Contractor flexibility. Sequence of Construction Plan shall include provisions for Emergency Operations due to weather, or any other site emergency. No work shall be allowed until Sequence of Operations plan is approved by the Owner's Representative and the Engineer.

1.4 UALITY ASSURANCE

A. Codes and Regulations: Work shall be performed in strict accordance with the terms and conditions of all current Federal, State, and Municipal statutes including OSHA. It shall be the Contractor's responsibility to determine all such statutes, codes, and regulations that are applicable or otherwise govern the performance of the work.

B. The Contractor shall obtain, file, and pay for all permits, fees, and licenses required to perform the work.

1.5 JOB CONDITIONS

A. Protection:

1. Prevent movement or settlement of adjacent structures. Provide and place bracing, shoring and underpinning and be responsible for safety and support of structures. Assume liability for such movement, settlement, damage, or injury. Provide services of Connecticut registered Structural Engineer to design bracing, shoring, and/or underpinning if this work is required.

2. Cease operations and notify Architect/Engineer immediately if safety of adjacent structures appears to be endangered. Take precautions to properly support structures. Do not resume operations until safety is restored.

3. Prevent movement, settlement, or collapse of adjacent services, sidewalks, driveways, and trees. Assume liability for such movement, settlement, or collapse. Promptly repair damage at no cost to the Owner.

4. Provide, erect, and maintain street boardings, sidewalk, barricades, lighting, and guiderails as required to protect general public, workers, and adjoining properties.

B. Utilities:

1. Arrange and pay for disconnecting, removing, capping, and plugging utility services. Disconnect and stub off. Notify the affected utility companies in advance and obtain approval before starting this work.

2. Place markers to indicate location of disconnected services. Identify service lines and capping locations on Project Record Documents.

C. Maintaining Traffic:

1. Conduct demolition operations and the removal of debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.
2. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

D. Explosives: The use of explosives will not be permitted.

PART 2 - PRODUCTS – Not used.

PART 3 – EXECUTION

3.1 GENERAL

A. Conduct site utility demolition and preparation to ensure minimum interference with roads and adjacent property owners and as required by the Owner.

B. Refer to Construction Documents for Construction Phasing and requirements and limitations on site clearing and grubbing.

C. Prior to any excavation, the Contractor shall notify all affected utilities in accordance with Public Act 77-350 ("Call Before You Dig": 811). In the event Call Before You Dig is unable to locate the utilities, the Contractor shall hire a private utility marking company at no additional cost to the owner.

D. All sedimentation control devices as shown on the plans, or as directed, shall be installed prior to any excavation activities or stump removal. Construction methods shall conform to Article 2.19.03 of the Form 817. See Section 312500 of the specifications.

E. Disposal of excavated material shall be in accordance with Federal, State and local regulations.

F. Excavate material, as required.

G. Existing trees that are to remain shall be adequately protected to ensure that they are not damaged.

H No burning of material will be allowed.

I. Existing bituminous and concrete pavement to remain shall be saw-cut in a neat line.

J. Contractor shall secure site at the end of each day and at the end of each week. No open trenches, excavations shall be allowed. At the end of each week the Owner's Representative shall complete an inspection of the site including security, erosion controls, and any other construction feature. The Contractor shall make any required modifications at no cost to the Owner and to the satisfaction of the Owner's Representative.

K. During the progress of the work, keep all adjacent sidewalks, drives, and streets clean and free of dirt and debris.

3.2 HA ARDOUS MATERIAL AND WASTE CONTROL

A. Excavation and disposal of contaminated, polluted, or "environmentally compromised" materials shall be conducted in conformance with the environmental and abatement specifications. The handling of contaminated polluted or "environmentally compromised" water to be discharged as a result of dewatering shall be performed in accordance with the environmental and abatement specifications.

END OF SECTION 31 11 00

EXCAVATION AND FILL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Excavation and disposal of existing materials, and earth excavation for trenches, construction of roads, foundations, walls, concrete paving, curbs, drainage, rain gardens, lawn, planting areas and other work.; backfilling and compacting excavations and trenches; furnishing necessary material; compaction; furnishing material for and constructing fill areas, embankments; miscellaneous earth excavations and miscellaneous grading.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to work of this Section.

B. All related Specification Sections shall be used in conjunction with this Section.

1.3 RELATED WORK

A. Division 02 Section “Maintenance and Protection of Traffic”

B. Division 31 Section “Site Preparation and Demolition”

C. Division 31 Section "Site Backfill"

D. Division 32 Section "Bituminous Asphalt Concrete Paving"

1.4 EXCAVATION CLASSIFICATIONS

A. Earth excavation or "excavation" consists of removal of materials encountered to the subgrade elevations indicated and subsequent reuse or disposal of the materials removed. All excavation is classified as earth excavation unless it otherwise meets the classifications provided below for unauthorized excavation, additional excavation, or rock excavation.

B. Unauthorized Excavation:

1. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of the Engineer. Unauthorized excavation, as well as remedial work directed by the Engineer, shall be at Contractor's expense.

C. Additional Excavation:

1. When excavation has reached required subgrade elevations, notify the Engineer who will make an inspection of conditions.

2. If unsuitable bearing materials are encountered at required subgrade elevations,

carry excavations deeper and replace excavated material as directed by the Engineer.

3. Removal of unsuitable material as directed and its replacement with suitable material will be paid for under the unit rate bid for this classification.

D. Trench Excavation:

1. Refer to Division 31 Section 31 23 23 Trenching and Backfilling.

1.5 SUBMITTALS

A. General: Refer to Division I for Submittal Requirements.

B. Laboratory and field test results including existing topsoil analysis, soil gradation, Modified Proctor and compaction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Subsoil Suitable for Reuse: Material used for general filling outside of limits of pavements may be either approved material available from excavation on-site or approved material, obtained from off-site, certified to conform to the following grain-size gradation:

Square Mesh Sieve	% Passing (by Weight)
3 ½"	100
2"	90
¼"	30-80
#40	5-30
#100	0-15

It shall be clean, free of clay and organic material and capable of satisfactory compaction. If sufficient approved on-site material is not available to meet grading requirements indicated, Contractor shall provide additional approved off-site material at no extra cost to Owner.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine the site and all work prepared by others and report to the Ownerr in writing any conditions detrimental to the proper and timely completion of work until unsatisfactory conditions have been corrected in an acceptable manner.

B. Verify stockpiled fill to be reused is approved.

C. Verify areas to be backfilled are free of debris, snow, ice or water, and ground surfaces are not frozen.

3.2 GENERAL

A. Erosion Protection: Prevent erosion on open cut slopes and beams at all times.

B. Construction Traffic: Disperse travel paths of traffic and construction equipment over entire width of compacted surfaces to aid in obtaining uniform compaction. Protect exposed soil layers with high moisture content from excessive wheel loads.

C. Use of Materials Found on the Site:

1. It is anticipated that some existing on-site materials may be suitable for use as fill material. If deemed suitable by the Engineer, the on-site material shall be placed and compacted in a manner conforming to the applicable specifications for backfill and fill material.

2. All unsuitable material, and suitable material not required for the proper completion of the Contract shall be removed and properly disposed of away from the jobsite at no additional cost to the Owner.

3. Do not excavate or remove any material from the site or right-of-way, which is not within the excavation, as indicated in the Drawings, without written authorization from the Owner.

D. Stockpiling of Material: Establish material stockpiles on site only at locations which will not interfere with the progress of the work. Such off-site stockpiling shall require written permission from the Owner. Place, grade, and shape stockpiles for proper drainage. Place erosion controls as required. Off-site stockpiling and re-handling, if required shall be the responsibility of the Contractor, at no additional expense to the Owner.

E. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.

F. Dispose of excess excavated soil material and materials not acceptable for use as backfill or fill off-site in a legal manner at no expense to the Owner.

G. Excess material may be generated as a result of excavations and grading. All excess material shall be disposed of legally off-site at the Contractor's expense.

H. Site areas requiring new fill shall be stripped of all topsoil, organics, and soft yielding material prior to the depositing of fill material.

I. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding the project site and surrounding area. The Contractor shall not convey water to any area outside the project limits.

J. Unfavorable Weather:

1. Fill and backfill materials shall not be placed on snow, ice, frozen subgrades or

un-compacted frozen soil.

2. Fill and backfill materials shall not be frozen when placed or be allowed to freeze prior to compaction. At the end of each day's work during freezing weather, the last lift of fill, after compaction, shall be rolled by a smooth-wheeled roller to eliminate ridges of un-compacted soil. The Contractor shall suspend backfilling operations when air temperatures are below 32 degrees F, if so directed by the Engineer.

3. Do not excavate to full indicated depth when freezing temperatures may be expected, unless slabs are poured immediately after the excavation has been completed. Protect the excavation from frost if placing of concrete is delayed. Concrete for foundations or slabs shall not be placed on frozen soil.

4. Soil bearing surfaces below completed slabs and foundations shall be protected against freezing. Frost protection shall be provided in a manner acceptable to the Architect as soon as practicable after slabs/foundations are constructed.

5. Wet Weather: If fill material placement, spreading, rolling or compaction operations are interrupted by heavy rain or other unfavorable conditions, do not resume such operation until ascertaining that the moisture content and density of the previously placed soil are as required by these specifications.

K. Bracing, Sheeting and Shoring

1. Provide all bracing, sheeting and shoring, where necessary to retain the sides of excavations and to prevent movement or settlement or adjacent structures, utilities, piping, conduit, roads and streets, etc. The Contractor shall be entirely responsible for the strength and adequacy of all such bracing, sheeting and shoring, and shall, if required, submit fully detailed shop drawings for review. The Contractor is solely and entirely responsible for the safety and support of such structures, utilities, etc., and is liable for any damage or injury caused by or resulting from any such movement or settlement.

2. Issue any notices to Owner of adjoining property, which may be required by any pertinent laws or ordinances. Furnish copies of such notices to the Owner.

3. Refer to Section 314100 Excavation Support.

3.3 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Identify known underground utilities. Stake and flag locations.

C. Identify and flag surface and aerial utilities.

D. Notify the appropriate utility authority to remove and relocate utilities.

E. Maintain and protect existing utilities remaining which pass through work area.

3.4 PROTECTION

A. Protect trees, shrubs, lawns, and other features remaining as a portion of final landscaping.

B. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from equipment and vehicular traffic.

C. Protect above and below grade utilities which are to remain.

D. Protect excavations by shoring, bracing, sheet piling, underpinning, or other methods required to prevent cave-in or loose soil from falling into excavation.

E. Underpin adjacent structures which may be damaged by excavation work, including service utilities and pipe chases.

F. Notify Engineer of unexpected subsurface conditions such as rock if encountered. Discontinue affected work in area until notified to resume work.

G. Protect bottom of excavations and soil adjacent to and beneath foundations from frost.

H. Grade excavation top perimeter to prevent surface water runoff into excavation.

I. Maintain bottom of all excavations stable, dry and free of water on a 24-hour basis.

3.5 EXCAVATION

A. Excavate topsoil and subsoil required for underground structures, construction operations, and other work.

B. Remove all muck, peat and other unsuitable bearing material from areas where structures are to be located. If unsuitable material exists at limits of excavation shown on Drawings, obtain approval of Engineer prior to removal of material. Unauthorized excavation of unsuitable material will not be considered for payment.

C. Machine slope banks to angle of repose or less until shored.

D. Excavation generally shall not interfere with normal 45° bearing splay of any foundation.

E. Hand trim excavation and leave free of loose matter.

F. Correct unauthorized excavation at no additional expense to the Owner with material approved by the Engineer.

G. Fill over-excavated areas under structure bearing surfaces with structural fill in accordance with direction by the Engineer.

H. Stockpile excavated material to be reused in area designated on site and remove excess or unsuitable subsoil not being reused from site.

I. Maintain bottom of all excavations stable, dry and free of water on a 24-hour basis.

J. Excavate to the lines and grades indicated, and deeper as required to reach suitable bearing soil as judged by the Engineer. The excavation shall be made deeper in areas where the subgrade is judged by the Engineer to have inadequate bearing capacity.

K. Conduct unclassified excavation using appropriate methods and equipment in sufficient quantity and sizes to perform the work as specified and as shown on the Drawings.

L. Adhere to specified restrictions for excavation and removal of buried structures.

M. Carry out excavation in such a manner that damage to adjacent roads, structures and utilities is prevented.

N. Control the inflow of water into excavations by acceptable construction de-watering methods and procedures. Control the inflow of water to prevent loss of materials from outside the limits of excavation.

O. Prevent disturbance to all soil subgrades.

P. Remove unsuitable and excess suitable excavated material from the excavation and site promptly. Do not stockpile excavated material immediately outside the site limits. Surplus and unsuitable materials shall be hauled away and disposed of at no additional cost to the Owner.

Q. Limits of the excavation shall allow for adequate working space for installing forms and as required for safety of personnel.

R. Remove unstable bottom material. Remove large stones, boulders, debris and unsuitable soil from excavation bottoms.

S. Excavation for the convenience of the Contractor shall conform to limits acceptable to the Engineer and shall be at no additional expense to the Owner.

T. Contractor shall provide 8-inches of 3/8" crushed stone at bottom of excavations in water.

3.6 SUBSURFACE OBSTRUCTIONS

A. All buried structures shall be removed in confined excavations as general excavation proceeds. Do not excavate for buried structure removal below subgrade elevations unless otherwise directed by the Engineer.

B. Buried structures which extend below foundation subgrade elevations shall be cut off and left in place below the subgrade elevation, except as directed by the Engineer. If the buried structures directly interfere with a foundation support location, immediately notify the Engineer who will determine whether the buried structures should be removed or left in place. The Contractor will be paid for removal of buried structures encountered below subgrade elevations only when removal of the buried structures is directed by the Engineer.

C. Buried structures below subgrade elevations which are removed by the Contractor without being directed by the Engineer to do so shall be backfilled with lean concrete or properly compacted granular fill, unless otherwise directed by the Engineer, at no additional cost to the Owner.

3.7 EXCAVATION FOR STRUCTURES

A. Excavation for buildings shall be done to provide proper bearing for structures, to produce the proper grade and dimensions for finished construction, and in a satisfactory manner.

B. Excavation related to the building shall be to the full depth required to provide suitable bearing material.

C. All traces of peat, loam or other unsuitable materials shall be fully removed.

D. Site preparation and other construction activities shall be conducted in a manner so as to minimize the disturbance of clay soils to remain in place, where applicable.

3.8 FIELD UALITY CONTROL

A. All subgrades must be observed and approved by the Engineer prior to fill placement. Sufficient time must be given to the Engineer to observe and perform any necessary tests on the subgrade.

B. The Contractor shall provide all offsets and other construction reference points necessary to establish and maintain location and elevation of all proposed improvements as shown on the Drawings and as field approved by the Owner's Representative during construction.

C. The Contractor, at his own expense, shall do all engineering required for establishing grades, lines, levels, dimensions and reference points for all trades; shall be responsible for maintaining bench marks and other survey marks, and shall replace as directed, any bench marks which have been disturbed or destroyed.

D. The Contractor shall compare all grades, lines, levels and dimensions as shown on the Drawings and actual site conditions, and shall promptly report to the Owner, before commencing work, any inconsistencies he may discover.

3. NOTIFICATION

A. When ledge rock or boulders are encountered, the material shall be uncovered and the Engineer notified. The Contractor shall be responsible for and provide the Engineer with cross sections of the ledge rock surface. The Engineer shall be notified in advance as to when the cross section of ledge is to be made.

If the Contractor uncovers ledge, but fails to notify the Engineer, the Contractor shall have no right of claim to any classification other than that allowed by the Engineer.

B. The average end area method shall be used in the computation of volumes wherever practicable.

3.10 LIMITS OF EXCAVATION IN ROCK

A. Excavation in rock shall be performed, unless otherwise indicated on the Plans directed, so that no projection shall come within vertical planes 12 inches outside of the structure being built, 12 inches below the bottom of the structure base slab and footings, or as shown on the Drawings. In trenches, the rock shall be removed to the limits shown on

the typical trench section. Where excavation is carried beyond the above determined limits, the additional space shall be refilled at the Contractor's expense with concrete or other selected material, as directed by the Engineer.

3.11 REMOVAL OF ROCK

A. No blasting will be allowed on this project.

B. Perform rock excavation in a manner that will produce material of such size as to permit it being placed in embankments in accordance with Section 312300. Remove rock to limits indicated. Remove loose or shattered rock, overhanging ledges and boulders which might dislodge.

C. Rock Excavation - Mechanical Method:

1. Excavate for and remove rock by mechanical method. Drill holes and utilize expansive tools and wedges to fracture rock.

2. Cut away rock at excavation bottom to form level bearing. Remove shaled layers to provide sound and unshattered base for foundations.

3. In utility trenches, excavate to 6 inches below invert elevation of pipe and 24 inches wider than pipe diameter.

4. Remove shaled layers to provide sound unshattered base for footings and foundations.

5. Re-use excavated rock materials on-site in accordance with Section 02300.

6. Remove excavated rock materials not re-used off-site.

D. Use lean concrete or suitable materials to replace rock overblast or overexcavation in building area and in expansion area to facilitate placement of utilities and future footings.

3.12 DISPOSAL AND REPLACEMENT OF ROCK

A. Rock shall be considered unsuitable for backfilling and removed from the site.

B. Rock and boulders shall be replaced at no additional expense to the Owner with suitable material as specified above.

C. If rock below limits of excavation is shattered by blasting, caused by holes drilled too deep, or too heavy charges of explosives, or any other circumstance due to blasting, and if such shattered rock does not provided suitable foundation, the rock shall be removed and the excavation refilled with gravel at the expense of the Contractor. The gradation of gravel shall be as specified above.

3.13 SUBGRADE PREPARATION AND PROTECTION

A. General:

1. Complete the excavations to the required subgrade elevations allowing for subbase material, bedding layers, plus any additional depth required to

accommodate particular requirements.

2. All subgrades must be observed and accepted by the Engineer prior to proof-rolling or placement of Compacted Granular Fill or any structure over subgrades.

3. Remove any additional materials below subgrade elevations, which are unsuitable where directed by the Engineer.

4. Proof-roll the exposed subgrade with a minimum 10-ton vibratory roller for a minimum of four (4) passes or as required by the Engineer.

5. Where directed by the Engineer, backfill all holes or voids encountered outside of minimum excavation limits with Compacted Granular Fill in layers not exceeding nine (9) inches measured before compaction and compact to 95 percent of maximum dry density (ASTM D1557) using appropriate compaction equipment.

3.14 PLACEMENT AND COMPACTION OF MATERIALS

A. General

1. Notify Owner's Representative when excavations have reached required subgrade elevations. When the Owner's Representative determines that unforeseen unsatisfactory soil is present as defined earlier, continue excavation and place with compacted granular fill material as directed.

2. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the Owner's Representative at no additional cost to the Owner.

3. Backfills of the various types specified shall be placed and compacted within the limits and to the thickness indicated on the Drawings unless otherwise specified.

4. All backfill material shall be placed "in-the-dry" on subgrades acceptable to the Engineer. The Contractor shall pump to remove water from within excavated areas on subgrade surfaces as required to perform the work, and in such a manner as to preserve the undisturbed state of the approved subgrade material.

5. The Contractor shall not place a layer of compacted fill on snow, ice, or soil that was permitted to freeze prior to compacting. Removal of these unsatisfactory materials will be required as directed by the Owner.

6. Compacted fill shall not be placed when temperatures are below freezing.

7. Processed Subbase for bituminous concrete pavements shall be placed in two courses and shall be in accordance with Section 3.04 of the CONNDOT Specification 817.

8. Under footings, foundation bases or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Lean concrete may be used to bring

elevations to proper position, when acceptable to Owner's Representative.

9. Under structures, building slabs and steps, and pavements, compact top 12 inches of subgrade and each layer of backfill or fill material at 95 percent maximum density.

10. Place backfill materials evenly adjacent to structures to required elevations. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around structure to approximately the same elevation in each lift.

11. Do not place any fill against retaining walls until concrete has sufficiently set to withstand pressure. Bulldozer, trucks, rollers and other mechanical equipment used in placement and compaction of backfill are expressly prohibited from approaching within 8 feet of walls unless protective measures are taken to insure transfer of loads away from walls.

12. Placement of all specified fill and backfill materials shall be systematically conducted in the specified uniform layer thicknesses.

13. Measurement of backfill layer or lift thickness shall be conducted in all cases prior to compaction.

14. Compaction of backfill materials shall be conducted with a minimum of four (4) complete coverages with acceptable compaction equipment and to at least the minimum specified density, which is expressed as a percentage of maximum dry density as determined by ASTM D1557.

B. Backfill excavations as promptly as work permits, but not until completion of the following:

1. Acceptance by the Engineer of construction below finish grade including, where applicable, damp-proofing, waterproofing, utility placements, etc.

2. Completion of quality control testing, acceptance by the Engineer and recording locations of underground utilities.

3. Removal of concrete formwork unless formwork is specified to remain in place.

4. Removal of temporary excavation support elements and backfilling of voids with materials acceptable to the Engineer.

5. Removal of trash and debris.

6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

C. Compaction Equipment:

1. In all cases, the Contractor shall only use compaction equipment, which is deemed acceptable by the Engineer.

2. Compaction in open areas shall be conducted with heavy equipment such as vibratory rollers weighing at least 15,000 lbs., or by other acceptable equipment.

3. Compaction in confined areas (against walls, footings, piers and in trenches) shall be conducted with acceptable equipment such as hand-guided vibratory compactors or tampers.

D. Control of Moisture: The amount of moisture in any one layer of backfill material shall be as uniform as practicable throughout.

1. The upper limit of water content in materials shall be that which will permit handling and placing and will permit proper compaction with the Contractor's equipment. In no case shall the water content during compaction exceed a value of two (2) percentage points on the wet side of optimum water content as determined by ASTM D1557.

2. The lower limit of water content shall not be less than two (2) percentage points below optimum water content. Material, which is too wet, shall be spread and permitted to dry, assisted by mechanical agitation, if necessary, until the water content is reduced to a value within the specified limits. Each layer of material, which is too dry, shall be sprinkled with water, and the water worked into the material by mechanical methods until a uniform distribution of moisture is obtained. Water applied to a layer of material shall be accurately controlled in amount sot hat free water will not appear on the surface during or subsequent to compaction.

E. Backfill and Fill Materials:

1. Place in layers not to exceed eight (8) inches when utilizing heavy compaction equipment and in four (4) inch layers when utilizing light hand operated compaction equipment.

2. Compact each layer of fill to the maximum dry density, percentage of ASTM D1557 indicated below or as directed by the Engineer.

a. Paved areas - 95 percent

b. Grassed Areas - 90 percent

F. Granular and Stabilized Subbase Materials:

1. Place in layers not to exceed six (6) inches when utilizing heavy compaction equipment and four (4) inches when utilizing light hand operated compaction equipment.

2. Procedures for placing granular fill and backfill shall conform to Form 817 Section 2.16. Granular fill and backfill shall be compacted to 95% modified proctor density as defined by ASTM D1557.

3. Place a minimum six (6) inch thickness below slabs-on-grade and paving slabs.

4. Subgrade beneath Granular fill should be compacted to 95% modified proctor density. Compact subgrade in accordance with Articles 2.09.03.

5. Compact Granular Fill to at least 95 percent of maximum dry density.

3.15 GRADING AND COMPACTING

A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with the compaction requirements and grade to profiles, lines and elevations shown on the plans. Provide a smooth transition between existing adjacent grades and proposed grades. Cut out soft spots, fill low spots, and trim high spots to conform to required surface tolerances.

B. Site grading: Slopes grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or unpaved areas: Plus or minus 1 inch

2. Walks: Plus or minus 1/2 inch

3. Pavements: Plus or minus 1/2 inch

4. Grading inside building lines: Plus or minus 1/4 inch when tested with a 10-foot straightedge.

C. Fine Grading and Compacting: Shape the subgrade to a fine surface conforming to the indicated cross section, and compact fill material to the maximum dry density specified. Cut down all high spots, fill depressions and re-compact until the surface is smooth and satisfactorily compacted.

D. Grading and Finishing: In areas designated for grading and finishing, rake or machine-grade the areas to remove stones over two inches and other unsatisfactory material; fill depressions and finish the surface within the indicated tolerances.

3.16 PLACEMENT OF GRANULAR AND STRUCTURAL FILL MATERIALS

A. Gravel and structural fill shall be a minimum of 8" deep and shall extend to undisturbed soil at all locations.

B. Installation shall be in layers no more than 8" deep for material compacted by 10-ton vibratory rollers and not more than 4" deep for material compacted by hand-operated tampers.

C. Material shall be compacted to a minimum of 95% optimum density as determined by the laboratory tests. All areas not meeting the required density shall be recompacted, at the Contractor's expense, until the required density is achieved.

D. Granular and structural fill shall be placed in the following locations:

1. Beneath slabs on grade within building area

2. Beneath exterior equipment slabs and entrance platforms

3. All other areas specifically noted on the drawings

E. When a compacted drainage course is indicated to be 8 inches thick or less, place material in a single layer. When indicated to be more than 8 inches thick, place material in less than 6 inches in thickness when compacted. Each layer shall be compacted to 95% of modified optimum density as achieved by AASHTO Method T180.

F. Gravel and structural fill shall be compacted at moisture content, which will allow proper compaction. Gravel and structural fill shall not be placed where standing water is present.

G. Gravel and structural fill shall be recompacted where disturbed by installation of pipes, conduits, etc. Compaction shall be performed so as not to damage the installed items. The excavation and recompaction described above is included in the Contract.

H. Grading Surface of Fill Under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation, provide final grades within a tolerance of 1/2 inch when tested with a 10-foot straightedge.

I. Protect all compacted gravel and structural fill from saturation with excess moisture and from freezing. Any material that loses its required density due to excess moisture or freezing shall be removed, replaced, and compacted at the Contractor's expense.

J. Do not backfill against foundation walls until walls have been adequately braced. Where backfill occurs on both sides of wall, keep levels of fill equal on each side at all times.

3.17 COMPACTION TESTING

A. Compaction testing will be performed in accordance with ASTM D 1556, or D 2922 and the General Conditions.

B. If tests indicate work does not meet specified requirements, remove work and replace at no cost to Owner.

3.18 TOLERANCES

A. Top Surface of Backfilling: Plus or minus one inch.

3.1 HA ARDOUS MATERIAL AND WASTE CONTROL

A. Excavation and disposal of contaminated, polluted or “environmentally compromised” materials shall be conducted in conformance with the environmental and abatement specifications. The handling of contaminated, polluted or “environmentally compromised” water to be discharged as a result of dewatering shall be performed in accordance with the environmental and abatement specifications. The Contractor is responsible for all additional testing, cost and schedule associated with the disposal facility selected by the Contractor.

END OF SECTION 31 23 00

DEWATERING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to work of this Section.

B. 2002 Connecticut Erosion and Sedimentation Guidelines

C. All related specification sections shall be used in conjunction with this section.

D. Connecticut Department of Transportation Form 817.

1.2 SYSTEM PERFORMANCE RE UIREMENTS

A. Dewatering shall include all necessary control and disposal of groundwater on a 24-hour basis during construction.

B. Dewatering shall include the lowering of the groundwater table to relieve any hydrostatic head that could cause a decrease in the stability of the excavated subgrade. It shall also include the intercepting of seepage, which could otherwise emerge from the slope or sides of excavations, which could cause a decrease in the stability of the excavated subgrade or the slopes or sides of the excavations.

C. Dewatering shall be performed during construction to temporarily protect against the following:

1. The loss of any material beneath the excavated subgrade or from the slopes or sides of the excavations or the movement of any fine particle materials from the soil.
2. Any increased vertical or lateral loads on the excavation support systems.
3. Any disturbance, rupture, instability, boiling or heaving of the bottom of excavated subgrade during:
    a. Excavation.
    b. Placement of foundation or bedding materials.
    c. Construction of slabs, footings, pipes, conduits, underdrains and any other structures.
    d. Backfilling operations.

D. The Contractor is forbidden from discharging water collected from the dewatering operations directly into watercourses, wetlands areas, and storm drainage systems. As a result, the Contractor shall provide for methods, materials, and construction, to be approved by the Engineer and Owner, for collection and treatment of the dewatering operations discharge(s). At a minimum, these methods will include conveying the

discharged water through a sedimentation system, appropriately sized for the operation, as described in Section 31 25 00 and indicated on the drawings.

If, in the sole opinion of the Engineer, the sedimentation system is inadequate, the contractor shall be required to provide dual compartment septic tank, appropriately sized for the operation, to which the dewatering water shall be directed.

In no case will discharge containing visible sediment, or other pollutants be allowed to discharge to wetlands areas or drainage systems. The proposal for treating the dewatering discharge water shall be prepared by a Connecticut Registered Professional Engineer.

1.3 ADDITIONAL PROVISIONS

A. Provide, operate, and maintain any dewatering system required to lower and control groundwater levels and groundwater hydrostatic pressure during the construction of the work, as required by this Section and the Contract Documents with no additional time allowed for the completion of the work.

B. Remove and dispose of water resulting from activities described in 1.1 A and C, and 1.2 C above.

C. Remove dewatering systems and equipment when no longer required.

1. 4 SUBMITTALS

A. Submit under provisions of Division 1.

B. DEWATERING PLAN: The Contractor shall submit plans for the proposed dewatering system to the Engineer for review. Dewatering system shall be designed by a Professional Engineer licensed to practice in the State of Connecticut for the drainage area being directed to the dewatering system and submitted for review. Sizes and locations shown on the plans are minimums.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 GENERAL PRACTICES

A. The dewatering system shall be capable of developing an excavated subgrade relieved of any hydrostatic pressure that could cause a decrease in the stability of the excavated subgrade and which will provide the necessary groundwater control for the proper performance required for completion of the work.

B. The dewatering system shall not cause damage to newly constructed or existing properties, buildings, utilities and other work due to the loss of ground or support from

incompletely drained soils or from removal of soil particles caused by the dewatering system.

C. Dewatering facilities shall be located only where they will not cause interference with work performed by others.

D. If the dewatering system utilized by the Contractor causes or threatens to cause damage to new or existing facilities, the dewatering system shall be removed and/or modified at no additional expense to the Owner.

E. Dispose of subsurface water collected in a manner that conforms to all applicable local and state ordinances, statutes and laws as well as Section 1.1 above.

F. Maintain continuous and complete effectiveness of the installation at all times.

G. Provide dewatering necessary to maintain the groundwater table a minimum of 2 feet below the bottom of excavated subgrade or the prevailing level of backfill as it is being placed. The groundwater table shall also be maintained at a level, which will not result in uplift pressure in excess of 80% of the downward pressure produced by the weight of the structure and any backfill in place.

3.2 JOB CONDITIONS

A. Erosion Control: The Contractor shall provide adequate protection from erosion from any of the dewatering operations utilized during the course of the construction. Any damage, disruption, or interference to newly constructed work or existing properties, building, structure, utilities and/or other work resulting directly or indirectly from dewatering operations conducted under this Contract shall be remedied by the Contractor to the satisfaction of the Engineer, at no cost to the Owner.

B. Treatment of Dewatering Operations Discharges: It shall be the responsibility of the Contractor to provide such additional treatment as may be required to meet the provisions of the Contract. This may include the construction of sumps and/or settling basins, stone rip rap, silt fences or other the noted septic tankage requirements. They shall be provided and later removed and/or filled in with acceptable backfill material once they are no longer needed at no additional expense to the Owner.

3.3 HA ARDOUS MATERIAL AND WASTE CONTROL

A. Excavation and disposal of contaminated, polluted, or ñenvironmentally compromisedò materials shall be conducted in conformance with the environmental and abatement specifications. The handling of contaminated, polluted, or ñenvironmentally compromisedò water to be discharged as a result of dewatering shall be performed in accordance with the environmental and abatement specifications.

END OF SECTION 31 23 1

SITE BACKFILL

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide all labor, materials and equipment necessary to perform site related backfilling operations shown on the Drawings, described herein, or reasonably inferable from either or both.

B. Include performing backfilling for embankments, and consolidation and compaction.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to work of this Section.

B. All related specification sections shall be used in conjunction with this Section.

1.3 REFERENCES STANDARDS CODES AND REGULATIONS

A. Conform to the latest editions of the following, unless otherwise specified herein:

ASTM C136	Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D1556	Test Method for Density of Soil in Place by the Sand-Cone Method
ASTM D1557	Test methods for Moisture Density Relations of Soils and Soil-Aggregate Mixtures using 10 Lb. Hammer and 18-Inch Drop: Modified Proctor Applicable Method
ASTM D2922	Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
CONNDOT	State of Connecticut Department of Transportation Standard Specification for Roads, Bridges and Incidental Construction (Form 817)

B. All Applicable Local and State codes and regulations.

1.4 SUBMITTALS

A. Submit the following in accordance with Division 1 Specification Sections.

1. Name, address, and telephone number of Supplier for each type of fill material to be used on the project and source (location) of material.

2. Samples: Submit 50 lb. sample of each type of fill material in air-tight containers to Engineer to be tested by others. Contractor shall notify Engineer 24 hours prior to sampling. Contractor shall perform sampling in the presence of the Engineer or

his authorized representative.

1.5 UALITY ASSURANCE

A. Conform to all applicable referenced standards.

B. Observations: Workmanship and materials furnished under this Specification will be subject to observation by the Engineer. Damaged material and materials not conforming to the Specification or Drawings may be rejected at any time. Remove rejected materials and replace without expense to the Owner. Notify the Engineer in advance of starting work in order that observations may be made.

C. Tests:

1. General: The Owner shall pay for the cost of testing. Cooperate with testing agency to maintain a complete record of samples taken, giving source (location) of each sample.

2. Results: If the test results indicate the material does not meet the Specifications, the Owner or his representative may require additional tests or new samples from the same source or new sources of material provided by the Contractor.

3. Additional testing: If additional testing is required as a result of samples originally tested not meeting specifications, or additional testing is required when material is obtained from more than one source, the cost for additional testing shall be paid for by the Contractor (see Division 1 specifications).

PART 2 - PRODUCTS

2.1 OFF-SITE SELECT FILL MATERIALS

A. Crushed Stone: Crushed stone material shall consist of clean, hard, durable, crushed particles or fragments of stone or ledge rock of uniform quality reasonably free of thin or elongated pieces.

1. The materials shall be free from ice, snow, rubbish, sods, roots and other deleterious or organic materials.

2. Gradation shall be as specified on the Contract Drawings.

B. Processed Aggregate Base Gravel: Gravel shall be clean, free from ice, snow, rubbish, sods, roots and other deleterious or organic materials and shall conform to the ConnDOT Form 817 M.05.01.

C. Road Subbase: The material shall be free from ice, snow, rubbish, sods, roots, and other deleterious or organic materials and shall conform to the ConnDOT Form 817 M.02.02.

D. Bank Run Gravel and Granular Fill shall comply with Article M.02 of the Form 817. Use a maximum 3 in. size for fill placed within 12 in. of concrete slabs or foundations unless otherwise noted.

E. Sand: Sand shall be clean, free from ice, snow, rubbish, sods, roots and other deleterious or organic materials and shall conform to the following gradation requirements.

SIEVE SI E	PERCENT PASSING BY WEIGHT
No. 4	95% - 100%
No. 8	80% - 100%
No. 16	50% - 85%
No. 30	25% - 60%
No. 50	10% - 30%
No. 100	2% - 10%

2.2 COMMON FILL MATERIALS

A. Subsoil Suitable for Reuse: As specified in Section 312300.

B. Additional common fill required shall exclude debris, concrete or other rubble, organic matter, topsoil, all soft or wet much, peat or clay, excavated ledge material and all rocks over 6 inches in largest dimension.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify stockpiled fill to be reused is approved.

B. Verify areas to be backfilled are free of debris, snow, ice or water, and ground surfaces are not frozen.

3.2 PREPARATION

A. Before the first layer of fill or base material is placed, the entire work area of the original ground shall be compacted to the density required to fill materials.

B. Maintain all areas to be backfilled, stable, dry and free of water on a 24-hour basis.

C. Prepare natural subgrade in accordance with Section 312300 – Excavation and Fill.

3.3 BACKFILLING

A. All liquid holding structures shall be tested for leakage prior to backfilling.

B. Do not backfill against any wall until waterproofing membrane has been approved by the Owner's Representative.

C. Contractor is responsible for damage to walls, and utilities, resulting from earth backfilling, trapped water or other causes.

D. Backfill areas to required contours and elevations. Use unfrozen materials.

E. Backfill systematically, as early as possible, to allow maximum time for natural settlement. Do not backfill over porous, wet, or spongy subgrade surfaces.

F. Protect fill area by grading to drain and providing a smooth surface which will readily shed water. Grade the surface of the areas in such a manner as to prevent ponding of surface water runoff in areas to receive compacted fill.

G. To the extent that it is practicable, each layer of fill shall be compacted to the specified density the same day it is placed.

H. Fill that is too wet for proper compaction shall be disced, harrowed or otherwise dried to a proper moisture content for compacting to the required density. If the fill material cannot be dried within 48 hours of placement, it shall be removed and replaced with drier fill.

I. If fill is too dry for proper compaction, the Contractor shall apply water to the fill uniformly applied over the surface of the loose layer. Sufficient water shall be added to allow compaction to the required density.

J. Employ a placement method so not to disturb or damage work.

K. Maintain optimum moisture content of backfill materials to attain required compaction density.

L. Backfill against supported foundation walls unless noted otherwise.

M. Where both sides of a wall are to be backfilled, the difference in depth of fill from one side to the other shall be no more than 8 inches.

N. Make changes in grade gradually. Blend slopes into level areas.

O. Remove surplus backfill materials from site and dispose of in an acceptable manner.

P. Leave stockpile areas completely free of excess fill materials.

Q. Contractor shall be aware of existing conditions, including existing building construction, and shall choose compaction equipment and methods accordingly. Compaction adjacent to foundation walls shall be performed with walk behind plate compactor.

R. Fill, and placement thereof, required due to over-excavation not approved shall be paid for by the Contractor.

3.4 AGGREGATE PLACEMENT

A. Spread coarse aggregate over prepared base to a total compacted thickness as indicated on the site plan details.

B. Place coarse aggregate in 6 inch layers and roller compact.

C. Level and contour surfaces to elevations and grades indicated.

D. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.

E. Compact placed aggregate materials to achieve compaction to 95% of its maximum dry density.

F. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.

G. Use mechanical vibrating tamping in areas inaccessible to compaction equipment.

3.5 TOLERANCES

A. Top Surface of Backfilling: Plus or minus one inch.

B. Aggregate Base

1. Flatness: Maximum variation of 1/4 inch measured with a ten foot straight edge.

2. Scheduled compacted thickness: Within 1/4 inch as shown on site plan details.

3. Variation from true elevation: Within 1/2 inch.

3.6 COMPACTION TESTING

A. Compaction testing will be performed in accordance with ASTM D 1556, or D 2922 and the General Conditions.

B. Compaction testing shall be performed on each lift of fill placed. Each lift shall have a minimum of 100 feet o.c. for roadway construction.

C. If tests indicate work does not meet specified requirements, remove work and replace at no cost to Owner. Retesting of replaced material shall be at the Contractor's expense.

3.7 FIELD UALITY CONTROL

A. All subgrades must be observed and approved by the Engineer prior to fill placement. Sufficient time must be given to the Engineer to observe and perform any necessary tests on the subgrade.

B. The Contractor shall provide all offsets and other construction reference points necessary to establish and maintain location and elevation of all proposed improvements as shown on the Drawings and as field approved by the Owner's Representative during construction.

C. The Contractor, at his own expense, shall do all engineering required for establishing grades, lines, levels, dimensions and reference points for all trades; shall be responsible for maintaining bench marks and other survey marks, and shall replace as directed, any bench marks which have been disturbed or destroyed.

D. The Contractor shall compare all grades, lines, levels and dimensions as shown on the Drawings and actual site conditions, and shall promptly report to the Owner, before commencing work, any inconsistencies he may discover.

END OF SECTION 31 23 24

TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.1 RELATED DOCUMENT

A. Drawings and general provisions of Contract, including General Supplementary Conditions, and Division 1 Specification sections, apply to this section.

1.2 SUMMARY

A. Provide all labor, materials, necessary equipment and services to complete the work called for in this Section or as shown on the plans, including but not necessarily limited to the following:

1. Excavating, backfilling and compacting for utilities. (All excavations for this project will be considered as unclassified excavation).
2. Addition of processed aggregate base or borrow (if required), and disposal of unsuitable or excess materials.
3. Granular fill for trench backfill.
4. Bank or crushed stone for use in utility trenches.
5. Geotextile (filter fabric).

B. Related Work: The following sections contain requirements that may apply to this section:

1. Section 31 11 00 - "Site Utility Preparation and Demolition.ò
2. Section 31 25 00 - ñStorm Water Pollution Control Plan (SWPCP).ò
3. Section 33 41 00 ï ñStorm Utility Drainage Piping.ò

1.3 SUBMITTALS

A. Submit for review sieve analysis of off-site borrow and all different fills for review. Provide test reports of existing material to determine if suitable for reuse.

B. Submit one modified proctor density test for each fill type in accordance with ASTM Method T-180.

1.4 UALITY ASSURANCE

A. All work of this section shall be provided in accordance with the latest edition of State of Connecticut Department of Transportation Form 817 which is considered to be part of this specification, the same as if fully set forth herein.

1.5 DEFINITIONS

A. Excavation consists of removal of material encountered to subgrade elevations indicated and the reuse (if acceptable) or subsequent disposal of excess materials removed. The classification for all excavations on this site shall be ñunclassifiedò and shall include but not be limited to the removal of any and all earth, rock, ledge, and unsuitable material as required to construct the buildings and pavement to the lines and grades shown in the drawings at no additional cost to the Owner.

B. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Owner's Representative. Unauthorized excavation, as well as remedial work directed by Owner's Representative, shall be at Contractor's expense.

C. Additional Excavation: When excavation has reached required subgrade elevations, notify Owner's Representative, who will make an inspection of conditions. If the Owner's Representative determines that bearing materials at required subgrade elevations are unsuitable, continue excavation until suitable bearing materials are encountered and replace excavated material as directed by Owner's Representative. The Contract Sum may be adjusted by an appropriate Contract Modification.

1. Removal of unsuitable material and its replacement as directed will be paid on the basis of Conditions of the Contract relative to changes in work.

D. Subgrade: The undisturbed earth or the compacted soil layer immediately below granular subbase, drainage fill, or topsoil materials.

E. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.

F. Subbase Course: The layer placed between the subgrade and the base course in a paving system or the layer placed between the subgrade and surface course of a walk.

G. Subbase Material: Gravel subbase material shall conform to the requirements of Section 2.12 of the Form 817. The minimum depth of subbase shall be as shown on the drawings and the contractor shall add additional processed aggregate base material as required.

H. Unsuitable Materials: ASTM D 2487 Soil Classification Groups:

SC Clayey sands, sand-clay mixtures.
ML Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity.
CL Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
OL Organic silts and organic silty clays of low plasticity.
MH Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
CH Inorganic clays of high plasticity, fat clays.
OH Organic clays of medium to high plasticity, organic silts.
Pt Peat and other highly organic soils.

SM Silt soils

1.6 PROTECTION

A. Underpin adjacent structures that may be damaged by excavation work, including service utilities and pipe chases.

B. Notify Owner's Representative of unexpected subsurface conditions and discontinue effected work in area until condition is resolved.

C. Protect bottom of excavations and soil adjacent to and beneath foundations against freezing when atmospheric temperature is less than 35°F.

D. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

E. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to sedimentation pools. Do not use trench excavations as temporary drainage ditches.

F. Grade top perimeter of excavation to prevent surface water runoff into excavation.

G. Use hay bales and silt fences for erosion protection and for preventing siltation of catch basins.

1.7 SPECIAL RE UIREMENTS

A. Before beginning work, the Contractor shall check, in the field, existing grades and layout as shown on the drawings and report any discrepancies that will affect the work of this contract to the Owner's Representative. Commencement of work will be implied to mean acceptance. No adjustments will be made for discrepancies discovered after work has begun.

B. The Contractor shall carefully protect all land monuments from disturbance or damage.

1.8 PROJECT CONDITIONS

A. Site Information: No subsurface investigations were completed for this project.

B. Locate existing underground utilities in areas of excavation work. If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.

C. Contractor shall be responsible to contact Call Before You Dig (CBYD), telephone 811, for information as to location of existing utilities and to obtain a permit number 48 hours before start of excavation. In the event CBYD cannot located the on-site utilities the Contractor shall hire a private utility marking company at no additional expense to the owner.

1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
2. Do not interrupt existing utilities serving facilities occupied by owner or others, during occupied hours, except when permitted in writing by Owner's Representative and then only after acceptable temporary utility services have been provided.
3. Provide the Owner's Representative a 48-hour minimum notice and wait to receive written approval to proceed before interrupting and utility.

D. Barricade open excavations occurring as part of this work and post with warning lights.

1. Operate warning lights as recommended by State authorities.
2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

PART 2 - PRODUCTS

2.1 ON-SITE MATERIALS

A. Existing site materials can be used for the following applications if in conformance with the applicable Section of the Specifications. The Contractor shall mix, pulverize, and add additional material as required to utilize material at no additional cost to the Owner.

2.2 OFF-SITE MATERIALS

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

B. Common Fill - Borrow shall comply with Article 2.07.02 of the CONN DOT Form 817.

C. Granular Fill shall comply with Article M.02.01 of the CONN DOT Form 817. Use a maximum 3 in. size for fill placed within 12 in. of concrete slabs or foundations.

D. Trench backfill under pavements shall consist of compacted gravel subbase and compacted processed base to the depths as shown on the plans. Compacted gravel subbase shall conform to Form 817, Article M.02.01. Compacted processed base shall conform to Form 817, Section M.05.01.

E. Processed or crushed stone shall conform to CONN DOT Form 817, Section M.02 for the size noted on the drawings and consist of sound, durable stone free of soft disintegrated pieces, mud, dirt, organic, or other injurious material.

F. Free-Draining Material shall conform to CONN DOT Form 817, Section M.02.07.

G. Geotextile (Filter Fabric) shall conform to Section 7.55 of the CONN DOT Form 817 and shall meet the following minimum requirements:

minimum fabric weight of 16 oz./sy
minimum grab tensile strength of 425 lbs
minimum puncture resistance of 195 lbs

2.3 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility.

PART 3 - EXECUTION

3.1 GENERAL

A. Stockpile excavated materials acceptable for backfill and fill where directed on the drawings. Place, grade, and shape stockpiles for proper drainage. Place erosion controls as required.

B. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.

C. Dispose of excess excavated soil material and materials not acceptable for use as backfill or fill off-site in a legal manner at no expense to the Owner.

D. Excess material may be generated as a result of excavations and grading. All excess material shall be disposed of legally off-site at the Contractor's expense.

E. Site areas requiring new fill shall be stripped of all topsoil, organics, and soft yielding material prior to the depositing of fill material.

F. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding the project site and surrounding area. The Contractor shall not convey water to any area outside the project limits.

3.2 TRENCH EXCAVATION AND BACKFILL

A. Trench excavation shall conform to Section 2.05.03 of the Form 817 Standard State Specifications.

B. Cut trenches sufficiently wide to enable installation of materials and to allow inspection. Slope banks to angle of repose or install shoring where needed.

C. Excavate trenches to depth indicated or required to establish indicated slope and invert elevations.

D. Unless otherwise shown, separate trenches for each utility shall be provided. Maintain ready access for fire-fighting apparatus.

E. Grading trench bottoms: The bottom of the trenches shall be graded evenly to insure uniform bearing for full length of all pipes. Excavate to at least 6" below the pipe.

F. Place and compact bedding course on rock and other underlying bearing surfaces and to fill unauthorized excavations. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Hand trim for bell and spigot pipe joints.

G. Place and compact trench backfill in accordance with Article 6.51.03 of the Form 817. Coordinate backfilling with required utilities testing.

H. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

I. The Contractor shall keep trenches free from standing water at all times. All necessary well pointing and/or pumping shall be performed and maintained at the Contractor's expense.

3.3 NOTIFICATION

A. When ledge rock or boulders are encountered, the material shall be uncovered and the Engineer notified. The Contractor shall be responsible for and provide the Engineer with cross sections of the ledge rock surface. The Engineer shall be notified in advance as to when the cross section of ledge is to be made.

If the Contractor uncovers ledge, but fails to notify the Engineer, the Contractor shall have no right of claim to any classification other than that allowed by the Engineer.

B. The average end area method shall be used in the computation of volumes wherever practicable.

3.4 LIMITS OF EXCAVATION IN ROCK

A. Excavation in rock shall be performed, unless otherwise indicated on the Plans directed, so that no projection shall come within vertical planes 12 inches outside of the structure being built, 12 inches below the bottom of the structure base slab and footings, or as shown on the Drawings. In trenches, the rock shall be removed to the limits shown on the typical trench section. Where excavation is carried beyond the above determined limits, the additional space shall be refilled at the Contractor's expense with concrete or other selected material, as directed by the Engineer.

3.5 ROCK REMOVAL

A. BLASTING WILL NOT BE ALLOWED ON THIS PROJECT.

3.6 DISPOSAL AND REPLACEMENT OF ROCK

A. Rock shall be considered unsuitable for backfilling and removed from the site.

B. Rock and boulders shall be replaced at no additional expense to the Owner with suitable material as specified above.

C. If rock below limits of excavation is caused by holes drilled too deep or any other circumstance due to excavation and if such shattered rock does not provided suitable

foundation, the rock shall be removed and the excavation refilled with gravel at the expense of the Contractor. The gradation of gravel shall be as specified above.

3.7 TESTING

A. Field density tests will be performed by a qualified laboratory and paid for by the Owner.

B. The Contractor shall give the Ownerôs Representative 24 hours notice when each layer of fill is in place and ready for testing so that the Ownerôs Representative can observe field testing.

C. At the direction of the Ownerôs Representative, all required re-testing (in case of failure) to meet specified density shall be at the Contractor's expense.

D. Compaction of fill materials shall conform to Section 2.02.03-6 State Specifications. Laboratory test to establish maximum density shall conform to AASHTO T-180 Method D, except that the molds used shall be 6.11" high. Field density tests shall be as specified by AASHTO T-191 or by use of a portable nuclear density testing device. Field density tests shall be taken at a depth equal to ½ the maximum depth of the lift tested. Compaction to 95% maximum density is required in all areas, except landscaped areas, where only 90% compaction is required. In areas receiving more than 3 feet of fill or backfill, each 3-foot portion of depth shall be tested separately. All areas receiving fill or backfill are subject to testing.

3.8 HA ARDOUS MATERIAL AND WASTE CONTROL

A. Excavation and disposal of contaminated, polluted, or ñenvironmentally compromisedò materials shall be conducted in conformance with the environmental and abatement specifications. The handling of contaminated, polluted, or ñenvironmentally compromisedò water to be discharged as a result of dewatering shall be performed in accordance with the environmental and abatement specifications.

END OF SECTION 31 23 33

STORM WATER POLLUTION AND CONTROL PLAN (SWPCP)

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Supplementary Conditions, and Division 1 Specification sections, apply to this section.

1.2 SUMMARY

A. Provide all labor, materials, necessary equipment and services to complete the work called for in this Section or as shown on the plans, including but not necessarily limited to the following:

1. Slope protection and erosion control devices and measures as shown on the Drawings, around material stockpiles, and where directed by the Engineer.
2. Maintenance, repair and replacement of slope protection and erosion control devices and measures as required. One employee of the General Contractor shall be assigned to inspect the erosion control measures and to maintain or repair them as necessary. Such maintenance and repair shall take precedence over other work.
3. Removal of slope protection and erosion control devices and measures when no longer required.
4. Construction of temporary perimeter stone swales, sediment forebays, dewatering basins, sediment basin, and outlet structures if provided.
5. Temporary seeding or vegetative cover.
6. Installation of anti-tracking pad.
7. Removal of collected sediment and debris.
8. Restoration of disturbed areas to finish surface indicated on Drawings.
9. Installation of permanent mulches.
10. Conformance to erosion notes on plans and Connecticut DEEP requirements.

B. Related Work: The following sections contain requirements that may apply to this section:

1. Section 02 41 13 - ñSite Preparation and Demolition.ò
2. Section 31 23 00 - ñExcavation and Fill.ò
3. Section 31 23 24 ï ñSite Backfill.ò
4. Section 32 92 19 - ñSod and Lawn Establishment.ò

1.3 REFERENCE STANDARDS

A. Connecticut Department of Energy and Environmental Protection General Permit for Stormwater and Dewatering Wastewaters from Construction Activities.

B. Form 817, State of Connecticut Department of Transportation, Standard Specifications for Roads, Bridges and Incidental Construction, 2002.

C. Connecticut Guidelines for Soil Erosion and Sediment Control, the Connecticut Council on Soil and Water Conservation, 2002.

D. Connecticut Stormwater Quality Manual, 2004.

E. Connecticut Department of Transportation Drainage Manual, 2000.

1.4 SE UENCING SCHEDULING

A. Install all soil erosion and sediment control devices and measures prior to commencing construction. Install additional measures as required during construction and maintain such structures throughout construction period.

1.5 SUBMITTALS

A. Submit under provisions of Division 1.

B. Erosion and Sedimentation Control Plan measures shown on the drawings are the minimum required. The Engineer can request additional measures at no additional cost to the Owner.

C. Submit a dewatering plan that will ensure protection of wetland areas and particularly the storm drainage system. Prior to the start of any work, this plan must be approved by the Engineer and the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Hay Bales.

1. Hay bales shall consist of hay from acceptable grasses and legumes, free from weeds, reeds, twigs, chaff, debris, other objectionable material, or excessive amounts of seeds and grain. Hay shall be free from rot or mold and the moisture content shall not exceed fifteen (15) percent by weight at the time of weighing.

2. The hay shall be securely baled with wire of adequate size to allow for possible rusting while in use and to permit rehandling when the bale is in a saturated condition.

3. Individual bales shall be of a longitudinal shape not exceeding one hundred (100) pounds when weighed.

B. Stakes for Silt Fence: Hardwood or metal. Posts shall be of wood or steel and a minimum of 3.5 feet long. Wood posts shall be nominal 1 x 1 inches. Steel posts shall be round or U, T or C-shaped with a minimum weight of 1.3 pounds per foot, and have projections for fastening the wire to the fence.

C. Silt Fence Fabric:

1. Filter fabric for silt fence shall consist of pervious sheets of woven propylene, nylon, polyester, or ethylene yarn. Filter fabric material shall be on the Connecticut Department of Transportation approved material list and shall meet the following requirements.

PHYSICAL RE UIREMENTS FOR FABRIC SILT FENCE

Property	Test Method	Requirement
Grab Strength	ASTM D-4632-86	100 lbs.
Grab Elongation	ASTM D-4632-86	30% maximum
Trapezoid Tear Strength	ASTM D-4632-86	65 lbs.
Mullen Burst Strength	ASTM D-3786-80a	200 psi
Coefficient of Permeability k	ASTM D-4491-85	0.01 cm/sec.
Ultraviolet Stability	ASTM D-4355-84	90%

The filter fabric shall contain a stabilizer and/or inhibitors to make the filaments resistant to deterioration resulting from exposure to sunlight or heat to provide a minimum of 6 months of expected usable construction life at a temperature range of 0 to 120 degrees F. The filter fabric shall be a minimum of 36 inches wide, cut from a continuous roll to finish fence length to avoid the use of seams. Splice filter fabric together only when absolutely necessary and only at a support post, with a minimum 6-inch overlap and securely sealed. The filter fabric shall be free of defects or flaws which significantly affect its physical and/or filtering properties.

D. Wire Backing:

1. Wire for backing reinforcement shall be a minimum of 14.5 gauge with maximum mesh spacing of 6 inches.
2. Minimum height shall be 42 inches.
3. Wire staples for attaching filter fabric to wooden posts shall be No. 9 gauge and shall be at least 1 inch long.

E. Filter Fabric shall conform to requirements of M.08.01-26 of Form 817.

F. Jute Mesh and Anchoring Devices: Conform to requirements of M.13.06 of Form 817.

G. Erosion Control Mat shall conform to Section M.13.09 of the Form 817. Erosion control matting shall be on the CT DOT Qualified Product List for erosion control materials.

TYPE 1. Slopes 4h:1v to 3.1h:1v or as noted on the drawings:
minimum fabric weight of 7.5 oz./sy
100% straw fiber matrix
Biodegradable natural organic or photodegradable fiber netting (one side)

TYPE 2. Slopes 3h:1v to 2.1h:1v or as noted on the drawings:
minimum fabric weight of 8.5 oz./sy
100% straw fiber matrix
Biodegradable natural organic or photodegradable fiber netting (top and bottom)

TYPE 3. Slopes 2h:1v to 1.6h:1v or as noted on the drawings:
minimum fabric weight of 10 oz./sy
70% straw fiber; 30% coconut fiber matrix
Biodegradable natural organic or photodegradable fiber netting (jute fiber top and bottom)

TYPE 4. Drainage swales or as noted on the drawings:
minimum fabric weight of 8.5 oz./sy
100% straw fiber matrix
Biodegradable natural organic or photodegradable fiber netting (top and bottom)

H. Shredded Bark Mulch:

1. Air-dried, pine or hardwood bark shredded to a size ranging from 1/4 inch to 2 inches.

2. Free from rot, leaves, twigs, shavings, coarse material, debris, and any other materials injurious to plant growth.

I. Hay Mulch:

1. Obtain from acceptable grass or legume mowings, free from weeds, course matter, or other objectionable material.

2. Free from rot or mold with moisture content of not more than 15 percent when delivered to project.

J. Netting: Approved material suitable for holding hay mulch in close contact with ground.

K. Mulch Binders:

1. Asphalt: Approved product manufactured for this purpose.

2. Synthetic: Approved product manufactured for this purpose.

L. Crushed stone for construction entrance and stone berms: 2 inch diameter conforming to M.02.01-2 of Form 817.

M. Temporary Seeding: Temporary seeding shall be placed if the contractor anticipates leaving exposed areas over the winter months.

N. Silt sack shall consist of filter fabric (see below), lifting straps, and containment area.

1. Filter fabric for silt sack shall consist of pervious sheets of woven monofilament fabric. Filter fabric material shall meet the following requirements.

PHYSICAL RE UIREMENTS FOR SILT SACK FABRIC

Property	Test Method	Requirement
Grab Strength	ASTM D-4632-86	200 lbs.
Grab Elongation	ASTM D-4632-86	24x10
Trapezoid Tear Strength	ASTM D-4632-86	75 lbs.
Mullen Burst Strength	ASTM D-3786-80a	450 psi
Coefficient of Permeability k	ASTM D-4491-85	0.14 cm/sec.
Ultraviolet Stability	ASTM D-4355-84	70%

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall plan and execute all operations, particularly those associated with excavation and backfilling, in such a manner as to minimize the amount of excavated and exposed fill or other foreign material that is washed or otherwise carried into wetlands and waterways.

B. The Contractor shall furnish and place hay bales, silt fencing, and other materials necessary for sedimentation and erosion control for streams and wetlands.

C. In the event the sedimentation or siltation prevention measures used by the Contractor prove to be inadequate as determined by the Engineer, the Contractor shall be required to adjust his operations to the extent necessary to prevent any such sedimentation or siltation from occurring.

D. The Contractor shall keep streams, brooks, and other water crossings clear of mud, silt, debris and other objectionable materials resulting from his construction operations.

1. The Contractor shall maintain flow capacity of river and stream channels to prevent unnatural flooding due to the Contractor's operations.

E. The Contractor shall use temporary vegetation, soil stabilization matting, and mulching to protect areas exposed during construction. He shall minimize the amount of bare earth exposed at any one time during construction, and he shall also minimize the length of time bare earth is exposed.

Excavated material to be stockpiled for reuse shall be stored away from brooks, streams, and wetland areas to prevent the washing of same back into the resource area.

F. Baled hay shall be placed to form temporary water stops, dams, diversions, dikes, berms and for other uses connected with water pollution control. Should any bales become too clogged to be effective, they shall be removed from the site and new hay bales provided as directed by the Engineer. Bales shall be replaced as often as necessary to provide effective sediment control.

Following completion of construction activities in a particular area, bales shall be legally disposed of, by the Contractor, off-site in an environmentally sound manner.

G. On sloping terrain, hay bales may be used to trap sediment until vegetation has become established. The details of their placement shall be as approved by the Engineer.

H. Sediment laden water that is being pumped from the trenches or excavations shall not be pumped directly into water courses and/or stormwater drainage systems. Sedimentation basins of filter fabric, wire fencing and hay bales or other means acceptable to the Engineer shall be used for this purpose.

1. I n n n En n d n a n n n n a a d d a a a ( ) a d a a a . T a a a n d a a n an n and a . T an a d a n d n a n a n d d a .

I. Spoil resulting from the trench excavation shall be leveled or removed to permit entry of water from adjacent land surfaces without excessive erosion or harmful ponding.

J. The silt fence shall be maintained at no additional cost to the Owner as follows: Inspect silt fences and filter barriers immediately before and after each rainfall and at least daily during prolonged rainfall. Provide any required repairs immediately. Should the fabric on a fabric silt fence decompose or become ineffective prior to the end of the expected usable life and the barrier still be necessary, replace the fabric promptly.

Remove sediment deposits after each storm event as directed by the Engineer. As a minimum, remove sediment when deposits reach approximately one-half the height of the barrier. Dispose of sediment deposits off-site, placed upland in a manner which will prevent its later erosion into the resource area, or in a manner approved by the Engineer.

Maintain the fabric silt fence until all upslope soils are permanently stabilized by vegetation.

3.2 HAY BALE CHECKS AND BARRIERS

A. Place hale bale checks and barriers where indicated on Drawings.

B. Excavate soil to form shallow trench, place, and firmly stake bales. Wedge loose hay between bales. Backfill and compact excavated soil against hay bales.

C. Conform to installation details indicated on Drawings.

D. Maintenance

1. Inspect checks and barriers periodically and after each storm.
2. Remove accumulated sediment periodically and when directed by Engineer.
3. Repair any damage immediately.

E. Removal and clean-up

1. Remove checks and barriers when no longer required or when directed by Engineer.
2. Restore disturbed areas to finish surface indicated on Drawings.

3.3 SILT FENCE

A. Place silt fence where indicated on the Drawings.

B. Firmly set stakes and attach wire backing and filter fabric as indicated on Drawings.

C. Maintenance

1. Inspect checks and barriers periodically and after each storm.
2. Remove accumulated sediment periodically and when directed by Engineer.
3. Repair any damage immediately.

D. Removal and clean-up

1. Remove checks and barriers when no longer required or when directed by Engineer.
2. Restore disturbed areas to finish surface indicated on Drawings.

3.4 JUTE MESH

A. Place jute mesh where indicated on Drawings immediately after surface upon which it is to be placed has been finished as specified under other sections of these specifications.

B. Conform to installation methods indicated on Drawings and described in 9.48.03 of Form 817.

C. Maintenance

1. Inspect checks and barriers periodically and after each storm.
2. Remove accumulated sediment periodically and when directed by Engineer.
3. Repair and damage immediately.

D. Removal and clean-up

1. Remove checks and barriers when no longer required or when directed by Engineer.
2. Restore disturbed areas to finish surface indicated on Drawings.

3.5 HAY MULCH

A. Spread mulch immediately following seeding operations.

B. Mulch shall be uniformly spread by hand or machine at a rate of approximately 2 tons per acre.

C. Apply mulch to obtain a uniform depth without matted spots.

D. Stabilize mulch immediately after mulch is spread with netting, asphalt, or synthetic tacking material.

E. Conform to manufacturerôs instructions and obtain firm, continuous contact between mulch and soil.

F. Maintenance

1. Repair and replace areas which have been damaged.

G. Removal and Clean-up

1. Remove checks and barriers when no longer required or when directed by Engineer.
2. Restore disturbed areas to finish surface indicated on Drawings.

3.6 SHREDDED BARK MULCH

A. Spread mulch immediately following finish grading and planting.

B. Apply mulch to obtain a uniform depth of 3 inches. Remove large pieces and debris.

C. Repair and replace mulch as required to protect underlying soil.

3.7 STONE BERMS AND SWALES

A. Place stone to form berms around catch basins in areas to be paved prior to placement of pavement at locations as indicated on the Drawings.

B. Conform to dimensions indicated on the Drawings.

C. Repair and replace stone berms as required to protect catch basins and pipes.

D. Construct stone swales around perimeter of excavation. Swale shall maintain a positive pitch to temporary sediment basin. Swales and sediment basin shall be cleaned as required to maintain function.

3.8 CONSTRUCTION ENTRANCE

A. Install temporary construction entrance consisting of 2 inch crushed stone placed to the depth and area indicated on the Drawings.

B. Remove stone when no longer required. Restore subgrade and finish to grades with materials indicated on the Drawings.

3. FILTER FABRIC AND SILT SACKS AT CATCH BASINS

A. Place filter fabric and/or silt sack under grate at each catch basin in areas to be paved immediately after catch basin installation at locations indicated on the Drawings.

B. Clean and replace filter fabric and silt sacks as required to protect catch basins and pipes.

3.10 PROTECTION OF AIR RESOURCES

A. During the progress of work, the Contractor shall conduct his operations and maintain the area of his activities, including sweeping and sprinkling of water as necessary, so as to minimize the creation and dispersion of dust. If the Engineer decides that it is necessary to use calcium chloride for more effective dust control then the Contractor shall furnish and apply the material as directed.

B. Calcium chloride shall be commercial grade, furnished in 100-pound, 5-ply bags, stored under weatherproof cover and stacked alternately for ventilation. Application for dust control shall be at the rate of about 1/2 pound per square yard per application, unless otherwise directed by the Engineer.

C. Burning of rubbish and waste material on the site shall not be permitted.

D. Construction equipment shall be equipped with properly operating emission control devices and mufflers. Equipment not utilizing said devices shall be removed immediately from the site.

3.11 HA ARDOUS MATERIAL AND WASTE CONTROL

A. Disposal of volatile fluid wastes (such as mineral spirits, waste oil, gasoline, or paint thinner) in storm or sanitary sewer systems or into streams or waterways shall not be permitted.

In the event that any such waste is spilled onto the ground, the Contractor shall immediately notify the Engineer, promptly clean up the spillage and all contaminated soil, and dispose of the cleanings as hazardous waste material. If a spill occurs, the clean-up activities shall take precedence over normal construction activities in order that damage to the environment is minimized.

B. Fuels, lubricants or other hazardous materials shall not be stored in any resource areas.

C. Fuel, lubricants and other hazardous materials shall be stockpiled within an area of positive containment. The area shall have no open communication with surface water

bodies or other resource areas, shall have a base of relatively impermeable material and shall have an adequate supply of materials required for spill cleanup.

D. All hazardous materials containers shall be properly marked and their contents identified. All fuel oil, lubricant, gasoline, and hydraulic fluid containers shall be fixed in place on the transport vehicle when the vehicle is in motion.

E. The construction project shall be in compliance with all Federal, State, and local laws with respect to hazardous materials.

F. All clean up and disposal operations shall comply with all applicable Federal, State, and local statutes, regulations and ordinances and anti-pollution laws.

G. Excavation and disposal of contaminated, polluted, or ñenvironmentally compromisedò materials shall be conducted in conformance with the environmental and abatement specifications. The handling of contaminated, polluted, or ñenvironmentally compromisedò water to be discharged as a result of dewatering shall be performed in accordance with the environmental and abatement specifications.

3.12 NOISE ABATEMENT

A. Construction equipment including generator and compressors shall be enclosed or equipped with mufflers, silencers or other equipment to minimize noise.

B. The Contractor shall limit construction noise in accordance with EPA latest standard criteria.

3.13 PERMITS

A. The Contractor shall comply with all requirements of all applicable Federal, State, and local regulations and all permits issued for the Contract.

B. General Permit Registration or the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities, for disturbed areas greater than 1 acre.

1. Assume responsibility for storm water pollution control by submitting to the Connecticut Department of Energy and Environmental Protection (DEEP) a "General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities" registration; conform to the permit requirements.

2. Conform to the Erosion and Sediment Control Plan included in the Contract Documents or use another plan, prepared at the Contractor's expense by a Professional Engineer, licensed by the State of Connecticut, which has been approved by the Owner and the Connecticut Department of Energy and Environmental Protection.

4. Sign and cause to be signed by each appropriate subcontractor, the Certification Statement required by the General Permit.

5. Provide, maintain, and monitor a rain gauge on the site; monitoring shall include maintaining a log of the readings. The rain gauge shall remain the property of the Contractor.

6. Inspect all erosion controls measures on a weekly basis and after each rainfall event. Record corrective measures and repairs that are required, when they were performed and who made the corrections/repairs.

END OF SECTION 31 25 00

EXCAVATION SUPPORT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to work of this Section.

B. All related Specification Sections shall be used in conjunction with this Section.

1.2 SUMMARY

A. Provide all labor, materials, necessary equipment and services to complete the work called for in this Section or as shown on the plans, including but not necessarily limited to the installation, maintenance and removal of excavation support systems including the following:

1. Shoring excavation.
2. Trench excavation.

1.3 SUBMITTALS

A. Provide services of registered State of Connecticut Structural Engineer to design bracing, shoring, and/or underpinning if required. Submit Engineerôs design for record purposes.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials shall include support members such as soldier piles, lagging, sheet piles, and other bracing members such as walers, struts, shores and tieback anchors.

PART 3 - EXECUTION

3.1 EXCAVATION SUPPORT

A. The Contractor shall be totally responsible for the means and methods of excavation and for the design and construction of the excavation support system.

B. All excavation support systems shall be constructed so as to be able to support all vertical and lateral loads and other surcharge loads imposed on the system during construction including earth pressures, utility loads and other surcharge loads in order to provide safe and expeditious construction of the permanent structures and prevent movement and/or damage to adjacent soil, buildings, structures and utilities.

C. The support system shall be designed to support the maximum loads that will occur during construction.

D. The Contractor shall not perform excavations in running ground and must employ a positive means of containing material behind support walls before excavation is allowed to proceed.

E. The Contractor shall monitor all excavations to accurately provide a means of determining movement of adjacent soil, buildings, structures, and utilities.

F. When movement or damage is observed, the Contractor shall immediately cease excavation operations and correct such deficiencies in the excavation support system that have allowed for movement or damage and repair any and all damage that has resulted.

G. The Contractor shall be responsible for and repair any and all damage resulting from his excavations at no additional cost to the Owner and at no additional time for performance.

3.2 ADJACENT STRUCTURES

A. Protect Adjacent Structures: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of adjacent structures.

1. Strengthen or add new supports as required during progress of the work.

END OF SECTION 31 41 00

BITUMINOUS ASPHALT CONCRETE PAVING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Bituminous paving for roadways and associated preparatory work.

B. Aggregate base course.

C. Gravel subbase.

D. Material for Tack Coat

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to work of this Section.

B. All related specification sections shall be used in conjunction with this section.

1. Section 31 23 23; “Site Backfill”
2. Section 32 17 23; “Pavement Markings”

1.3 REFERENCE STANDARDS

A. The State of Connecticut Department of Transportation Standard Specifications for Road and Bridge Construction (FORM 817).

1.4 SUBMITTALS

A. Submit under provisions of Division 1.

B. Letter of compliance shall be furnished by the Contractor to the Engineer prior to the placing of material listed under this Item.

C. Mix/batch design shall be submitted for each type of bituminous asphalt concrete to be placed.

D. Material certificate for tack coat.

PART 2 - PRODUCTS

2.1 MATERIALS

A. SUBBASE

1. Subbase material shall conform to the requirements of Article M.02.02, CONN DOT FORM 817 for Bank Run Gravel or unless indicated otherwise on the drawings and Section 31 23 23.

B. PROCESSED AGGREGATE BASE

1. Base material shall conform to the requirements of Article M.05.01, CONN DOT FORM 817 as noted in Section 31 23 23.

C BITUMINOUS MATERIALS

1. Bituminous concrete, tack coat, joint sealer, etc. for road repairs shall conform to the requirements of Section M.04, CONN DOT FORM 817.

a. Surface course of pavement mixture shall be HMA S0.375 (Superpave) Level 2, as defined in ConnDOT M.04.03.

b. Binder course of pavement shall be HMA S0.50 (Superpave) Level 2, as defined in ConnDOT M. 04.03.

D TEMPORARY STEEL PLATES

1. Temporary steel plates for temporary trench covers shall be suitable to withstand traffic loading, including AASHTO H20 loads. Plates shall also conform to additional requirements as indicated on the traffic control plans. Steel plates shall not be left in place for more than 12 hours. All trenches must be backfilled prior to holidays, weekends and other extended suspensions of the work.

E. MATERIAL FOR TACK COAT

1. Tack coat shall be emulsified asphalt conforming to Section M.05 of Form 817.

PART 3 - EXECUTION

3.1 GENERAL

A. Areas to receive bituminous paving shall be as shown on the Drawings or as specified herein.

B. Pavement restoration shall be as shown on the Drawings or as specified herein.

3.2 CONSTRUCTION METHODS

A. In areas where trenching was conducted, the Contractor shall allow a 30-day settling period to transpire before placing permanent pavement, or as determined by the Engineer.

B. Edges of pavement removed during trenching or other excavations shall be sawcut to provide one-foot minimum overlap of the final patch on undisturbed material.

C. Base course shall be constructed in the areas and to the depths shown on the Drawings and in accordance with CTDOT Specifications, except as herein modified.

1. Gravel base and processed gravel base courses shall be placed in maximum 6-inch lifts compacted to 95% maximum density, unless otherwise directed by the Engineer.

2. Gravel shall be fine graded with a power grader or other approved equipment. Tolerance shall be within 1/2" or less.

3. No pavement shall be placed until fine grading has been checked and reviewed by the Engineer.

D. Bituminous wearing and base courses shall be constructed as per CONNDOT Specifications, except as herein modified.

1. Pavement shall only be placed when the underlying surface is dry, frost-free and the surface temperature is above 50°F, unless otherwise directed by the Engineer.

2. Pavement shall only be placed during daylight hours.

3. Material delivered to the paver shall not have a temperature lower than 265°F. The maximum temperature of the mix shall not exceed 325°F.

4. Place Material for Tack Coat in accordance with Form 817 between all lifts of bituminous pavement, along edges where new pavement meets existing pavement and as directed by the Engineer.

5. All catch basins shall be covered with a acceptable cover before the paver passes over the grate.

6. Manholes and other castings shall be sprayed with kerosene or other product before the paver passes over the casting. The casting shall be clean of asphalt at the completion of the paving.

7. Extreme care shall be used around catch basins. The Contractor shall do the necessary handwork to provide a downward slope into the grate.

8. Compaction shall be performed by an 8-ton minimum static steel wheel roller followed by a pneumatic-tired roller.

   All rollers shall be self-propelled and designed for compaction of bituminous concrete. Roller types shall include steel-wheeled, pneumatic or a combination thereof and may be capable of operating in a static or dynamic mode. Rollers that operate in a dynamic mode shall have drums that use a vibratory or oscillatory system or combination. The vibratory system achieves compaction through vertical amplitude forces. Rollers with this system shall be equipped with indicators that provide the operator with amplitude, frequency and speed settings/readouts to measure the number of impacts per foot during the compaction process. The oscillatory system achieves compaction through horizontal shear forces. Rollers with this system shall be equipped with frequency indicators. Rollers can operate in the dynamic mode using the oscillatory system on concrete structures such as bridges and catch basins if at the lowest frequency setting.

   Pneumatic tire rollers shall be self-propelled and equipped with wide-tread compaction tires capable of exerting an average contact pressure from 60 to 90

lb./in^2 uniformly over the surface, adjusting ballast and tire inflation pressure as required. The Contractor shall furnish evidence regarding tire size, pressure and loading to confirm that the proper contact pressure is being developed and that the loading and contact pressure are uniform for all wheels.

9. The wearing course shall be rolled until all roller marks are eliminated.

END OF SECTION 32 12 16

CONCRETE PAVING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, and Division 1 Specification sections, apply to this section.

1.2 SUMMARY

A. Provide all labor, materials and equipment required to perform the work called for in this section of the Specification, or as shown on the drawings, including but not necessarily limited to the following:

1. Concrete Sidewalks.
2. Concrete Sidewalk Ramps.
3. Dectable Warning Strips
4. Concrete Base for Unit Pavers

B. Related Work: The following sections contain requirements that may apply to this section:

1. Section "Excavation and Fill".
2. Section "Site Preparation and Demolition".
3. Section "Cast-in-Place Concrete".
4. Section “Concrete Reinforcing”.
5. Section “Unit Pavers”.

1.3 SUBMITTALS

A. Submit supplies, product test reports, and required material certification for concrete.

1.4 UALITY ASSURANCE

A. All work of this section shall be provided in accordance with the latest edition of State of Connecticut Department of Transportation Form 817 which is considered to be part of this specification, the same as if fully set forth herein.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Concrete: Article M.03.01, DOT Specifications. Concrete shall be 4,500 psi.

B. Air-Entraining Portland Cement and Entraining Admixture: Article M.03.01, Form 817.

C. Welded Steel Wire Fabric: Six inch square steel mesh shall conform to Sub article M.06.01-3, Form 817.

D. Reinforcement: Sub article M.06.01-1, Form 817.

E. Processed Aggregate Base: As specified under Section "Excavation and Fill" and CTDOT From 817 Article M 5.0

F. Expansion Joint Filler: Bituminous cellular type, AASHTO M213.

G. Detectable Warning Strip: Detectable warning strips shall be prefabricated vitrified polymer detectable warning panels chosen from CTDOT's Qualified Products List for retrofit or cast in place applications. Color to be selected by the Owner.

PART 3 - EXECUTION

3.1 GENERAL

A. The concrete installer shall hold current ACI certification for flatwork

B. Excavation shall be made to the required depth and to a width that will permit the installation and bracing of the forms. The foundation shall be shaped and compacted to a firm, even surface conforming to the section shown on the plans. All soft and yielding material shall be removed and replaced with acceptable material.

C. Place and compact the base in layers not to exceed 6" in depth and to dimension after compaction as shown on the drawings. Wet and roll or tamp the base after the spreading of each layer to a maximum toleration shall be 1/4" and compacted to 95% maximum density.

D. Construct forms of metal or wood. Construct forms straight, free from warp and of sufficient strength to resist springing from the pressure of concrete. Make forms tight to prevent leaking of mortar. Clean and wet forms before placing concrete against them.

E. Proportion, mix and place concrete in accordance with Section 03 30 00.

F. Concrete sidewalk shall be placed utilizing a mechanically vibratory screed to ensure proper densification of the concrete.

G. Finishing:

1. Concrete shall have a smooth trowel finish by skilled concrete finishers, a medium broom finish shall then be applied to obtain a non-skid texture.

2. All outside edges and joints shall be edged with an edging tool having a radius of 1/4 inch or as indicated on the Plans.

3. Additional water shall not be added to the surface to aid in finishing the concrete. If finishing aid is required, it shall be similar to Eucobar.

H. Concrete sidewalk wet cure shall commence immediately or no longer than 30 minutes after finishing and continue uninterrupted for a period of 7 days, 5 days minimum. Wet cure shall utilize a non-marking curing paper or other curing cover similar to Hydra Cure Cover S16. Upon approval the contractor shall utilize a dissipating curing compound only if moisture curing is not feasible. Plastic sheets or other approved materials shall be placed in close contact with the finished concrete as soon as the concrete has set sufficiently to avoid damage from the placement of coverings. The protective covering shall be maintained vapor-proof in close contact with the concrete for the entire curing period. All traffic shall be excluded during the curing period. Vehicular traffic shall be excluded for such additional time as ordered.

I. Concrete retarding materials shall be utilized when weather has an adverse effect on placement, all sidewalk placement shall take place between April 15th and October 15th unless previously requested and approved by the University.

J. Acceptance: The Engineer shall review each panel after the concrete has had sufficient time to set. The Engineer shall also review concrete test results. If in the opinion of the Engineer sufficient imperfection exists, the panel will be rejected and the Contractor shall remove and repour the defective panel. The Contractor is responsible for any damage, either by construction-related activities or vandals until final acceptance.

K. Protective Coating:

1. The concrete must be at least 14 days old before application of the linseed oil mixture. The concrete shall have at least a 48-hour period without rain just prior to the application, and shall be cleaned to remove all oil, grease and loose particles which would prevent penetration. Immediately before the application, an air blast shall be directed over the concrete so as to remove all dust.

2. The mixture may be sprayed, brushed, squeegeed, or rolled. If a sprayer is used, the nozzle shall be held within 18 inches of the concrete or as directed. Unless otherwise directed, the temperature of the concrete and air shall be at least 40°F at the time of application.

3. Two coats of protective coating shall be applied. The first coat shall be applied to the surface at a rate to obtain maximum penetration possible, taking care to prevent the material from discoloring curbs or other parts of the work. The second coat shall be applied as a seal coat, with special attention given to the lighter appearing areas. The rate of application shall be approximately 0.025 gallons per square yard for the first coat and 0.015 gallons per square yard for the second coat. The second application shall not be made until the concrete has regained its dry appearance, and in any event not until at least 24 hours have passed.

4. The linseed oil mixture is readily flammable and all due precautions shall be observed.

L. Backfill sides of work with suitable material thoroughly compacted and finished flush with the tops of the sidewalks. Remove and dispose of all surplus material.

M. The Contractor will be responsible for all concrete sidewalks, driveway aprons and ramps until accepted by the Owners Representative.

3.2 CONCRETE SIDEWALKS DRIVEWAY APRONS AND RAMPS

A. All work shall be in conformance with Form 817, Section 9.21.03.

B. The foundation shall be thoroughly moistened immediately prior to the placing of the concrete.

C. Steel mesh reinforcement, shall be placed as shown on the plans, using the methods described in CONNDOT Specifications. Wire mesh shall be 6" x 6", W2.9 x W2.9 W.W.M. Wire mesh shall have a minimum twelveinch overlap. Wire mesh shall be placed on chairs spaced no more than eighteen inches on center.

D. The concrete sidewalks shall be placed in alternate panels as shown on the plans except as otherwise directed by the Engineer.

E. Joints:

1. Trowel joints shall be of the dimensions specified. The sidewalk shall be divided into sections, as directed, by trowel joints formed by a jointing tool or other acceptable means as directed.

2. Construction joints shall be formed around all appurtenances such as manholes and utility poles, curbs extending into and through the sidewalk and as indicated on the Plan. Preformed expansion joint filler of the thickness indicated shall be installed between concrete sidewalks and any fixed structure such as a building or curbs. This expansion joint material shall extend for the full depth of the walk.

3. Contraction joints shall be placed parallel to length of walk. Joint spacing shall be as shown on the Contract Drawings. Jointing pattern shall not allow for joints at radius that create a "zero" edge.

4. Expansion joints shall utilize a full depth asphalt saturated cellulosic fiber strip.

5. Steel diamond shape load plates shall be utilized at all expansion joints in lieu of round dowels with the exception of areas where sidewalk ties into existing walks. Load plates, dowels and expansion joints shall be utilized at all locations where concrete is poured up against stationary objects.

6. Contraction Joints shall be ¼ of the overall depth of the concrete pour to ensure contraction of the material takes place at these locations.

3.3 DETECTABLE WARNING STRIP

A. The detectable warning strip for new construction shall be set directly in concrete and each strip shall be weighed down to prevent the strip from floating after placement in wet concrete in accordance with curing procedures. Install detectable warning strip,

according to the plans and the manufacturer's specifications, or as directed by the Engineer.

B. The detectable warning strip for retrofit construction shall be installed according to the plans in the direction of pedestrian route and contained wholly within painted crosswalk when present. Its installation shall meet all manufacturer's requirements.

3.4 TESTING

A. The concrete shall be tested according to ASTM and ACI standards. Tests shall be performed by an independent licensed material testing laboratory. Test shall include the following:

1. Entrained air (6% ±1.5%).
2. Slump (4" maximum ±1")
3. Concrete strength (4,500 psi)
    a. Four cylinders shall be taken each concrete pour.
    b. Breaks shall be performed at 7 days, 28 days, 56 days. One cylinder shall be kept for future breaks as necessary.

END OF SECTION 32 13 13

UNIT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all the Sections within DIVISION 01 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

B. Section 01 74 19 Construction Waste Management and Disposal.

1.2 SUMMARY

A. Section Includes:

1. Concrete pavers set on concrete base.
2. Concrete pavers reset on existing base.
3. Aluminum edge restraint for pavers.

B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the CT High Performance Building Standards (CTHPS) Mandatory Requirements and minimum required sustainable strategies, as indicated on the Sustainable Matrix. Refer to Section 018113 – SUSTAINABLE DESIGN REQUIREMENTS for mandatory and targeted strategies.

C. Related Requirements:

1. Section 32 12 16 “Asphalt Paving” for asphalt base under unit pavers.
2. Section 32 13 13 "Concrete Paving" for concrete base under unit pavers .

1.3 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Submit latex-additive manufacturer, for testing as indicated below, samples of paving materials will contact or affect mortar grout that contain latex additives.

1. Use manufacturer’s standard test methods to determine whether mortar and grout materials will obtain optimum adhesion with, and will be nonstaining to, installed pavers and other materials constituting paver installation.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Conc. Pavers
2. Granite Pavers

B. Samples for Initial Selection:

1. For each type of unit paver indicated and the following:
2. Color blends for pavers. Sample provided to show full range of paver color blend.
3. Polymeric Sand joint materials for color selection.

C. Samples for Verification:

1. Full-size units of each type of unit paver indicated. Assemble no fewer than five.
2. Polymeric Sand for joint color.
3. Exposed edge restraint.

1.5 INFORMATIONAL SUBMITTALS

A. Adhesion and Compatibility Test Reports: From latex-additive manufacturer for mortar and grout containing latex additives.

B. Material Certificates: For unit pavers. Include statements of material properties indicating compliance with requirements, including compliance with standards. Provide for each type and size of unit.

1.6 CLOSEOUT SUBMITTAL

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of the unit pavers.

1.7 UALITY ASSSURANCE

A. Source Limitations:

1. Obtain concrete pavers from one source location with resources to provide products of consistent quality in appearance and physical properties.
2. Obtain polymeric joint sand from one source with resources to provide materials and products of consistent quality in appearance and physical properties.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Provide the following Unit Paver Mockups:
   a. Reset Existing Paver Mockup – A 6’x6’ area that demonstrates the double soldier course banding, edger paver, and infill paver. Rework mockups until acceptable to

      the Architect. Upon acceptance, panels will be the standards for all unit paving.

   b. New Concrete Paver Mockup - A 6’x6’ area that demonstrates the double soldier course banding, infill paver, typical 90-degree corner and accent paver located

within infill pattern. Rework mockups until acceptable to the Architect. Upon acceptance, panels will be the standards for all unit paving

2. Approval of mockup does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Submit to latex-additive manufacturer, for testing as indicated below, Samples of flooring materials that will contact or affect mortar and grout that contain latex additives.

1. Use manufacturer's standard test methods to determine whether mortar and grout materials will obtain optimal adhesion with, and will be nonstaining to, installed unit pavers and other materials constituting unit paving installation.

1. DELIVERY STORAGE AND HANDLING

A. Store pavers on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Store liquids in tightly closed containers protected from freezing.

1.10 FIELD CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

B. Weather Limitations for Mortar and Grout:

1. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in ACI 530.1/ ASCE 6/TMS 602.

2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 5301/ ASCE 6/ TMS 602. Provide artificial shade and windbreaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of (100 deg F) and higher.

a. When ambient temperature exceeds (100 deg F), or when wind velocity exceeds (8 mph) and ambient temperature exceeds (90 degree F), set pavers within 1 minute of spreading setting-bed mortar.

C. Weather Limitations for Bituminous Setting Bed:

1. Install bituminous setting bed only when ambient temperature is above 40 deg F (4 deg C) and when base is dry.

2. Apply asphalt adhesive only when ambient temperature is above 50 deg F (10 deg C) and when temperature has not been below 35 deg F (2 deg C) for 12 hours immediately before application. Do not apply when setting bed is wet or contains excess moisture.

D. Weather Limitations for Polymeric Sand

1. Install polymeric joint sand only when ambient temperatures is above 40 degrees F, under dry conditions with no rain forecast for 24 hours and when surface of pavement is completely dry.

1.11 PAVER OVERAGE AND ATTIC STOCK

A. Provide a minimum of 5% additional material for overage to be used during construction.

B. Contractor to provide 10% 'attic stock' for each product and size used to Owner. Furnish pavers from the same production run as installed materials.

C. Manufacturer to supply maintenance and reinstatement manuals for concrete pavers

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of unit paver, joint material, and setting material from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

2.2 PAVERS

A. Concrete Pavers New: Solid interlocking paving units to match selected University standard pavers as outlined by the University. Pavers to meet or exceed the below listed performance criteria.

1. Pavers to be manufactured as a "face-mix" paving unit. And at a minimum meets the following performance criteria:

a. Average compressive strength of 55 MPa (8,000 psi) with no individual unit under 50 MPa (7,200 psi).

b. Average absorption of 5% with no unit greater than 7% when tested in accordance with ASTM C 140.

c. Resistance to 50 freeze-thaw cycles when tested in accordance with ASTM C 1645.

2. Pavers manufactured by one of the following or an approved equal:

a. Conc Pavers: Nicolock or Hollandstone with Paver-Shield. Color – Rustic Red.

B. Granite Pavers New: Granite shall be sound and uniform in quality, texture, and strength, and shall be free of flaws, reeds, rifts, laminations, cracks, seams, starts, or other defects that may impair its strength, durability, function, or appearance. Exposed surfaces shall be free from spots, spalls, chips, stains, discoloration, or other defects that would affect its appearance. The Dimension Stone Design Manual, Version VIII, 2016 Marble Institute of America quality standards shall apply to the work.

1. Gran. Pavers: shall be Deer Isle or Dogwood or approved equivalent (light pink granite, medium textured). Only one variety will be accepted for all items using this type.

C. Pavers Layout

1. Banding

a) Size: Nominal 8”x 8” x 2 3/8” thick square granite with thermal finish.

2. Infill

a) Design: 90 Degree Herringbone. As indicated on drawings.

b) Color: Standard color as selected by the University from full range of standard colors.

C. Concrete Pavers Reset – Reset existing pavers salvaged during demolition.

2.3 ACCESSORIES

A. Compressible Foam Filler: Preformed strips complying with ASTM D 1056, Grade 2A1.

2.4 CONCRETE BASE FOR UNIT PAVERS

A. Conform with Section 32 13 13 Concrete Paving for concrete base to be used under unit pavers.

2.5 SAND SETTING-BED MATERIALS

A. Sand for Leveling Course: Sound, sharp, washed, natural sand or crushed stone complying with gradation requirements in ASTM C 33 for fine aggregate.

B. Sand for Joints: Fine, Sharp, washed neutral sand or crushed stone with 100 percent passing No.16 sieve and no more than 10 percent passing No. 200 sieve.

1. Provide sand of color needed to produce required joint color.

C. Polymeric Sand for Joints: Joint sand meeting minimum material and physical properties as follows:

1. Compression Strength: Proven resistance to compression of 550 PSI after drying for 7 days under controlled conditions.

2. Gradation: 100 percent passing No. 16 sieve and no more than 10 percent passing No. 200 sieve.

3. Only use with approved paver selection.

D. Geotextile: Comply with CDOT Form 817, M.08.02.19.

2.6 POLYMERIC JOINT SAND

A. Provide Polymeric Joint Sand meeting the minimum material and physical properties as follows:

1. Compression Strength: Proven resistance to compression of 550 PSI after drying for 7 days under controlled conditions

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces indicated to receive unit paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove substances from concrete substrates that could impair mortar bond, including curing and sealing compounds, form oil, and laitance.

B. Sweep concrete substrates to remove dirt, dust, debris, and loose particles.

3.3 INSTALLATION GENERAL

A. Do not use unit pavers with chips, cracks, voids, discolorations, or other defects that might be visible or cause staining in finished work.

B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.

C. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.

D. Joint Pattern: As indicated.

E. Tolerances: Do not exceed 1/16-inch (1.6-mm) unit-to-unit offset from flush (lippage) nor 1/8 inch in 24 inches (3 mm in 600 mm) and 1/4 inch in 10 feet (6 mm in 3 m) from level, or indicated slope, for finished surface of paving.

F. Expansion and Control Joints: Provide for sealant-filled joints at locations and of widths indicated. Provide compressible foam filler as backing for sealant-filled joints

unless otherwise indicated; where unfilled joints are indicated, provide temporary filler until paver installation is complete. Install joint filler before setting pavers. Sealant materials and installation are specified in Section 32 13 73 "Concrete Paving Joint Sealants."

3.4 SAND SETTING-BED APPLICATIONS

A. Place geotextile over weep holes in concrete base, adhered with construction adhesive at each corner.

B. Place leveling course and screed to a thickness as indicated on Drawings, taking care that moisture content remains constant and density is loose and uniform until pavers are set and compacted.

C. Place pavers hand tight against spacer bars. Use string lines to keep straight lines.

D. Provide space between paver units of 1/32 inches wide to achieve straight bond lines.

E. Vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a 3500-to-5000-lbf compaction force at 80 to 90 Hz. Use vibrator with neoprene mat on face of plate or other means as needed to prevent cracking and chipping of pavers. Perform at least three passes across paving with vibrator.

1. Compact pavers when there is sufficient surface to accommodate operation of vibrator, leaving at least 36 inches of uncompacted pavers adjacent to temporary edges.

2. Before ending each day's work, compact installed concrete pavers except for 36-inch width of uncompacted pavers adjacent to temporary edges (laying faces).

3. As work progresses to perimeter of installation, compact installed pavers that are adjacent to permanent edges unless they are within 36 inches of laying faces.

4. Before ending each day's work and when rain interrupts work, cover pavers that have not been compacted and cover leveling course on which pavers have not been placed with nonstaining plastic sheets to protect them from rain.

F. Install polymeric joint sand per manufacturers recommended instructions.

G. Do not allow traffic on installed pavers until sand has been vibrated into joints.

H. Repeat joint-filling process 30 days later.

3.5 REPAIRING AND CLEANING

A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

B. Cleaning: Remove excess dirt from exposed paver surfaces; wash and scrub clean.

END OF SECTION 32 14 00

GRANITE CURB

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, and Division 1 Specification sections, apply to this section.

1.2 SUMMARY

A. Provide all labor, materials and equipment required to perform the work called for in this section of the Specification, or as shown on the drawings, including but not necessarily limited to the following:

1. Placing new granite curbing and resetting existing granite curbing.

B. Related Work: The following sections contain requirements that may apply to this section:

1. Division 32, Section "Excavation and Fill".
2. Division 31, Section "Site Preparation and Demolition".

1.3 SUBMITTALS

A. Submit under provisions of Division 1.

B Submit supplies, product test reports, and required material certification for granite curb, sealants, backer rod.

B. Submit storage and handling instructions.

1.4 UALITY ASSURANCE

A. All work of this section shall be provided in accordance with the latest edition of State of Connecticut Department of Transportation Form 817 which is considered to be part of this specification, the same as if fully set forth herein.

B. Installer Qualifications: Engaged firm must be able to provide evidence to indicate successful documented experience in the installation work specified herein.

C. Source Quality Control.

1. Obtain material of each type from a single source to ensure matching of quality, color, pattern and texture.
2. Do not change source of materials during course of construction.

1.5 JOB CONDITIONS

A. Existing Conditions: Examine all work that the Work of this section is contingent upon and report any deficiencies to the Owner’s Representative. Commencement of the

work will be construed to mean complete acceptance of the preparatory work of others. No adjustments will be made for discrepancies brought to the Owner's Representative's attention after work has begun.

B. Coordination: Coordinate all Work of this section with related Work of other sections. Failure to coordinate properly will not reduce the obligation to meet the standards of acceptance of the various elements of Work contained herein.

C. Sequencing and Scheduling:

1. No placement of granite curbing is to commence until acceptance of the subgrade by the Owner's Representative.
2. Bituminous concrete pavement shall not be placed until installation of granite curbing is approved by the Owner's Representative.

PART 2 - PRODUCTS

2.1 GENERAL MATERIALS

A. The material for this work shall conform to the requirements of ConnDOT Form 817 Article M.12.06-1 for granite curbing.

1. All curbing shall match existing granite curbing throughout the campus, being hard and durable, fundamentally of light color, of general uniform texture, of smooth splitting appearance, free from seams or imperfections that would impair its structural reliability and containing only such color variations as in the opinion of the Engineer would reasonably be characteristic of the material source.
2. All curbs shall be New England quarried granite, 18" in height installed 2/3rds in ground. Granite curbs shall have a split face and sawn top.
3. Granite curb color match existing curb to remain or approved equal

B. Mortar shall conform to the requirements of ConnDOT Form 817 Article M.11.04.

C. Gravel base shall conform to the requirements of ConnDOT Form 817 Article M.05.01 for compacted processed aggregate base.

2.2 SEALANTS

A. Granite Sealant:

1. Manufacturer: Dow Corning or approved equal.
2. Product: Dow Corning 790 Silicone Sealant and Primer as recommended by the manufacturer.
3. Color: Color as selected by Owner's Representative, to match existing construction.

B. Back-up foam: material shall be closed cell "Ethafoam", or pen cell "Denver Foam" as recommended by the manufacturer.

PART 3 - EXECUTION

3.1 PRE-INSTALLATION RE UIREMENTS

A. Secure approval of the subgrade by the Owner's Representative prior to commencing the placement of the granite curbing.

B. Excavation: Excavation shall be made of sufficient depth and width to accommodate the granular base as shown on the plans. The granular base shall be compacted to a firm, even surface and shall be approved by the Engineer.

C. Granular Base: The granular base for the granite curbing shall be placed in layers not to exceed 6 inches in depth, loose measurement, and thoroughly rammed.

3.2 INSTALLING GRANITE CURBING

A. The curbing shall be set as shown on the typical section and settled into place with a heavy woken rammer to the line and grade required, straight and true for the full depth. The top line of the curbing shall be set true to grade and alignment, allowing for the natural variations in depth of curbing to occur at the bottom of the face. Allow no solitary high points to occur along the top of the curbing. Round off such potential high points over several sections of curb.

B. Granite curb shall be set on a bed of compacted processed aggregate base.

C. Joints shall be no greater than ½" and no less than 1/4". The joints of the stone cubing shall be pointed with mortar for the full depth of the curbing. Neatly point on the top and exposed front portions. After pointing, curb stones shall be satisfactorily cleaned of all excess mortar that may have been forced out of the joints. At approximately 50-foot intervals, a ½" joint shall not be filled with mortar but shall be sealed with a backer rod and caulked with sealant to allow for expansion.

D. When the curbing is set adjacent to concrete surfaces, it shall be set as shown on the plans. The joint between the concrete surface and the granite curbing shall then be sealed flush with the surface of the concrete. At the time of sealing the joint, the concrete, the stone curbing and the joint area shall be clean and dry to the depth specified for placement of the seal material.

E. When the cubing is to be placed adjacent to surfaces other than concrete, the curbing shall be set before final surfacing is placed.

F. After the granite curbing is set, the space between it and wall of the trench shall be filled with approved material and thoroughly tamped to the depth directed, care being taken not to affect the line or grade of the curb.

3.3 PROTECTION AND ADJUSTMENT

A. The Contractor shall protect curb stones and keep them in first class condition until completion of the project. Particular care must be exercised to prevent discoloration of exposed surfaces.

B. Prior to final acceptance, all damaged curbing shall be repaired or replaced as determined by the Owner's Representative.

END OF SECTION 32 16 40

PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Pavement marking as indicated on the Drawings, to include but not be limited to:

1. Parking Stalls.
2. Double Yellow for Roadways.
3. Crosswalks.
4. Handicap/Accessible Parking Stalls and Symbols.
5. Other markings as may be required.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to work of this Section.

B. All related specification sections shall be used in conjunction with this Section.

1.3 REFERENCE STANDARD

A. State of Connecticut Department of Transportation Standard Specifications for Road and Bridge Construction (Form 817).

B. Manual on Uniform Traffic Control Devices.

C. American Society for Testing and Materials (ASTM)

D 522 Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings

D 562 Standard Test Method for Consistency of Paints Measuring Krebs Unit (KU) Viscosity Using a Stormer-Type Viscometer

D 711 Standard Test Method for No-Pick-Up-Time of Traffic Paint

D 968 Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasives

D 969 Standard Test Method for Laboratory Determination of Degree of Bleeding of Traffic Paint

D 1210 Standard Test Method for Fineness of Dispersion of Pigment-Vehicle Systems by Hegman-Type Gage

D 1394 Standard Test Methods for Chemical Analysis of White Titanium Pigments

D 1640 Standard Test Methods for Drying, Curing, or Film Formation of Organic

Coatings at Room Temperature

D 1729 Standard Practice for Visual Appraisal of Colors and Color Differences of Diffusely Illuminated Opaque Materials

D 1849 Standard Test Method for Package Stability of Paint

D 2243 Standard Test Methods for Freeze-Thaw Resistance of Water-Borne Coatings

D 2244 Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates

D 2369 Standard Test Method for Volatile Content of Coatings

D 2486 Standard Test Methods for Scrub Resistance of Wall Paints

D 2697 Standard Test Method for Volume Nonvolatile Matter in Clear or Pigmented Coatings

D 2805 Hiding Power of Paints by Reflectometry

D 3335 Standard Test Method for Low Concentrations of Lead, Cadmium and Cobalt in Paint by Atomic Absorption Spectroscopy

D 3718 Standard Test Method for Low Concentrations of Chromium in Paint by Atomic Absorption Spectroscopy

D 3723 Standard Test Method for Pigment Content of Water-Emulsion Paints by Low-Temperature Ashing

E-1347 Standard Test Method for Color and Color-Difference Measurement by Tristimulus (Filter) Colorimetry

G 154 Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials

1.4 SUBMITTALS

A. Submit under provisions of Division 1.

B. Material Safety Data Sheet.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Roadway pavement markings (lane striping, stop bars, crosswalks, yield symbols, etc.) shall be epoxy resin conforming to CT DOT Form 817 Articles 12.10 and M 07.22 with glass beads.

B. Parking bay and parking lot marking shall be epoxy resin conforming to CT DOT Form 817 Articles 12.10 and M 07.22 with glass beads.

C. Block out Paint: Line block out paint shall conform to CT DOT Form 817, Articles 12.16 and M.07.25, color black.

D. Colors shall be as follows:

1. Provide white paint for crosswalks, yield symbols, shoulders and stop bars.
2. Provide yellow paint for centerline striping.
3. Provide white paint for parking stall striping, crosswalks, directional arrows and stop bars on asphalt and concrete within the parking area.
4. Provide blue paint for handicap stalls and hatching.

E. Color FED-STD-595 color chip shall be as follows.

1. Yellow – 33538
2. Green – 34108
3. Black – 37038
4. Blue -- 35180
5. Red – 31136
6. White -- 37925

2.2 PROHIBITED MATERIAL.

A. The manufacturer shall certify that the product does not contain mercury, lead, hexavalent chromium, toluene, chlorinated solvents, hydrolysable chlorine derivatives, ethylene-based glycol ethers and their acetates, nor any carcinogen, as defined in 29 CFR 1910.1200. The lead content shall not exceed 0.06 percent by weight of the dry film and the test for chromium content shall be negative.

PART 3 - EXECUTION

3.1 GENERAL

A. Pavement shall be cleaned of all dirt, oil and other matter prior to painting.

B. Parking and pavement marking shall be laid out and reviewed by the Engineer prior to painting.

C. Paint shall not be placed on damp pavement or within 24 hours of the last precipitation.

D. The Contractor shall be responsible for securing the area in order to allow the paint sufficient time to dry.

3.2 INSTALLATION

A. Equipment:

1. Use atomizing spray-type equipment, guides, and templates designed for the purpose and which are also designed to apply strips, symbols, and letter of uniform size and cross section, with clear-cut edges and uniform thickness for the

coverage specified.

B. Layout of the Work

1. Provide sufficient control points to permit application of stripes, directional arrows, messages, crosswalk marking, and parking space delineations as shown on the drawings.

a. Locate and layout marking in a manner that will not interfere with adhesion of paint or leave permanent non-specified markings.

C. Application:

1. Surface Conditions: Do not apply paint to new bituminous pavement until 48 hours after pavement has been placed. On new Portland Cement concrete pavement, do not apply paint until the pavement has been allowed to cure for a minimum of seven days.

2. Cleaning: Clean the surface of areas to be painted of dust, dirt, laitance, oil, and other foreign substances detrimental to paint adhesion.

3. Painting:

a. Apply paint only during daylight hours. Except for special area and markings requiring hand painting, apply all pavement marking by machine.

b. Suspend painting operations when wind conditions are such that blowing of spray-applied paint and deposit of dust on newly applied paint is likely.

c. Sweep and clean surface to eliminate loose material and dust. Do not begin marking asphalt surfacing until acceptable by the Owner's Representative.

d. Paint shall be asphalt base traffic paint applied in accordance with the manufacturer's recommendations with a width as shown on the plans and a thickness of not less than 12 nor more than 18 mils.

e. Apply paint with mechanical equipment to provide uniform straight edges. Apply in two coats at manufacturer's recommended rates. Paint shall be applied at a rate of 100 square feet to 115 square feet per gallon.

f. Quick drying, hot applied paint shall be applied at a temperature of 120° F to 150° F at the spray gun.

g. Proceed with pavement marking only on clean, dry surfaces and at a minimum and rising ambient or surface temperature of 40° F for oil based materials and 55° F for water-based materials, and not exceeding 95° F.

D. Corrective Measures

1. Repair or remove and reapply any pavement markings that fail to satisfy the requirements indicated. Submit proposed means of cleaning, removing, or obliterating unsatisfactory markings to the Architect for approval prior to

commencing corrective work. Use materials for cleaning pavement of spills, spatter, or overspray that will not injure the paved surface.

END OF SECTION 32-1723

PLANTING SOIL AND FINE GRADING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to perform all work and related items as indicated on the Contract Documents and as specified in this Section and includes, but is not limited to, the following:

1.Furnishing, testing, placing, spreading, amending and grading of planting soil.

B. Related Sections

1. Section 31 25 00 - Erosion and Sedimentation Controls
2. Section 31 23 00 Excavation and Fill
3. Section 32 92 19 Seeding and Lawn Establishment

1.2 UALITY ASSURANCE

A. Qualification of Landscape Contractor: The work of this Section shall be performed by a landscape contracting firm which has successfully installed work of a similar quality, schedule requirement, and construction detailing with a minimum of five years' experience. Proof of this experience shall be submitted per SUBMITTALS paragraph of this Section.

1.3 SUBMITTALS

A. Submit proof of landscape contractor's experience to the Engineer in accordance with QUALITY ASSURANCE paragraph of this Section.

1. Experience: The Contractor shall submit two copies of the proof of experience for the Landscape Contracting firm for this project to the Engineer for review and approval.

B. Testing shall be at the Contractor's expense. Collect samples per the requirements of the testing laboratory. Contractor shall deliver all samples to testing laboratories via overnight courier and shall have the testing report sent directly to the Engineer. Perform all tests for gradation, organic content, soil chemistry and pH by UMASS Soil and Plant Tissue Laboratory, West Experiment Station, North Pleasant Street, Engineer of Massachusetts, Amherst, MA 01003, (413) 545-2311 or approved equal.

1. Loam analysis shall include:

a. soil pH by water pH and buffer (smp) pH tests, percentage organic content, nitrate nitrogen, ammonium nitrogen, phosphorus, potassium, calcium, alumi-

num, magnesium, manganese, Micronutrients, Toxins including but not limited to lead, cadmium, arsenic and mercury, Saturated hydraulic conductivity per ASTM D5856, Calculated CEC

b. Soil analysis tests shall show recommendations for new lawns for soil additives to correct soils deficiencies as necessary, and for additives necessary to accomplish the work as specified.

c. Test results: test data and recommendations for soil amendments including but not limited to: nitrogen, phosphorus, potassium and limestone.

C. Limestone: Submit supplier's certification that the limestone being supplied conforms to these Specifications

D. Fertilizer: Submit product data of seeding fertilizer and certificates showing composition and analysis. Submit fertilization rates for fertilizer product based upon soil testing, analysis, and recommendations as specified, performed and paid for under in this Section.

E. Compost: The Contractor shall submit two 10-lb samples of compost to be used in backfill mix accompanied by certified laboratory test results per the requirements of this special provision.

F. Planting Soil Installation Procedures: Contractor shall submit written program containing but not limited to the following:

1. Schedules of work

2. Description of the equipment that will be used for transport, compaction and installation of Planting Soil on the Project site

3. Cleanup

4. Removal of environmental protections

5. Acceptance of the program does not relieve the Contractor from the responsibility to conduct the work in strict accordance with the requirements of Federal, State and local regulations, standards and laws, the Project specifications, or to adequately protect the health and safety of all workers involved in the Project, any members of the public who may be affected by the Project, and the surrounding environmental resources.

1.4 EXAMINATION OF CONDITIONS

A. All areas to be improved shall be inspected by the Contractor before starting work and any defects such as incorrect compaction, grading or drainage problems shall be reported to the Engineer prior to beginning this work. The commencement of work by the Contractor shall indicate acceptance of the areas to be improved, and assumption of full responsibility for the work of this Section.

B. The Contractor shall be solely responsible for judging the full extent of work requirements involved.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Loam borrow for turf areas

1. Existing on site soil shall not be allowed for use as planting soil.

2. Loam shall be loamy sands and sandy loams; “loamy sand”, “loamy fine sand”, “loamy very fine sand”, or “coarse sandy loam”: determined by mechanical analysis (ASTM D 422) and based on the "USDA Classification System" and as defined in this Section. It shall be of uniform composition, without admixture of subsoil.

3. It shall be free of stones greater than 0.75 inches lumps, plants and their roots, debris and other extraneous matter as determined by the Engineer.

4. Planting soil for lawn areas shall have the following grain size distribution for material passing the #10 sieve:

Millimeter	Percent Passing by Weight	
	Maximum	Minimum
2	-------	100
1	100	82
0.5	87	65
0.25	72	49
0.10	45	30
0.05	32	22
0.002	5	2

5. Maximum size shall be one and one quarter inches largest dimension. The maximum retained on the #10 sieve shall be 25% by weight of the total sample.

6. The ratio of the particle size for 80% passing (D80) to the particle size for 30% passing (D30) shall be 6.0 or less. (D80/D30 < 6.0).

7. In addition to the foregoing, all loam borrow to be used for loaming and seeding shall be mechanically screened processed loam borrow that passes a 3/4 inch by 6 inch screen size.

8. Loam shall contain not less than 4 percent nor more 6 percent organic matter as determined by the loss on ignition of oven-dried samples.

9. Loam shall be free of debris and other extraneous matter. It shall be uncontaminated by salt water, foreign matter and substances harmful to plant growth. The electrical conductivity (EC2) of a 1:2 soil-water suspension shall be equal to or less than 1.0 millimhos/cm. (Test minus sieve #10 material). Soils shall not have levels of extractable aluminum greater than 200 parts per million.

10. No loam shall be delivered to the site until the review and approval of loam test results by the Engineer.

11. Loam shall be altered per the testing recommendations to support seed germination and turf establishment. Amend as required to ensure the following:

    a. The loam shall have an acidity range of 6.2 pH to 6.8 pH.

    b. Macro and Micro nutrients levels recommended per the test report.

B. Manufactured Compost

1. Manufactured Compost shall be mature, stable, weed free, and produced by aerobic decomposition of organic matter. Compost feedstock may include, but is not limited to: agricultural, food or industrial residuals; class A biosolids as defined in the EPA CFR Title 40, Part 503; yard trimmings, or source-separated municipal solid waste. The product must not contain any visible refuse or other physical contaminants, substances toxic to plants, or over 5% sand, silt, clay or rock material by dry weight. The product shall possess no objectionable odors.

2. Manufactured Compost must meet all applicable USEPA CFR, Title 40, Part 503 Standards for Class A biosolids. The moisture level shall be such that no visible water or dust is produced when handling the material.

3. In addition, Manufactured Compost shall have the following properties:

    a. pH: 5.5 – 7.5

    b. Organic matter (% dry weight basis): 30 – 65

    c. Soil salt (electrical conductivity): maximum 5 dS/m (mmhos/cm)

    d. Moisture content %, wet weight basis: 30 – 60

    e. Particle size, dry weight basis: 98% pass through 3/4 inch screen or smear

    f. Stability carbon dioxide evolution rate: mg CO_2-C/ g OM/ day < 2

    g. Solvita maturity test: > 6

    h. Physical contaminants (inerts), %, dry weight basis: <1%

    i. Chemical contaminants, mg/kg (ppm): meet or exceed US EPA Class A standard, 40CFR § 503.13, Tables 1 and 3 levels

j. Biological contaminants select pathogens fecal coliform bacteria, or salmonella, meet or exceed US EPA Class A standard, 40 CFR § 503.32(a) level requirements

C. Soil Additives

1. General: Soil additives shall be used to counteract soil deficiencies as recommended by the soils analysis and as supplements for Planting Soil construction as specified herein.

2. Ground limestone for adjustment of Planting Soil pH shall contain not less than 85 percent of total carbonates and shall be ground to such fineness that 40 percent shall pass through 100 mesh sieve and 95 percent shall pass through a 20 mesh sieve. Contractor shall be aware of Planting Soils pH and the amount of lime needed to adjust pH to meet the requirements of the testing lab recommendations.

3. Commercial fertilizer shall be a product complying with the State and United States fertilizer laws. Deliver fertilizer to the site in the original unopened containers bearing the manufacturer's certificate of compliance covering analysis and which shall be furnished to the Engineer's Representative. Fertilizer shall contain not less than the percentages of weight of ingredients as recommended by the soil analysis.

a. One hundred percent of the nitrogen content shall be derived from organic materials. Nitrogen source shall be coated to ensure slow release. Fertilizer percentages of weight of ingredients shall be as recommended by the soil testing and analysis specified, performed, and paid for under this Section.

PART 3 - EXECUTION

3.1 FILLING AND COMPACTION

A. Perform all earthwork in accordance with Sections 31 23 00 Excavation and Fill, of this Specification.

3.2 GENERAL

A. Planting Soil shall be protected from erosion at all times. Materials shall be spread as soon as possible after completion of the work of rough grading and excavation and filling has been completed.

B. Planting soil for trees, shrubs, groundcover shall consist of (1) part compost to (3) parts loam evenly mixed.'

C. Planting soil for lawn area shall consist of loam only **(N).**

D. 'Evenly distribute and spread Planting Soil to depths required across the project site.

E. No Planting Soil shall be handled, planted, or seeded in any way if it is in a wet or frozen condition. A moist Planting Soil is desirable

3.3 LAWN AREA FINE GRADING

A. Lawns areas subgrades shall be scarified to a 6" depth prior to dumping and placing planting soil.

B. Immediately prior to dumping and spreading Planting Soil in locations shown on the Contract Documents, the subgrade shall be cleaned of all stones greater than 2 inches and all debris or rubbish. Such material shall be removed from the site, not raked to the edges and buried. Notify the Engineer that the subsoil has been cleaned and request his/her attendance on site to review and approve subgrade conditions prior to spreading Planting Soil.

C. After Planting Soil has been spread in turf areas, spread fertilizer and limestone across the surface of the spread Planting Soil and till the Planting Soil to a depth of 6 inches to integrate fertilizer and limestone into the top layer of the Planting Soil.

D. Remove all large stiff clods, lumps, brush, roots, stumps, litter and other foreign matter from the Planting Soil. Remove from unscreened soils all stones over 1 inch in diameter from the top 6 inches of the Planting Soil bed.

E. Sufficient grade stakes shall be set for checking the finished grades. Stakes must be set in the bottom of swales and at the top of slopes. Deviation from indicated elevations that are greater than one-tenth of a foot shall not be permitted. Connect contours and spot elevations with an even slope. Finish grades shall be smooth and continuous with no abrupt changes at the top or bottom of slopes.

F. During the compaction process, all depressions caused by settlement or rolling shall be filled with additional Planting Soil and the surface shall be re-graded and rolled until presenting a smooth and even finish corresponding to the required grades.

G. The Contractor shall install Planting Soil in successive horizontal lifts no thicker than 6 inches in turf areas to the required compaction levels as described herein. At the edges of bituminous concrete walkway, the Contractor shall install Planting Soil at a higher level to anticipate any reduction of Planting Soil volume due to settling during the warranty period.

1. Compact Planting Soil to the required density as specified herein.

2. Maximum dry density for Planting Soil shall be determined in accordance with ASTM D698. In lawn areas the following percentages of minimum to maximum dry densities shall be achieved:

Minimum	Maximum
83%	86%

3. The surface area of each lift hall shall be scarified by raking prior to placing the next lift.

H. In addition to the range cited above, compact each lift sufficiently to reduce settling but not enough to prevent the movement of water and feeder roots through the soil. The Planting Soil in each lift should feel firm to the foot in all areas and make only slight heel prints. At completion of the Planting Soil installation, the soil should offer a firm, even resistance when a soil sampling tube is inserted from lift to lift. In the presence of the Engineer's Representative probe installed Planting Soil with Penetrometer to verify Planting Soil compaction is no greater than existing conditions probed at the start of the Contract.

I. Select equipment and otherwise phase the installation of the Planting Soil to ensure that equipment does not travel over already installed soil. Contractor shall back his way out of the project site.

J. Disturbed areas outside the limit of lawn work shall be graded smooth and spread with a minimum of 6 inches of Planting Soil to the finished grade.

3.4 ACCEPTANCE

A. Confirm that the final grade of the Planting Soil is at the proper finish grade elevations. Adjust grade as required to meet the contours and spot elevations noted on the Plans. Request the presence of the Engineer to inspect final grade. Do not proceed with the remaining work of this Contract until the Engineer has given his/her written approval of the final grade.

END OF SECTION 32 1 1

SODDING AND LAWN ESTABLISHMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to provide a self-sustaining turf, including but not limited to sodding, establishment, maintenance and protection.

B. Related Sections

1. Section 329119 - Planting Soil and Fine Grading
2. Section 312300 - Excavation and Fill

1.2 UALITY ASSURANCE

A. All sodded areas shall receive an application of a pre-emergent weed killer. And erosion control mats shall not contain any poly netting. Netting shall be 100% natural.

B. Qualification of Landscape Contractor: The work of this Section shall be performed by a landscape contracting firm which has successfully installed work of a similar quality, schedule requirement, and construction detailing with a minimum of five years' experience. Proof of this experience shall be submitted per SUBMITTALS paragraph of this Section.

C. 2. Submit a harvesting and planting plan for lawn installation. Plan shall include identification of the plant material source(s), the method of harvesting, storage and transportation plans, and installation methods. Harvesting and planting plans shall address all requirements set forth in this Specification. No work shall commence until the Owner has reviewed and approved the plan.delivery, storage and handling

1.3 SUBMITTALS

A. Submit proof of landscape contractor's experience to the Engineer in accordance with QUALITY ASSURANCE paragraph of this Section.

B. Fertilizer, erosion control systems for steep slopes, limestone additives for amendment of soils, and other miscellaneous materials required by this Section: Submit product literature and certificates showing composition and analysis.

C. Sod: Submit a manufacturer's Certificate of Compliance to the Specifications with each shipment of each type of sod. No seed may be sown until the Contractor has submitted the certificates.

D. Submit program for turf maintenance to the Engineer for review and consideration. Program shall include maintenance and watering schedule. Acceptance by the Engineer of the submitted program does not reduce Contractor obligation to establish a full and healthy turf landscape in all areas.

1.4 EXAMINATION OF CONDITIONS

A. All areas to be improved shall be inspected by the Contractor before starting work and any defects such as incorrect grading or drainage problems shall be reported to the Engineer prior to beginning this work. The commencement of work by the Contractor shall indicate acceptance of the areas to be improved, and assumption of full responsibility for the work of this Section.

B. The Contractor shall be solely responsible for judging the full extent of work requirements involved.

PART 2 - PRODUCTS

2.1 MATERIALS

A. PLANTING SOIL

1. Loam shall be specified in accordance with, provided, installed and paid for under the work of Section 329119 - PLANTING SOIL AND FINE GRADING

B. SOIL ADDITIVES

1. Soil additives shall be specified, provided and paid under Section 329119 - PLANTING SOIL AND FINE GRADING except for additional applications of fertilizer that shall be provided and paid for under this Section 32 9219, based upon recommendations from soil analysis and testing as specified under Section 32 9119.

C. SEED

1. Sod shall be nursery grown sod grown from the following seed mixtures and in accordance with percentages as specified:

Common Name	Proportion of Seed by Weight
Kentucky Bluegrass (at least three improved varieties to be approved by Owner's Representative.)	30% minimum
Creeping Red Fescue or Chewings Fescue (varieties to be approved by Owner's Representative)	45% minimum
Perennial Rye	25% minimum

2. Sod shall be machine cut from an established sod farm specializing in the production and harvesting of top quality, grass turf products. Sod shall be machine cut at a uniform soil thickness of 3/4-inch +/- 1/4 inch, at the time of cutting. Measurement for thickness shall exclude top growth and thatch. Individual pieces of sod shall be cut to the supplier's standard width and length. Maximum allowable deviation from standard widths and lengths shall be 5 percent. Broken pads and torn or uneven ends will not be acceptable. Sod shall be at least one year old from time of original seeding.

3. Sod shall be free of grass species other than those specified in this section. Sod shall be free of weeds.

4. Sod shall be furnished and installed in rectangular sod strips measuring 12 inches or 16 inches in width and from 4 feet to 6 feet in length, stored in rolls with the grass top side inverted so that the topsoil is to the exterior.

5. Sod shall be harvested, delivered and installed within a period of 36 hours. Soil on sod pads shall be kept moist at all times.

6. Stakes: Stakes for pegging the sod shall be sound hardwood approximately one inch by 2 inches and of sufficient length to penetrate the mat, the seed bed and to a minimum depth of 2 inches of subsoil. Stakes shall be free from insects and fungi and capable of remaining in the ground at least 2 years.

7. Sod delivered to the construction site which does not conform to the requirements of this specification, will be rejected by the Owner and shall be removed from the site by the Contractor at no additional cost. Sod found to contain unacceptable levels of unspecified grass species or weed species at any time up to and including Final Acceptance will be rejected by the Owner. Contractor shall remove such sod from the site at no additional cost. Contractor shall replace unacceptable sod with new, approved sod at no additional cost. The Owner shall be the sole judge of what constitutes acceptable or unacceptable levels of unspecified grass species or weed species.

D. FERTILIZERS

1. Fertilizer shall be a commercial product complying with the State and United States fertilizer laws. Deliver to the site in the original unopened containers that shall bear the manufacturer's certificate of compliance covering analysis. Fertilizer shall contain not less than the percentages of weight of ingredients as recommended by the soil analysis specified, performed and paid for under the Section 329119 - PLANTING SOIL AND FINE GRADING

E. EROSION CONTROL BLANKETS

1. Erosion control blanks shall be for short-term use with functional longevity of no less than 12 months duration.

2. Blankets shall have consistent thickness with straw evenly distributed over the entire area of the mat. Matrix of straw fiber shall be 0.5 lbs/yd2.

3. The blanket shall be covered on the top and bottom sides with 100 percent biodegradable woven natural jute fiber netting. Top netting shall be 9.3 lbs/1000 ft2. Bottom netting shall be 7.7 lbs/1000 ft2.

4. Thread shall be degradable.

5. Erosion control blankets shall meet all requirements of the Erosion Control Technology Council Specification and the FHWA Standard Specification FP-03 Section 713.17, type 2.D Short-term Double Net Erosion Control Blanket

F. HERBICIDES, CHEMICALS AND INSECTICIDES

1. Provide chemicals and insecticides as needed for fungus or pest control.

2. Provide post emergent crab grass control throughout the maintenance period to ensure a germinated and mown lawn free of crab grass.

G. WATER

1. Contractor shall provide all water, machinery and labor required to establish turf. During the maintenance period the Contractor shall irrigate as required to insure sufficient water is applied to all sodded areas to ensure growth and establishment of permanent grass species. Soluble salt levels in irrigation water shall be less than 1 mmhos/cm (ds/m).

PART 3 - EXECUTION

3.1 FILLING AND COMPACTION

A. Filling, compaction and fine grading of planting soils shall be specified, performed and paid for under the work of Section 329119 - PLANTING SOIL AND FINE GRADING.

3.2 LAYING SOD

A. The season for laying sod shall be from April 1 to June 1 and from August 15 to October 1. The actual lawn construction work shall be done, however, only during periods within this season that are normal for such work as determined by weather conditions and by accepted practice in this locality.

B. Immediately prior to laying sod operations, the loam bed shall be lightly scratched with a fine toothed harrow or hand rake to provide a slightly roughened surface to accept the sod application.

C. The soil on which the sod is laid shall be reasonably moist and shall be watered, if necessary. The sod shall be laid smoothly, edge to edge, and where continuous or solid sod is called for on the plans sod shall be laid with the longest dimension parallel to the contours. Laying of sod shall start at the base of slopes and progress upwards in continuous parallel rows. Vertical joints between sod shall be staggered. Immediately after laying, press the sod firmly into contact with the soil bed by tamping, rolling, or by other approved methods so as to eliminate all air pockets. Provide

true and even surfaces, insure knitting and protect all exposed sod edges, but without displacement of the sod or deformation of the sod surface.

D. In all swales, and on all slopes steeper than or equal to three to one (3:1) and elsewhere as specified or as directed by the Owner, sods shall be held in place by stakes. Stakes shall be untreated wood one inch by two inches by twelve inches long. Staking shall be done immediately after tamping. At least one stake shall be driven through each sod to be pegged and the stakes shall be not more than two feet apart. Stakes shall have their flat sides against the slope and be driven flush.

3.3 TURF MAINTENANCE

A. Maintenance shall begin immediately after any area is sodded and shall continue until Final Acceptance of the project. In the event that sodding operations are completed too late in the fall season for adequate germination and growth of grass, then maintenance shall continue into the following spring for the minimum 120 Day period or until Final Acceptance, whichever occurs later. Install blankets or netting to prevent loam degradation and movement over the winter. Submit product literature and samples of erosion control system to the Engineer for review and approval. Blankets and netting shall be placed in a timely manner at no additional cost to the Owner.

B. Maintenance shall include resodding, mowing, watering, weeding, fertilizing a minimum of two times in addition to the fertilizer incorporated by harrowing into the spread planting soil, and resetting and straightening of protective barriers. Lawn work maintenance shall also include chemical treatments as required for fungus and/or pest control.

C. During the maintenance period, any decline in the condition of seeded areas shall require immediate action to identify potential problems and to undertake corrective measures.

D. Watering shall be done in a manner that will provide uniform coverage, prevent erosion due to application of excessive quantities over small areas, and prevent damage to the finished surface by the watering equipment.

1. The Contractor shall provide all labor and arrange for all watering necessary to establish an acceptable lawn. In the absence of adequate rainfall, watering shall be performed daily or as often as necessary to maintain moist soil to a depth of at least 4 inches for sod areas. At no time shall a tank truck be allowed on the sod beds.

2. Watering shall be done in a manner that will provide uniform coverage, prevent erosion due to application of excessive quantities over small areas, and prevent damage to the finished surface by the watering equipment. The Contractor shall furnish sufficient watering equipment to apply water to the required soil depths each 8-hour period.

E. Mowing and Edging of Turf Areas:

F. The Contractor shall keep turf areas mowed until Acceptance of the contract by cutting to a height of 2 inches when growth reaches 3 inches or as directed by the Landscape Architect.

G. At each mowing, all edges of walks, drives, plant beds and other border conditions shall be edge trimmed by hand or machine to produce straight and uniform edge conditions.

H. Remove and discard from paved areas only clippings and debris generated by each mowing and edging operation legally off-site. Engineer, if practical and aesthetic, may allow sweeping (not blowing) clippings back into grass. Mowers shall be equipped with mulching blades. Do not remove from grass areas any clippings that have been generated by mowing operations. Do not mow grass when wet.

I. Fertilizing: The first application of fertilizer is specified, purchased, performed and paid for under the 329119 - PLANTING SOIL AND FINE GRADING. A second application of fertilizer shall be quick release and shall be applied to seeded lawn, slope and buffer areas at the time of the first mowing and shall be performed and paid for under this Section 32 9219. This second application shall be applied at a rate that ensures that one-half pound of nitrogen is applied per 1,000 square feet. Phosphorus and potassium shall be applied proportionally in accordance with the recommendations of the soil tests and the quantities previously integrated into the soil during the first application. A third application of 100 percent slowly soluble or slow release nitrogen fertilizer shall be applied to seeded areas approximately two months after the second application. This third application shall correspond to the following application rates dependent upon the month of application. Fertilizer application rates shall be based upon soil testing results.

1. May 1-15: Apply 1.0 pound of nitrogen per 1,000 square feet.
2. June 15-30: Apply 1.0 pound of nitrogen per 1,000 square feet.
3. August 15 through September 15: Apply 1.0 pound of nitrogen per 1,000 square feet.
4. November 1-15: Apply 1.5 pounds of nitrogen per 1,000 square feet.

J. Reset and replace all lawn protection fencing as required to prevent access onto lawn areas.

K. During the maintenance period, any decline in the condition of seeded areas shall require immediate action to identify potential problems and to undertake corrective measures.

1. The Contractor shall provide all labor and arrange for all watering necessary to establish an acceptable lawn. In the absence of adequate rainfall, watering shall be performed daily to promote the germination and growth of specified grass species and varieties.
2. Watering shall be done in a manner that will provide uniform coverage, prevent erosion due to application of excessive quantities over small areas, and prevent damage to the finished surface by the watering equipment. The Contractor shall

furnish sufficient watering equipment to apply water to the required soil depths each 8-hour period.

3.4 APPLYING LIMESTONE

A. The Contractor shall return to the site at the beginning of the next seeding season and spread limestone across all lawn areas installed under this Contract. Limestone shall be spread at rates determined by the soil tests specified.

3.5 ACCEPTANCE

A. Following the minimum required maintenance periods for lawn construction, the Contractor shall request the Engineer in writing for a formal inspection of the completed work. Request for inspection shall be received by the Engineer at least 10 Days before anticipated date of inspection.

B. Acceptance Requirements

1. At the end of the maintenance period, sod areas shall have a close stand of grass as defined above with no weeds present and no bare spots greater than 3 inches in diameter over greater than 5 percent of the overall sod area. At least 90 percent of the grass established shall be permanent grass species

2. Sod areas shall be in vigorous growing condition with no discolored, dead or otherwise unacceptable areas. Sod will have knit firmly to the loam subgrade and no weeds shall be present.

C. Furnish full and complete written instructions for maintenance of the lawns to the Owner at the time of acceptance in conformance with Submittals requirements.

D. Engineer’s inspection shall determine whether maintenance shall continue in any part.

3.6 CLEAN UP

A. Absolutely no debris may be left on the site. Excavated material shall be removed daily by the Contractor as directed. Repair any damage to site or structures to restore them to their original condition, as directed by the Landscape Architect, at no cost to the Owner.

3.7 TEMPORARY COVER CROP

A. Sow a temporary cover crop of buckwheat, domestic rye grass or other acceptable seed if there is insufficient time in the planting season to complete seeding, fertilizing, and permanent seeding at the option of Contractor or order of Engineer. Cut and water cover crop as necessary until the beginning of the following planting season, at which time it shall be plowed or harrowed into soil, the areas shall be fertilized and permanent seed crop sown as specified.

END OF SECTION 32 21

PLANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to perform all planting work and related items as indicated on the Contract Documents and as specified in this Section and includes, but is not limited to, the following:

   a. Planting trees, shrubs, perennials, groundcover, bulbs and vines

   b. Staking, guying, and anchoring trees

   c. Planting maintenance

   d. One-year guarantee period for all plants

   e. Providing and placing backfill mix

B. Related Sections

1. Section 312300 - Earth Excavation and Fill

2. Section 329119 – Planting Soil and Finished Grade

1.2 UALITY ASSURANCE

A. Qualification of Landscape Contractor: The work of this Section shall be performed by a landscape contracting firm which has successfully installed work of a similar quality, schedule requirement, and construction detailing with a minimum of five years' experience. Proof of this experience shall be submitted per SUBMITTALS paragraph of this Section.

B. Foreman or Crew Leader: The project foreman or crew leader shall have at least five years experience in management, handling and installation of ornamental and native plant material for municipal or state landscape construction projects, be a Connecticut licensed Arborist and shall be on-site during all work activities required by this special provision. Proof of this experience shall be submitted per submittals.

C. All work shall conform to Connecticut Pesticide Laws and Regulations per the Department of Agricultural Resources Pesticide Program. All applicators must have a State Pesticide License. Mixing, applying and/or disposing of herbicides shall be in accordance with instructions on the labels. All applicators must wear the required personal protective equipment specified on the label.

D. The Landscape Contractor shall be responsible to coordinate with plant material suppliers in sufficient time to ensure that all of the plants as specified in the contract plant list are available in sufficient quantity for installation.

E. An arborist, licensed by the State of Connecticut, is required for performing all pruning work.

F. At least one tree and one shrub of each variety is to be tagged with a waterproof tag bearing legible designation of botanical and common names, and all other standard products shall be delivered sealed and unbroken.

G. Do not make substitutions without written approval. If specified landscape material is not available, obtain approval for substitution from the Engineer.

H. The Engineer reserves the right to inspect all plant materials for compliance with specifications, and to reject unsatisfactory or defective work at any time during progress of work.

I. REFERENCES

1. The following standards shall apply to the work of this Section.

   a. Pruning Standards: ANSI A300 Part 1: Trees, Shrubs & Other Woody Plant Maintenance – Standard Practices (Pruning).

   b. SPN: "Standardized Plant Names," latest edition, by the American Joint Committee on Horticultural Nomenclature.

   c. American National Standards Institute (ANSI): Z60.1 American Standard for Nursery Stock, latest edition, published by American Association of Nurserymen, (AAN)

1.3 SUBMITTALS

A. Submit in accordance with Submittal requirements,

1. Submit proof of landscape contractor's experience to the Engineer in accordance with QUALITY ASSURANCE paragraph of this Section.

   a. Experience: The Contractor shall submit two copies of the proof of experience for the Landscape Contracting firm and the firm's foreman or crew leader for this project to the Engineer for review and approval.

   b. Licenses: The Contractor shall submit two copies each of the herbicide applicator's license, the foreman or crew leader's arborist license, and the arborist license for the individual who will be pruning plant material to the Engineer's approval.

2. Plant Material: At least 90 days prior to anticipated planting, the Contractor shall submit confirmation of availability for all plants on the plant list, accompanied by nursery sources. When the specified types and sizes of plants are not available, substitutions may be made upon written request by the Contractor. Substitutions

proposed by the Contractor shall have equivalent overall form, height, and horticultural characteristics and must be approved in writing by the Engineer prior to tagging.

3. Selection of Plant Material: At least 14 work days prior to the date on which the plant selections are to be made and at least 30 days prior to the expected planting date, the Contractor shall request, in writing, that the Engineer select and tag plant material to be furnished. The letter of request shall also have attached a certification from the supplier attesting to the fact that the stock to be selected from is, in fact, the specified plants required under this Section. No substitutions will be permitted unless approved in writing by the Engineer.

4. The Contractor shall arrange for and bear the cost of transportation, meals in transit, and overnight accommodations, if necessary, for the Engineer during the period of time required to select and tag the required plant material. All trees shall be tagged at the source and in the ground prior to digging. The Contractor shall provide the necessary tags or seals for identifying the plant material. The tags shall be of durable construction and are numbered sequentially with raised lettering.

5. For all other materials outlined the Contractor shall submit to the Engineer material samples, manufactures' product data, certified test results, and (where applicable) installation instructions attesting that the following materials meet the requirements specified. No materials shall be ordered until submittals have been approved by the Engineer. Delivered materials shall match the samples.

6. These materials are as follows:

    a. Backfill Mix: The Contractor shall submit a 10 lb. representative sample of the backfill mix according to the requirements specified herein.

    b. Water Retention Agent: The Contractor shall submit certified laboratory test results per the requirements of this special provision.

    c. Antidessicant: The Contractor shall submit certified laboratory test results per the requirements of this special provision.

    d. Tree and Shrub Fertilizer: The Contractor shall submit certified laboratory test results per the requirements of this special provision.

    e. Mulch: The Contractor shall submit one 10-lb sample of mulch accompanied by certified laboratory test results per the requirements of this special provision.

    f. Water: The Contractor shall submit certified laboratory test results per the requirements of this special provision.

    g. In addition, the Contractor shall submit the following:

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

i. Planting Schedule: Submit to the Engineer in writing the proposed planting schedule. Obtain approval of planting schedule from the Engineer prior to performing any work.

1.4 EXAMINATION OF CONDITIONS

A. All areas to be improved shall be inspected by the Contractor before starting work and any defects such as incorrect grading or drainage problems shall be reported to the Engineer prior to beginning this work. The commencement of work by the Contractor shall indicate acceptance of the areas to be improved, and assumption of full responsibility for the work of this Section.

B. The Contractor shall be solely responsible for judging the full extent of work requirements involved.

1.5 PRODUCT DELIVERY STORAGE AND HANDLING

A. Protect all products from weather or other damaging or deteriorating conditions.

B. Plants which have been damaged or have deteriorated in transit or storage are not acceptable.

C. Keep plants moist, fresh, and protected against exposure to sun, wind, and freezing temperatures whether in the receiving yard, in transit, while being handled, or at the job site awaiting planting.

D. Deliver trees, shrubs and groundcover after preparations for planting have been completed and plant immediately

1.6 PLANTING DATES

A. Prepare a proposed planting schedule. Schedule dates for each type of landscape work during normal seasons for such work. Once accepted, revise dates only as approved in writing, after documentation of reasons for delays. Unless otherwise directed by the Engineer, the planting season shall be as follows:

Deciduous material:	Spring - March 15 to June 15 Fall - September 1 to October 15
Evergreen material:	Spring - March 15 to May 30 Fall - August 15 to November 15

B. Requests for exceptions to this schedule shall be submitted in writing to the Engineer for approval. Planting under frozen conditions in either the spring or fall will not be permitted. Planting before or after the above referenced planting dates will increase the likelihood of plant or grass seed establishment failure. Any deviation from the above referenced planting dates is undertaken at sole risk of the contractor and it is the respon-

sibility of the contractor to provide any additional maintenance and watering which may be required to ensure satisfactory plant establishment.

C. Those species known to be fall digging hazards shall be dug during the spring season only. Fall planting of these species shall be permitted only with certification, from the nursery, of the time of digging and at the discretion of the Engineer.

D. Correlate planting schedule with specified maintenance periods to provide maintenance to date of acceptance.

E. Coordination with Lawns: Plant trees, shrubs, and groundcover after final grades are established and prior to planting of lawns, unless otherwise acceptable to Engineer. If planting of trees and shrubs occurs after lawn work, protect lawn areas and promptly repair damage to lawns resulting from planting operations.

1.7 SPECIAL CONDITIONS

A. Should discrepancies exist between plant quantities or plant sizes as shown in the Planting Schedule and on the Planting Plan, quantities and sizes shown on the Planting Plan shall govern. Contractor shall install all plants as shown on the plan at no additional cost to the Owner.

1.8 WARRANTY

A. Provide a warranty for plant material for a minimum of (18) months including one continuous growing season after the completion of the Plant Establishment. Commence warranty on date identified in the Certificate of Final Completion.

B. Warranty: Include coverage of plants from death or unhealthy conditions as determined by the Engineer.

C. Replacements: Plants of same size and species as specified, planted as soon as possible in the next planting season, with a new warranty and a Plant Establishment commencing on date of replacement.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Loam

1. Loam shall be specified in accordance with, provided, installed and paid for under the work of Section 329119 - PLANTING SOIL AND FINE GRADING

B. Manufactured Compost

1. Manufactured Compost shall be specified in accordance with, provided, installed and paid for under the work of Section 329119 - PLANTING SOIL AND FINE GRADING

C. Water Retention Agent

1. Water Retention Agent shall be medium grade Hydrogel.
2. Water Retention Agent shall be a cross-linked potassium polyacrylamide/acrylate copolymer.

D. Antidessicant

1. Antidessicant shall be an emulsion which permits transpiration while retarding excessive loss of moisture from plants. Use "Wiltpruf" or approved equal.
2. Deliver in manufacturer's fully identified containers and mix according to manufacturer's direction.

E. Tree and Shrub Fertilizer

1. When soil tests indicate soil amendments, apply soil conditioners or fertilizers to amend soil to specified conditions as indicated in the analysis.
2. Complete fertilizer in granular form, from commercial sources bearing manufacturer’s analysis; 10-10-10 ratio of N-P-K.
3. Significant quantities of trace elements such as iron, boron, etc. shall be contained in the fertilizer.
4. One hundred percent (100%) of available nitrogen shall be in a slow release form as found in certain urea form products or natural organic forms or a combination of both.

F. Staking and Guying Materials

1. Guy Web: Shall be a low abrasion woven fiber webbing with a break strength of 900 lbs. or better. The width of the webbing shall be no less than 5/8 inch, nor greater than ¾ inch. The length shall be sufficient enough to be attached to the tree trunk and stake.
2. Stakes: Shall be on a hardwood source, free of knots, insects and fungi. Stakes shall be of uniform size and shape and shall be a minimum of 2 inches by 3 inches by 8 feet. Stakes shall be pointed with a taper of no less than 4 inches
3. The above ground stake height shall be 8 inches above the point of attachment. The type of stakes shall be uniform throughout the job.
4. Tree Staples- Tree Staple shall be a Tree Staple stabilizer as provided by Tree Staple Inc. or approved equivalent. Size and Quantity per tree shall be per manufacturer’s recommendations.

G. Mulch

1. Pine Bark Mulch shall be derived from evergreen tree bark aged to a minimum of six months and no more than eighteen months. The bark shall be shredded so that the resulting pieces are no more than 1/2 inch thick and no longer than 3 inches. The mulch shall be ninety-eight percent (98%) organic matter with a pH of 3.5 to 4.5. The mulch shall be free of stringy material and shall not contain an excess of

fine particles. The mulch shall be brown in color, free of leaves, twigs, sod, weeds, shavings and other foreign materials which are injurious to health plant growth.

H. Portable Drip Irrigation Bag

1. Portable Drip Irrigation Bag shall hold a minimum of 15 gallons of water with slow drip holes release system taking place over several days. Use "Treegator Original" or approved equal.

I. Water

1. Clean, fresh potable water free from injurious chemicals and other toxic substances harmful to plant life. No brackish water will be permitted.

2. The Engineer will reject any water delivered to the site which, after on-site, post-delivery testing, does not meet these specifications.

J. Plant Materials

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

2. Plant materials shall conform in size, grade and quality to the "American Association of Nurserymen Standards for Nursery Stock." As approved by the United States of America standards institute, in effect at the time of bidding.

3. Plants of other kinds than those named in the Plant Schedule on the Drawings shall not be accepted without written approval of the Engineer.

4. Unless otherwise approved by Engineer, all plants shall be nursery-grown in accordance with good horticultural practices and shall have been grown within hardiness Zones 4 through 6a, as established by the USDA Plant Hardiness Zone Map, will be accepted. The Contractor's suppliers must certify in writing that the stock has actually been grown under Zone 6a or hardier conditions. Plants not so certified will not be accepted.

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

6. Container-grown stock shall have been grown in the container long enough for the root system to have developed sufficiently to hold its soil together firmly. No plants shall be loose in the container. Container-grown plants shall not be pot

bound, with spiraling roots or roots growing densely against the sides of the container. Score or butterfly cut rootball of all container-grown plants prior to planting.

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

8. Plants shall be dug, handled and transported so as to prevent damage of any sort including but not limited to breakage of branches or limbs, scraped or bruised trunk or broken rootball. Plants shall be protected from desiccation during digging, storage and transportation by watering, covering and application of anti-desiccants as necessary to ensure their continued health and viability.

9. All plant material shall comply with the state and federal law with respect to inspection for plant disease and insect infestation.

10. Replacement plants larger in size than existing may be used if approved by the Engineer, provided use of larger plants does not increase Contract price.

11. If use of larger plants is approved, increase ball of earth of spread of roots in proportion to size of plant.

PART 3 - EXECUTION

3.1 PLANTING

A. Verification: Determine the full extent of Work required, including but not limited to the potential need for storing and maintaining plants temporarily and re-handling plants prior to final installation. Inspect all areas to be planted before starting any landscape work and report any defect, such as incorrect grading, incorrect subgrade elevations, or drainage problems, etc., to the Engineer prior to beginning work. Do not proceed with installation until all unsatisfactory conditions have been corrected. Commencement of Work indicates the Contractor's acceptance of site conditions and filled subgrade material in areas to be planted, and the Contractor assumes responsibility for work.

B. Layout: Determine location of underground utilities and layout plants so as to avoid possible damage to such structures. Plant pits and bed locations as shown graphically and/or verbally on plans, shall be staked on ground by contractor and approved by the Engineer prior to excavation. Notify the Engineer at a minimum of 48 hours in advance prior to scheduling any field inspections. Should discrepancies exist between plant quantities in Planting Schedule and Planting Plan, quantities shown on the Planting Plan shall govern. Adjustments in locations and outline shall be made as directed in field. Labor, equipment, and new smooth stakes are to be furnished by the Contractor for this purpose.

C. Excavation: Planting beds and pits shall conform to the approved staked locations and outlines. Holes dug for plantings shall in all cases be large enough to include the com-

plete root system of the plant (tree, shrub, and groundcover) to be received and also sufficient amounts of approved backfill around the periphery of the rootball. All sod, weeds, roots, cobbles, and stones and other objectionable materials excavated from the plant holes, which is unsuitable for backfill shall be removed from the site immediately and legally disposed of.

D. Plant Hole Size: The minimum plant hole size, unless otherwise specified, shown on the plans or directed by the Engineer shall be as follows

1. Trees and Shrubs - The planting hole shall be twice the diameter of the rootball in width and no deeper than 2 inches less than the distance from the bottom of the rootball to the root collar (i.e. a 12 inch tall ball will require a 10 inch deep hole). Any excavation in excess of that required shall be replaced and compacted to eighty-five percent (85%) of maximum density.

2. Groundcover - The planting hole shall be twice the diameter of the rootball in width and equal to the depth from the bottom of the rootball to the level at which it was grown in the nursery. Any excavation in excess of that required shall be replaced and compacted to eighty-five percent (85%) of maximum density.

E. Any rocks or underground obstructions shall be removed to a depth necessary for planting as specified, unless alternate locations for the planting are approved by the Engineer. If removal of obstructions results in a deeper hole than specified for planting, backfill material shall be added and compacted to eighty-five percent (85%) of maximum density to the correct depth.

F. Backfill Mix: Add loam and compost to existing suitable soil excavated from the planting hole to create mix for planting pits. Backfill Mix shall be at least twenty-five percent 75%) loam and twenty-five percent (25%) compost.

3.2 SETTING PLANTS

A. Plants shall be handled in such a manner that the soil of the rootball will not be loosened from the roots. Carefully place plant into the prepared hole. Set plants plumb, place one third of the manufacture's recommended Water Retention Agent around the rootball, and fill in around the rootball to one half the depth of the hole with backfill mix. Thoroughly tamp the backfill mix to eighty-five percent (85%) of maximum density.

B. Fill remaining area of planting hole with water. Once the water has completely drained loosen burlap and peel down at least the top two-thirds. Wire baskets to be cut off and removed. Roots that have been wrapped around the ball within the burlap shall be made to lay in as natural a manner as possible. Cut broken or frayed roots cleanly. Prune girdling roots.

C. Fill remaining area of hole with backfill mix, place two-thirds of the manufacture's recommended Water Retention Agent around the rootball, and thoroughly tamp to eighty-five percent (85%) of maximum density. Form a saucer around the edge of through backfill hole by constructing a berm. The finish height of the compacted berm shall be

4 inches higher than the surrounding grade. No excess soil shall be allowed to remain within the plant saucer. Fill saucer with water.

3.3 PRUNING OF NEW PLANT MATERIAL

A. After planting, prune only dead, broken or deformed branches and in such manner as to preserve natural character of plant.

B. Perform all pruning with sharp tools, with cuts flush and clean. Do not apply paint or asphalt emulsion tree wound compound on cut area.

C. Trees which have had their leaders cut, or so damaged that cutting is necessary, will not be accepted. There shall be no abrasion of bark, nor fresh cuts of limbs over ½ inch.

3.4 WATERING

A. The plants shall be watered immediately following planting.

B. Soak the plants thoroughly again within a twenty-four hour period after the initial planting.

C. Additional watering shall be made at least once every week, or as directed by the Engineer based on weather conditions, until final acceptance of the plant material.

3.5 FERTILI ING

A. During backfill operations, place fertilizer in upper foot of back fill around perimeters at a rate of two ounces per foot of diameter of plant pit, or as recommended by manufacturer.

3.6 MULCHING PLANTS

A. Application of mulch should only occur after planting operations have been completed and initial watering has taken place. Mulch shall be applied no later than forty-eight hours after planting.

B. Mulch shall be applied to a maximum of 3 inches in depth for all individual trees and planting beds, as indicated graphically or verbally on the drawings.

C. Where mulch abuts seeded lawn areas or other finish grade materials, edge of planting bed shall be cut smooth and cleanly. Mulch shall be placed carefully so as not to spill into adjacent areas. Any excess or spilled mulch shall be promptly removed from the project area. The cost of the mulch is incidental to new plantings.

3.7 GUYING AND STAKING

A. Immediately after planting, stake trees (tree staple) as indicated on the drawings or as directed by Engineer.

B. Install tree staples at locations indicated on drawings. Install per manufacturers recommendations.

3.8 TRUNK WRAPPING

A. Remove all trunk wrap and trunk protection devices prior to staking and guying operations unless otherwise directed by the Engineer.

3. ANTIDESSICANT SPRAYING

A. Spray antidessicant as directed by the manufacturer's recommendation and as approved by the Engineer.

3.10 TAGS AND LABELS

A. Leave all tree tag and label seals unbroken and visible on plant material until final inspection. Remove all seals immediately after final inspection.

3.11 PLANT CARE

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

B. During the 60 day Maintenance Period, plants shall be inspected for watering needs at least twice each week using moisture meters supplied by the Contractor. In addition, during the portion of the Establishment Period occurring between May 1 and November 1, the plants shall be inspected weekly using moisture meters.

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

D. Trees and shrubs shall be pruned, if necessary, following planting and in accordance with the American Nurserymen's Association Standards for Class I, fine pruning, to preserve the natural character of the plant. All dead wood or suckers and all broken or badly bruised branches shall be removed. Do not cut leaders.

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

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

3.12 INVASIVE PLANT CONTROL

A. Planting beds shall be monitored for growth of invasive species, in particular, Japanese Knotweed. All invasive plants shall be either manually removed such that the entire root system is removed or shall be treated with herbicide during the most effective time period. Herbicide application for invasive control in planting beds shall be incidental to the planting items.

3.13 MAINTENANCE PERIOD 60 DAYS

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

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

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

D. Inspection shall be as follows:

1. Plants shall be alive and in satisfactory growth at that time. The Contractor is responsible for arranging inspection early enough in the season to allow adequate time to procure and install replacement material. Plants found to be unacceptable shall be removed promptly from the site and replaced immediately or during the next normal planting season. Contractor is responsible for replacing any plants found unacceptable prior to this inspection. Upon acceptance of the work of replacement planting, the Engineer shall issue a written Certificate of Final Acceptance for all plants installed under this Section to the Contractor.

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

3.14 WARRANTY PERIOD 18 MONTHS

A. The purpose of the Warranty Period is to warranty plants for (18) months. The Contractor shall be responsible for replacing plants at any time throughout the (18) months period per the request of the Engineer. The Warranty Period shall begin immediately after Certificate of Final Acceptance is provided and shall continue for (18) months.

B. If in the Engineer's opinion, plant materials and/or workmanship are deficient, the contractor shall replace the plants during the Warranty Period until plant replacements are made or other deficiencies are corrected. All dead and unsatisfactory plants shall be removed promptly from the project. Replacement plants shall conform in all respects to the Specifications for the original plants and shall be planted in the same manner.

C. Decision of Engineer as to necessity to replace any plant materials or repair any defects on workmanship, or cause of any destruction or loss, impairment or failure to flourish, shall be conclusive and binding upon Contractor. Replacements shall be of same spe-

cies and size as specified on Plant List. All plant replacements shall be inspected, sealed, furnished, planted and mulched as specified herein at Contractor's expense.

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

END OF SECTION 32 3 00

STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Supplementary Conditions, and Division 1 Specification sections, apply to this section.

1.2 SUMMARY

A. Provide all labor, materials, necessary equipment and services to complete the work called for in this Section or as shown on the plans, including but not necessarily limited to the following:

1. Storm drainage system.
2. Cleaning of all existing and proposed storm pipes and structures within the project limits and any downstream structures as directed upon the completion of the construction activities.
3. Connection to existing structures.
4. Stormwater quality management.

B. Related Work: The following work contains requirements that may refer to this section.

1. Section 31 25 00 - ñStorm Water Pollution Control Plan (SWPCP)ò
2. Section 31 23 33 - ñTrenching and Backfillingò
3. Section 31 11 00 - ñSite Utility Preparation and Demolitionò

1.3 SUBMITTALS

A. Submit manufacturersô descriptive literature for all items proposed to be furnished and installed under this Section.

B. Submit manufacturerôs specifications and other data required to demonstrate compliance with the specified requirements.

C. Manufacturersô recommended installation procedures which, when accepted by the Engineer, shall become the basis for inspecting and accepting (or rejecting) the actual installation procedures used on this work.

D. Hydrodynamic Sediment Chamber removal rate data, as reported by an independent testing laboratory.

E. Submit as-built drawings to the Owner and the Connecticut Department of Administrative Services (DAS). The as-built shall be certified by a land surveyor licensed to practice in the State of Connecticut. Record final and actual sizes, materials,

locations, and elevations of all components on as-builts. Contractor shall submit paper prints to the Engineer for review. Upon acceptance of the as-built, final format shall include paper copies and electronic files in both PDF and AutoCAD 2018 formats.

PART 2 – MATERIALS

2.1 CATCH BASINS (CB) and YARD DRAINS (YD)

A. Catch basins shall be ñC-Lò or ñCò State DOT standard with a sump of 4ô-0ò minimum below outlet, as shown on drawings unless otherwise specified.

B. Concrete yard drains shall be able to carry H-20 loading with a sump of 4ô-0ò minimum below outlet, as shown on drawings unless otherwise specified.

C. Yard drains shall include the drain basin type as indicated on the Contract Drawing. The ductile iron grates for each of these fittings are to be considered an integral part of the surface drainage inlet and shall be furnished by the same manufacturer.

D. Structural steel for catch basin and concrete yard drain grates shall conform to the requirements of ASTM A-36 or A-283, Grade B or better.

E. Frames and grates shall be painted immediately before installation with a shop coat of primer and painted in the field, with a coat of RC2 Asphalt or SS-1 Emulsion.

F. Catch basins shall be constructed in accordance with the drawings. Materials used shall conform to section M.08.02 of State of Connecticut DOT Specification Form 817.

G. Mortar shall conform to Article M.11.04 of the Connecticut DOT Specification, Form 817.

H. Catch basins and yard drains shall have frame and grates as identified on the drawings. Contractor shall provide proper risers and tops to the structures as required to accept the identified frame and grates.

I. The grates and frames furnished for yard drains shall be U.S Foundry & MFG. Corporation hot dip galvanized ductile iron, ADA/heel proof compliant (item number: 8040222). USF 4175 frame & USF 6319 grate.

2.2 STORM DRAINAGE PIPING

A. Storm drainage pipe shall be PVC, RCP or HDPE as shown on the plans and as follows:

1. Reinforced concrete pipe & flared end sections: AASHTO-M-170. Class IV with flexible, water-tight, rubber-type gaskets conforming to AASHTO M-198.

2. Polyvinyl chloride plastic pipe to be installed in the storm drainage system shall conform to Section M.08.01-27 State of Connecticut Department of Transportation (DOT) Specification Form 817, and ASTM D-1785.

3. Polyvinyl chloride (PVC) pipe-perforated: conform to ASTM F-758 and D-1784.

4. PVC pipe shall have factory installed integral bell gasket joints and conform to ASTM F477. Connection to manholes shall be by use of manhole coupling adapters or flexible rubber connections.

5. Corrugated high density polyethylene pipe (HDPE) to be installed in the storm drainage system shall conform to Section M.08.01-25 State of Connecticut Department of Transportation (DOT) Specification Form 817, and AASHTO M252 and M294.

2.3 MANHOLE MATERIALS

A. Precast Concrete Manhole Sections: Precast Concrete manhole sections or units shall conform to ASTM C-478 as referenced herein before. Joints for such manholes shall conform to ASTM-C443 as previously referenced.

B. Precast manhole walls shall have a minimum of 18 inches of concrete above and below any opening.

C. Monolithic base slab and wall sections shall have a minimum of 8 inches of concrete wall above the base slab.

D. All precast units shall be designed for H20 Traffic loading.

E. Manhole steps, as shown on the Drawings, shall be built into manhole walls as indicated. The top step shall be 4 inches below the manhole cover frame.

F. Manhole Castings:

1. Manholes are to be fitted with the Standard Frame and Cover, as shown on the drawings. E.L. LeBaron (Pat. No. LJ-105) cast iron frame, and 23-7/8-inch cover having one center 1-1/4-inch pick hole (Pat. No. L24C-21) or District approved equal.

2. All covers shall be appropriately marked ñSTORM.ò

3. Castings shall conform to ASTM Specification A-48, Class 30 and shall be thoroughly cleaned, heated, and dipped in black asphaltum paint.

G. Bank run gravel refill shall conform to the requirements of Section 312323.

H. In order to prevent covers rocking or rattling under traffic and to insure proper fit and interchangeability between different frames and covers, the lower surface of the cover and the corresponding upper surface of the frame shall be machine-finished in a lathe to provide a round, smooth, flat contact with the dimensions and clearances called for on the District's standard drawings.

I. All non-U.S. manufactured manhole frames and covers submitted for approval and use must be clearly and conspicuously marked on the top surface of each in English letters designating the manufacturing country of origin. Such marking shall be either by means of die stamping, cast in molding, etching, or engraving. No other type of marking is acceptable.

J. Brick:

1. Brick used for inverts, water - tables and under frames and covers shall conform to ASTM C32, GRADE SM.

K. Mortar for Brickwork:

1. Mortar shall conform to Article M11.04, CONN DOT FORM 817 A -MORTAR.

L. Precast Concrete Masonry Units:

1. Precast concrete masonry units shall be machine-made solid segments, conforming to ASTM Standard Specifications for Concrete Masonry Units for Construction of Catch Basins and Manholes, Designation C139-73 (1989), with the following exceptions and additional requirements:

   a. Type II cement shall be used except as otherwise permitted.

   b. The width of the units shall be as indicated on the drawings.

   c. The inside and outside surfaces of the units shall be curved to the necessary radius and so designed that the interior surfaces of the structures shall be cylindrical, except the top batter courses shall be designed to reduce uniformly the inside section of the structure to the required size and shape at the top.

   d. Units shall be designed such that only full-length units are required to lay any one course.

   e. Acceptance of the units will be on the basis of material tests and inspection of the completed product.

   f. The manufacturer's name and the date of manufacture shall be clearly marked on the units.

M. Mortar for Masonry Units

1. The mortar shall be composed of one part portland cement and two parts of sand by volume with sufficient water to form a workable mixture. Cement and sand shall be as specified for mortar for brickwork.

2.4 MANHOLE FALL PREVENTION SYSTEMS

A. Where manholes exceed 20 vertical feet from the proposed rim elevation to the invert, manholes shall be provided with a fall prevention system. Fall prevention systems shall be in accordance with OSHA requirement 29 CFR 1910.27 and as described herein and as indicated on the contract drawings.

B. Carrier rail assembly shall be 1-5/16-inch O.D. by 1-inch ID Type 6061-T6 aluminum notched .875-inches by .875-inches by 5/32-inches at 6-inch centers; tapped 3/8-inches at 9-inch centers opposite notches.

C. Manhole rung clamp assembly shall be constructed from 6061-T6 aluminum 11-inches long by 1.25-inches wide with 2 slots 7/16-inches by 1.25-inches at 9-inch centers and serrated on one side.

D. Safety locking mechanism shall be cast of manganese bronze with stainless steel springs, and drop forged links and snap-locking pawl shall be minimum tensile strength of 110,000 psi. Roller bearing shall be killian type. Stainless steel springs shall comply with Military Specification QQ-W-423B.

E. Safety harness shall be adjustable to fit waists 30-inch to 48-inch. Belt shall be nylon web equipped with 3 stainless steel 'D' rings.

F. Fall preventions systems shall be manufactured by DBI/SALA, Safe Approach or approved equal.

2.5 UNDERGROUND MARKING TAPE

A. All storm piping installed under this project shall be marked and identified by use of a 6" wide marking detection tape. The marking detection tape shall consist of a minimum 0.35 mil thickness solid aluminum foil core running the full length and width that is impervious to all known alkalis, acids, chemical reagents and solvents likely to be encountered in the soil.

B. The tape shall have imprinted the words "CAUTION BURIED STORM LINE BELOW" continuously over its entire length in permanent black ink for identification. Material shall be a vivid opaque color (safety green for storm) for maximum contrast with soil. Minimum weight shall be 5 pounds per 1000' unit and 6" width. Minimum tensile modulus shall be 27,000 psi and minimum tensile strength of 5,000 psi. The minimum overall thickness shall be 5.5 mils. The tape shall be as manufactured by Allen Systems, Inc. or approved equal.

2.6 CRUSHED STONE

A. Crushed stone shall be as specified in Section 31 23 23.

2.7 SAND BEDDING

A. Coarse sand shall be as specified in Section 31 23 23.

2.8 FILTER FABRIC

A. Filter fabric shall be non-woven drainage fabric and shall meet the following requirements.

Grab Strength (ASTM D-4632-86)..... 120 lbs.
Grab Elongation (ASTM D-4632-86)..... 55%
Trapezoidal Tear Strength (ASTM D-4533-85)..... 45 lbs.

Mullen Burst Strength (ASTM D-3786-87) ..... 270 psi
Puncture Strength (ASTM D-3787-80) ..... 80 LBS

PART 3 - EXECUTION

3.1 STORM DRAINAGE SYSTEMS

A. Excavation:

1. Excavate all pits and trenches to the proper depths and elevations.
2. The bottom of all trenches shall be graded to a uniform firm bearing for the pipe throughout its entire length.
3. All required shoring shall comply with OSHA regulations.

B. Base Materials:

1. Place level and true, and compact base materials for catch basins, yard drains, and manholes.

C. Piping:

1. Control of Alignment and Grade
   a. Lay pipes to proper elevations as indicated on drawings
   b. The Contractor may use laser equipment to assist in setting the pipe provided he can demonstrate satisfactory skill in its use.
   c. The use of string levels, hand levels, carpenter's levels or other curved devices for transferring grade or setting pipe are not permitted.
   d. During construction, the Contractor shall provide the Engineer, at his request, all reasonable and necessary materials, opportunities, and assistance for setting stakes and making measurements, including the furnishing of one or two rodmen or chainmen as needed at intermittent times. He shall not proceed until he has made timely request of the Engineer for, and has received from him, such controls, and instructions as may be necessary for the work to progress. The work shall then be done in strict conformity with such controls and instructions.
   e. The Contractor shall carefully preserve benchmarks, reference points and stakes, and in case of willful or careless destruction by his own men, he will be charged with the resulting expense and shall be responsible for any mistakes or delay that may be caused by their unnecessary loss or disturbance.
2. Lay pipe by proceeding upgrade with the spigot ends of bell-and-spigot pipe. Lay the tongue ends of tongue-and-groove pipe pointing in the direction of flow.
3. Jointing Pipe

a. PVC pipe shall use Bell-and-Spigot with lock-in rubber gaskets. Ends of pipe are to be pushed home and the inner surfaces to be flush and even. PVC pipe shall have glued joints.

b. RCP shall be jointed as required by CONN DOT Form 817.

c. HDPE pipe shall be jointed per the manufacturer and as required by CONN DOT Form 817.

4. Provide bedding material in accordance with the details and Section 31 23 33.

D. Construct CBôs in accordance with requirements of Article 5.07.03 of the DOT Specification, Form 817.

E. Backfill and compact all trenches and CBs, YDs and MHs as specified in Section 312333.

F. Contractor will insure that at all times, the safety ribbons or barricades are erected around the outside of all open trenches when an excavation is left open overnight. Flashing lights will be at 15 foot intervals along the barrier to insure the safe visibility of nearby individuals. The contractor will be required to return to the site after hours, should an unsafe condition be indicted by the Owner, and will immediately provide whatever safety barriers are necessary to protect the public.

G. At the completion of the project the Contractor shall clean the existing and proposed storm pipes and structures within the Contract Limit Line (CLL) as well as any sediment build-up outside the limits of construction resulting from construction activities. Pipes shall be flushed as necessary and the sumps of all basins shall be vacuumed in accordance with local procedures. All material removed from the system shall be disposed of in accordance with these specifications.

H. The specified PVC YD shall be installed using conventional flexible pipe backfill materials and procedures. The backfill material shall be crushed stone or other granular material meeting the requirements of Class 2 material as defined in ASTM D2321.

1. The drain basin body will be cut at the time of the final grade. No brick, stone or concrete block will be required to set the grate to the final grade height.

2. Bedding and backfill for surface drainage inlets shall be placed and compacted uniformly in accordance with ASTM D2321.

3. For H-20 load rated installations, a concrete ring will be poured under and around the grate and frame. The concrete slab must be designed taking into consideration local soil conditions, traffic loading, and other applicable design factors.

3.2 PRECAST CONCRETE MANHOLES

A. Precast bases shall be placed on a layer of compacted bedding material as specified in Section 31 23 33 and as shown on the Drawings. The excavation shall be properly dewatered while placing bedding material and setting the base.

B. Inlet and outlet stubs shall be connected and sealed in accordance with the manufacturer's recommended procedure, and as shown on the Drawings.

C. Barrel sections and cones of the appropriate combination of heights shall be placed, using manufacturer's recommended procedure for sealing the horizontal joints. Joint sealant shall be bitumastic sealant unless otherwise approved by the Engineer.

D. The exterior asphaltic waterproofing shall be touched up after installation and shall be applied to the exterior of all joints in accordance with manufacturer's recommendations.

E. The inverts and the shelf shall be constructed of brick. "Puddling" of steps in the invert shall be basis for rejection.

F. The frame and cover shall be placed on the top of the manhole or some other approved means shall be provided to prevent accidental entry by unauthorized persons, children, animals, etc., until the Contractor is ready to make final adjustment to grade.

3.3 MANHOLE FRAMES AND COVERS

A. Frames shall be set with the tops conforming accurately to the grade of the pavement or finished ground surface.

Frames shall be set concentric with the top of the masonry and in a full bed of mortar so that the space between the top of the manhole masonry and the bottom flange of the frame shall be completely filled and made watertight. A thick ring of mortar extending to the outer edge of the masonry shall be placed all around and on the top of the bottom flange. The mortar shall be smoothly finished and have a slight slope to shed water away from the frame.

B. Manhole covers shall be left in place in the frames on completion of other work at the manholes.

C. Mixing Mortar:

1. ASTM C 270.

D. Brick Masonry:

1. Only clean bricks shall be used in brickwork for grade adjustment and manhole inverts. The brick shall be moistened by suitable means, until they are in a surface dry, saturated condition.

2. Each brick shall be laid in full bed and joint of mortar without requiring subsequent grouting, flushing, or filling, and shall be thoroughly bonded.

3. Brick masonry shall be protected from too rapid drying by the use of burlap kept moist, or by other approved means, and shall be protected from the weather and frost, all as required.

4. All masonry joints, which are exposed to view, shall be examined to locate cracks, pointed up, and filled with mortar. Where necessary, in the opinion of the

Engineer, the joints shall be cut out and repointed with setting mortar of the same color as that of the original and adjoining work.

5. All brick masonry inverts will allow unimpeded flow. Steps or puddles will be basis for rejection.

3.4 MODIFY EXISTING STRUCTURES

A. Catch Basins and/or manholes to be core drilled at the specified locations and elevations as noted on the Contract Drawings or as directed by the Owner. Jack hammering or hand work necessary for creating or enlarging the hole for the proposed pipe will not be allowed unless approved by the Owner in advance of the work.

B. Existing manhole flowline/channels to be chipped out to accommodate proposed pipe and redirect flow. Surface of flowline/channel to be worked to provide smooth surface. When the condition of the manhole is such that core drilling will cause damage to the manhole, the contractor may, upon approval of the owner, alter the manhole modification construction methods to include hand methods or light jack hammering to create or enlarge the hole in the existing manhole wall, reblock or grout with non-shrink grout around the proposed pipe after installation or other construction methods as the Contractor may propose and are approved by the Owner to complete the work. This may include knocking down and rebuilding the existing manhole if approved by the Owner.

C. The Contractor shall check condition and depth of existing structures which the proposed pipe is to be connected in the field prior to bidding to ensure he understands the nature and extent of the work.

D. Work also includes converting structures from manholes to catch basins and from catch basins to manholes. Provide frame and covers as shown on the Contract Drawings. This work includes removal/lowering of top sections of structures and installing clay brick as necessary to install the proposed top at the proper grade. Concrete brick will not be allowed.

E. This work also includes modifying existing structures to meet proposed grades. This work includes the removal of top sections of structures and installing clay brick and/or precast riser sections as necessary to install the proposed top at the proper grade. Concrete brick will not be allowed.

3.6 MAINTAINING EXISTING FLOW

A. In the course of performing this work, it may be necessary to intercept flows in existing storm drainage systems, as well as their associated service laterals or other miscellaneous connections. Included in the scope of this item shall be the temporary rerouting and maintenance of these flows so as not to interfere with the proposed work and without interruption of service. The method shall be the responsibility of the contractor, but shall be approved by the Owner in advance of the starting of the work. In order to receive approval of methods for temporary diversion or maintenance of

existing storm drainage systems, the Contractor shall submit a written procedure, including any necessary sketches, plans, and details, to the Owner at least two (2) weeks prior to starting construction.

B. Submersible pumps shall be placed in the catch basin or manhole immediately upstream from work area. Outlet hoses or temporary diversion piping are to be placed along the gutter, or in other areas that do not interrupt or interfere with traffic. When hoses cross traffic lanes, hoses to be stabilized to prevent movement caused by crossing vehicles. Outlets are to be installed in the catch basin or manhole immediately downstream of work area.

C. Open structures are to be properly barricaded and protected from passing vehicles. Structures are not to be left open overnight. Outlet pipes are to be temporarily plugged at upstream end and plugs are to be removed at end of each day.

D. All storm drainage systems are to be restored to operating condition at the end of each working day.

END OF SECTION 33 41 00