PROJECT MANUAL / SPECIFICATIONS

Mynatt Park Softball Field and Path

Gatlinburg, TN

Project # 326-799



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SECTION 04 43 00 - STONE MASONRY

PART 1- GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DESCRIPTION OF WORK

A. Extent of stone masonry work is indicated on drawings and schedule.

B. Type of stone work required include

1. Match existing Mill Park Stonework on CMU backup.

1.03 QUALITY ASSURANCE

A. Submittals: Prior to installation of the stonework, the stonework contractor shall meet with the Architect to submit sample stone sizes and shapes, showing the proposed range of size, color, and texture of the stone materials to be used. Upon approval by the Architect of the sizes, colors, shapes, and textures of stones submitted, the stonework contractor shall proceed with a “mock-up” wall as specified hereinafter, using stone, anchors, and jointing as directed by the Architect and specified herein.

B. Single Source Responsibility for Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.

C. Field Constructed Mock-ups: Prior to installation of stonework, erect sample wall panel to further verify selections made for color and texture characteristics, and to represent completed stone work for qualities of appearance, materials, and construction.

D. Locate mock-ups on site in locations indicated by Architect.

E. Build mock-ups for stone masonry work of approximately 3’ long by 3’ high by full thickness, including face and back-up wythes as well as accessories.

F. Protect mock-ups from the elements with weather resistant membrane.

1. Retain mock-ups during construction as standard for judging complete stone. If agreeable to the Architect, the mock-up may be an actual component of the work.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver stone to project in undamaged condition.

B. Store and handle stone to prevent deterioration or damage due to moisture, temperature changes, contaminants, corrosion, or other causes.

C. Store cementitious materials off the ground, under cover and in dry location.

D. Store aggregates where grading and other required characteristics can be maintained.
E. Store stone accessories including metal items to prevent deterioration by corrosion and accumulation of dirt.

1.05 PROJECT CONDITIONS

A. Protection of Work: During erection, cover top of walls with waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress.

B. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

C. Staining: Prevent grout or mortar or soil from staining the face of stone. Remove immediately grout of mortar in contact with such stone.

D. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over mud surface.

E. Protect sills, ledges, and projections from droppings of mortar.

1.06 COLD WEATHER PROTECTION

A. Do not lay stone that is wet or frozen.

B. Remove any ice or snow formed on stone bed by carefully applying heat until top surface is dry to the touch.

C. Remove stone damaged by freezing conditions.

D. Perform the following construction procedures while stone work is progressing. Temperature ranges indicated below apply to air temperatures existing at time of installation except for grout. For grout, temperature ranges apply to anticipated minimum night temperatures. In heating mortar and grout materials, maintain mixing temperature selected within 10 degrees F.

1. 40 degrees F to 32 degrees F

    a. Mortar: Heat mixing water to produce mortar temperature between 40 degrees F and 120 degrees F.
    b. Grout: Follow normal masonry procedures.

2. 25 degrees F to 25 degrees F

    a. Mortar: Heat mixing water and sand to produce mortar temperatures between 40 degrees F. and 120 degrees F; maintain temperature of mortar on boards above freezing.
    b. Grout: Heat grout materials to 90 degrees F. to produce in-place grout temperature of 70 degrees F at end of workday.

3. 25 degrees F to 20 degrees F

    a. Mortar: Heat mixing water and sand to produce mortar temperatures between 40 degrees F and 120 degrees F; maintain temperature of mortar on boards above freezing.
    b. Grout: Heat grout materials to 90 degrees F to produce in-place grout temperature of 70 degrees F at end of workday.
    c. Heat both sides of walls under construction using salamanders or other heat sources.
    d. Use windbreakers or enclosures when wind is in excess of 15 mph.

4. 20 degree F and below
   a. Mortar: Heat mixing water and sand to produce mortar temperatures between 40 degrees F and 120 Degrees F.
   b. Grout: Heat grout materials to 90 degrees F to produce in-place grout temperature of 70 degrees F at end of workday.
   c. Stone: Heat stone so that it is above 20 degrees F at time of laying.
   d. Provide enclosure and auxiliary heat to maintain an air temperature of at least 40 degrees F for 24 hours after laying.

E. Do not heat water for mortar and grout to above 160 degrees F.

F. Protect completed stonework and stone not being worked on in the following manner. Temperature ranges indicated apply to mean daily air temperatures except for grouted masonry. For grouted masonry, temperature ranges apply to anticipated minimum night temperatures.

1. 40 degrees F to 32 degrees F: Protect stone from rain or snow for at least 24 hours by covering with weather-resistant membrane.
2. 32 degrees F to 25 degrees F: Completely cover stone with weather-resistive membrane for at least 24 hours
3. 25 degrees to 20 degrees F: Completely cover stone with weather-resistive insulating blankets or similar protection for at least 24 hours, 48 hours for grouted stone.
4. 20 degrees F and below: Except as otherwise indicated, maintain stone temperature above 32 degrees F for 24 hours using enclosures and supplementary heat, electric heating blankets, infrared lamps or other methods proven to be satisfactory. For grouted masonry maintain heated enclosures to 40 degrees F for 48 hours.

PART TWO – PRODUCTS

2.01 STONE

A. Provide stone masonry units of the sizes and shapes as approved by the Architect from field constructed mock up.

B. Stone shall be rubble (fieldstone) as approved by Architect and shall be of appropriate scale a s approved by Architect. Match existing stone at Mills Park

C. Pattern shall match existing stone at Mills Park, as approved by the Architect in field constructed mock up panel prior to beginning actual work.

2.02 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, except complying with ASTM C 91 for staining requirements. Provide Type I, except Type III may be used for cold weather work.

B. Hydrated Lime: ASTM C 207, Type S.

C. Sand: ASTM C 144.

D. Additive for Moisture Resistance, if required: Ammonium stearate or calcium stearate.

E. Water: Drinkable.

2.03 STONEWORK ACCESSORIES

A. Stone Anchors: Provide type and size as required to securely anchor and fasten stonework into place. Fabricate anchors and dowels from Type 302/304 stainless steel.

PART THREE – EXECUTION

3.01 INSPECTION

A. Installer shall examine the supporting structure and the conditions under which the stonework is to be installed, and shall notify the Contractor in writing of any conditions detrimental to the proper and timely completion of the stonework. Do not proceed with installation of stonework until the unsatisfactory conditions have been corrected in a manner acceptable to the stonework installer.

3.02 INSTALLATION OF WALLS

A. WORKMANSHIP

1. Do not use stone units with chips, cracks, voids, stains, or other defects, which will be visible in the finished work. No broken faces or defects shall be visible in the finished work.
2. Set stone in accordance with approved sample panels. Provide anchors, supports, fasteners, setting buttons, etc., as shown or required to secure stonework in place. Stonework shall be anchored at not less than 16” vertically and 24” horizontally. Shim and adjust accessories as required for proper setting of stones. Completely fill holes, slots, and other sinkages for anchors, dowels, fasteners and supports with mortar during setting of stone.
3. Rake out joints in stonework deeply to provide “dry-stacked” look as approved by Architect in the approved field constructed mock-up.
4. Clean faces of stone after pointing and raking.
5. Cure grout by maintaining in a moist condition for 7 days.
6. Remove grout spillage from face of stone as work progresses.
7. Do not permit traffic on horizontal stone surfaces during setting of units or for at least 24 hours after final grouting of joints.

3.03 REPAIR AND CLEANING

A. Remove and replace stone which is chipped, broken, cracked, stained or otherwise damaged. When directed by the Architect, remove and replace stone that does not match the adjoining stonework. Provide new matching units, install as specified, and point up joints to eliminate evidence of replacement. Re-point any defective or unsatisfactory joints to provide a neat clean appearance.

B. Clean stonework not less than 6 (six) days after completion or work, using clean water and stiff fiber bristle brushes. Do not use wire brushes, acid type cleaning agents, or other cleaning compounds with caustic or harsh fillers or abrasives.

C. Installer shall advise General Contractor of proper procedures required to protect the stone work from collapse, deterioration, discoloration, or damage during the remainder of the construction period and until acceptance of the work.

END OF SECTION 04 43 00

SECTION 07 46 46 – FIBER CEMENT SIDING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary conditions, and other Division – 1 specification sections apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Extent of fiber-cement siding is indicated on the drawings.

B. Types of work required include the following:

1. Hardi 18” individual cement shingles with 8” exposure in 6”, 8”, and 12” random width with squared edge.
2. “Miratec” treated exterior composite trim - smooth
3. Cedar mill 8¼” lap siding with 7” exposure

1.03 QUALITY ASSURANCE

A. Installer qualifications: Engage an experienced installer competent in maintenance and installation of the preformed siding and its accessories.
B. Fire Performance Characteristics: Provide siding with surface burning characteristics indicated below.

1. Frame Spread: 0
2. Fuel Contributed: 0
3. Smoke Developed: 5

When tested in accordance with ASTM test method E-84. Provide siding, which is noncombustible when tested according to ASTM test method E-136.

C. Thermal Resistance: Preformed siding to have an approximate R-Value of .13 for ¼” thick panels and .15 for 5/16” thick panels.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer’s technical data and installation instructions for each material and component part.
B. Samples: Submit full range of color samples for each type of unit, trim, and accessory required. Provide 12” long samples of siding. Provide samples of each texture of lap siding and sheet.
C. Maintenance Data: Submit manufacturer’s maintenance and service data for all items specified under this section. Provide the name, address, and telephone number of the nearest authorized service representative.
D. Warranty: Provide manufacturer’s written warranty for all items specified under this section. Warranty shall cover manufacturing defects and warrant against rotting, delamination, and cracking.

1. Warranty Period: 5 years after date of substantial completion.

E. The warranty shall not deprive the Owner of other rights or remedies that the Owner may have under the other provisions of the Contract Documents, and is in addition to, and runs concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

1.05 COORDINATION

A. Coordinate the work of this Section with all other work which affects installation.
B. Take field measurements for all work prior to installation.

1.06 DELIVERY, STORAGE AND HANDLING

A. Store materials in a dry area. Cover to protect from moisture. If product should become wet, allow to dry thoroughly before installation. Store in manufacturer's original packaging. Store sheets on edge.

1.07 JOB CONDITIONS

A. Substrates: Proceed with work only after substrate construction has been completed.
B. Weather: Proceed with work when existing and forecasted weather conditions are in accordance with manufacturer's recommendations.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers offering acceptable products include the following:
   1. James Hardie Building Products.

B. The use of equal products by other manufacturers is acceptable, subject to the approval of the Architect.

2.02 MATERIALS

A. Hardi 18" individual cement shingles with 8" exposure in 6", 8", and 12" random width with squared edge.
B. Hardi cedar mill 8¼" lap siding with 7" exposure.
C. Hardiplank fasteners for wood stud applications: 6 d common corrosion-resistant nails, at overlapping planks, or 1¼" long corrosion-resistant roofing nails at top edge of shingle planks.
D. Hardiplank fasteners for metal stud applications: 1¼" long #8 – 18 x 0.323" HD self-drilling, self-furring, corrosion-resistant screws at overlapping planks, or 1¼" long #8 – 18 x 0.375" HD self-drilling, self-furring, corrosion resistant screws at top edge of single planks.

E. Hardiplank preformed metal joiner for plank splices between studs.

F. Hardipanel fasteners shall be corrosion-resistant nails or screws, of size and spacing recommended by manufacturer.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Substrate: Prior to installation, inspect installed work of other trades for readiness for siding installation. Verify that adequate support for siding is in place.

B. Cutting planks and sheets: Score and snap planks or sheets to desired dimension. Cut with handsaw or power saw.

C. Installing planks: Framing shall be wood or steel studs at a maximum of 24” o.c. Place ¼” lath starter strip at bottom course of wall. Apply planks with 1¼” wide laps at the top. The bottom edge of the plank overlaps the lap starter strip. Vertical joints in planks shall occur at studs. Butt planks tightly together. Fasten securely each side of joint. Where vertical joints must occur at “off-stud” locations, secure joint with a preformed off-stud metal joiner. Install joiner as recommended by manufacturer.

D. Installing sheets: Framing shall be wood or steel studs at a maximum of 24” o.c. Framing members must have a minimum 1½” face and be straight, true, and properly aligned. The maximum variation in alignment shall be 1/8” in 10 linear feet. Install blocking between studs where sheet joints will fall. Metal stud framing shall be a minimum 20 gauge 3-5/8” C-stud. Nailing patterns for anchoring sheets to studs shall be as recommended by manufacturer for wind load requirements.

E. Vertical joints in sheets shall occur over studs or blocking. Fasten joints according to manufacturer’s directions. Cover joint with “Hardijointer” joint treatment, lumber battens, or caulking.

F. Cleaning: Wipe surfaces of installed preformed siding in preparation for painting. Remove any excess caulk.

END OF SECTION 07 46 46

SECTION 31 10 00 - SITE CLEARING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, and removing site utilities.
7. Temporary erosion- and sedimentation-control measures.

1.02 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.

D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and indicated on Drawings.

F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.03 MATERIAL OWNERSHIP

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

1.04 SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
1. Use sufficiently detailed photographs or videotape.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.05 PROJECT CONDITIONS

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

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
   1. Do not proceed with work on adjoining property until directed by Architect.

C. Salvable Improvements: Carefully remove items indicated to be salvaged and store were directed by Owner.

D. Utility Locator Service: Notify Tennessee One Call at 811 before site clearing.

E. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.

F. The following practices are prohibited within protection zones:
   1. Storage of construction materials, debris, or excavated material.
   2. Parking vehicles or equipment.
   3. Foot traffic.
   4. Erection of sheds or structures.
   5. Impoundment of water.
   6. Excavation or other digging unless otherwise indicated.
   7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

G. Do not direct vehicle or equipment exhaust towards protection zones.

H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

I. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Division 31 Section "Earth Moving."

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly identify trees, shrubs, and other vegetation to remain. Wrap a 1-inch blue vinyl tie tape flag around each tree trunk at 54 inches above the ground.

C. Protect existing site improvements to remain from damage during construction.
   1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.02 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control shown on the Drawings.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

E. The Contractor shall follow the latest edition of the Tennessee Erosion and Sedimentation Control handbook.

3.03 TREE AND PLANT PROTECTION

A. General: Protect trees and plants remaining on-site according to requirements in Division 01 Section "Temporary Tree and Plant Protection."

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

3.04 EXISTING UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.
   1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed.
   1. Arrange with utility companies to shut off indicated utilities.
   2. Do not shut off any utilities without coordinating with Architect. Utility interruption will only be allowed during time that the exiting school facilities are not in use.

C. Locate, identify, and disconnect utilities indicated to be abandoned in place.

D. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Architect not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Architect's written permission.

E. Excavate for and remove underground utilities indicated to be removed.

F. Removal of underground utilities is included in Division 33 Sections.

3.05 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
   1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
   2. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches below exposed subgrade.
   3. Use only hand methods for grubbing within protection zones.
   4. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
   1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.06 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to a minimum depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.
   1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil in location(s) indicated on the plans and away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
   1. Do not stockpile topsoil within protection zones.

3.07 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

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

3.08 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 10 00

SECTION 31 20 00 - EARTH MOVING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Preparing subgrades for slabs-on-grade, walks, pavements, turf and grasses, and plants.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for concrete slabs-on-grade.
4. Subbase course for concrete walks and pavements.
5. Subbase course and base course for asphalt paving.
6. Subsurface drainage backfill for walls and trenches.
7. Excavating and backfilling trenches for utilities and pits for buried utility structures.

1.02 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect.
2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch-wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700

lbf and stick-crowd force of not less than 18,400 lbf with extra-long reach boom; measured according to SAE J-1179.

2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp flywheel power and developing a minimum of 47,992-lbf breakout force with a general-purpose bare bucket; measured according to SAE J-732.

I. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by a geotechnical testing agency, according to ASTM D 1586.

J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

K. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

L. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

M. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.03 SUBMITTALS

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

B. Samples for Verification: For the following products, in sizes indicated below:
1. Geotextile: 12 by 12 inches.
2. Warning Tape: 12 inches long; of each color.

C. Qualification Data: For qualified testing agency.

D. Material Test Reports: For each on-site soil material proposed for fill and backfill as follows:
1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 698.

E. Blasting plan approved by authorities having jurisdiction.

F. Seismic survey report from seismic survey agency.

G. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

1.04 QUALITY ASSURANCE

A. Blasting: Comply with applicable requirements in NFPA 495, "Explosive Materials Code," and prepare a blasting plan reporting the following:

1. Types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
2. Seismographic monitoring during blasting operations.

B. Seismic Survey Agency: An independent testing agency, acceptable to authorities having jurisdiction, experienced in seismic surveys and blasting procedures to perform the following services:
1. Report types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
2. Seismographic monitoring during blasting operations.

C. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

D. Pre-excavation Conference: Conduct conference at Project site.

1.05 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
3. Improvements on Adjoining Property: Work on adjoining properties will consist of utility connections and extensions that require work to be performed on City of Knoxville right-of-way or other properties owned by Owner. Contractor shall not proceed with work on City of Knoxville Right-of-way before notifying City of Knoxville Engineering of the scope and schedule of the intended work. Contractor shall not proceed with work on other Owner owned properties before notifying Owner of the scope and schedule of the intended work.

B. Utility Locator Service: Notify Tennessee One Call at 811 before beginning earth moving operations.

C. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in “Division 31 Section "Site Clearing," are in place.

D. Do not commence earth moving operations until plant-protection measures specified in Division 01 Section "Temporary Tree and Plant Protection" are in place.

E. The following practices are prohibited within protection zones:
1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

F. Do not direct vehicle or equipment exhaust towards protection zones.

G. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

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

B. Satisfactory Soils: Soil Classification Groups CL, CH, GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 6 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter. Soils shall have a plasticity index of less than 30 and a maximum dry density of not less than 90 pounds per cubic foot (pcf).

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, ML, OL, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.
   1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; AS

I. Sand: ASTM C 33; fine aggregate. TM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

J. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.

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

2.02 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 157 lbf; ASTM D 4632.
3. Sewn Seam Strength: 142 lbf; ASTM D 4632.
4. Tear Strength: 56 lbf; ASTM D 4533.
5. Puncture Strength: 56 lbf; ASTM D 4833.
6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.2 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 247 lbf; ASTM D 4632.
3. Sewn Seam Strength: 222 lbf; ASTM D 4632.
4. Tear Strength: 90 lbf; ASTM D 4533.
5. Puncture Strength: 90 lbf; ASTM D 4833.
6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.03 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material: Self-compacting, flowable concrete material produced from the following:
1. Portland Cement: ASTM C 150, Type II.
2. Fly Ash: ASTM C 618, Class C or F.
3. Normal-Weight Aggregate: ASTM C 33, 3/8-inch nominal maximum aggregate size.
4. Foaming Agent: ASTM C 869.
5. Water: ASTM C 94/C 94M.
6. Air-Entraining Admixture: ASTM C 260.

B. Produce conventional-weight, controlled low-strength material with 140-psi compressive strength when tested according to ASTM C 495.

2.04 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.02 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
   1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
   2. Provisions shall be taken to at the end of each work day to ensure all areas of the project site shall be protected from accumulated water.

C. Localized pockets of groundwater encountered during grading activities shall be collected in sumps and pumped out of the construction area with proper filtering. The sumps shall be constructed with a waterproof lining to prevent infiltration of water back into the soil.

3.03 EXPLOSIVES

A. Explosives: Obtain written permission from authorities having jurisdiction before bringing explosives to Project site or using explosives on Project site.
   1. Perform blasting without damaging adjacent structures, property, or site improvements.
   2. Perform blasting without weakening the bearing capacity of rock subgrade and with the least-practicable disturbance to rock to remain.

3.04 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
   1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
   2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
      a. 24 inches outside of concrete forms other than at footings.
      b. 12 inches outside of concrete forms at footings.
      c. 6 inches outside of minimum required dimensions of concrete cast against grade.
      d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
      e. 6 inches beneath bottom of concrete slabs-on-grade.

f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

3.05 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Trench design and safety for utility construction is solely the responsibility of the contractor and shall conform with all applicable local, state, and OSHA regulations.

3.06 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
   1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
   2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
   3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:
   1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
   2. Cut and protect roots according to requirements in Division 01 Section "Temporary Tree and Plant Protection."

3.07 SUBGRADE INSPECTION

A. Notify Architect when excavations have reached required subgrade.

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
   1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
   2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.08 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean

concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.09 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

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

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Backfill of Trenches: See detail on plans for Pipe Bedding & Backfill (Plan Sheet C2.1).

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

3.12 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:
   1. Under grass and planted areas, use satisfactory soil material.
   2. Under walks and pavements, use satisfactory soil material.
   3. Under steps and ramps, use satisfactory soil or engineered fill.
   4. Under building slabs, use satisfactory soil or engineered fill.
   5. Under footings and foundations, use satisfactory soil or engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.13 SOIL MOISTURE CONTROL

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

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inchesin loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
   1. Under structures, building slabs and steps scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 100 percent.
   2. Under pavements, scarify and recompact top 24 inches of existing subgrade and each layer of backfill or fill soil material at 100 percent
   3. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 98 percent.
   4. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
   5. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

3.15 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
   1. Provide a smooth transition between adjacent existing grades and new grades.
   2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
   1. Turf or Unpaved Areas: Plus or minus 1 inch.
   2. Walks: Plus or minus 1 inch.
   3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.16 SUBSURFACE DRAINAGE

A. Subdrainage Pipe: Specified in Division 33 Section "Subdrainage."

B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
   1. Compact each filter material layer with a minimum of two passes of a plate-type vibratory compactor.

C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
   1. Compact each filter material layer with a minimum of two passes of a plate-type vibratory compactor.
   2. Place and compact impervious fill over drainage backfill in 6-inch-thick compacted layers to final subgrade.

3.17 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
   1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
   2. Place base course material over subbase course under hot-mix asphalt pavement.
   3. Shape subbase course and base course to required crown elevations and cross-slope grades.
   4. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
   5. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
   6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 98 percent of maximum dry unit weight according to ASTM D 698.

3.18 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
   1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
   2. Place drainage course 6 inches or less in compacted thickness in a single layer.
   3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
   4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 100 percent of maximum dry unit weight according to ASTM D 698.

3.19 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified geotechnical engineering testing agency to perform the following special inspections:
   1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
   2. Determine that fill material and maximum lift thickness comply with requirements.
   3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
   1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
   2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length, but no fewer than two tests.
   3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.
   4. Tests will be performed, reviewed and approved by the Architect before any area my be used to stockpile soil.

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

3.20 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
   1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
   1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 20 00

SECTION 31 22 00 - GRADING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Removal of topsoil.

B. Rough grading the site for site structures.

1.02 RELATED REQUIREMENTS

A. Section 31.10.00 - Site Clearing.

B. Section 31.23.16 - Excavation.

C. Section 31.23.16.13 - Trenching: Trenching and backfilling for utilities and storm sewer pipes.

D. Section 31.23.16.26 - Rock Removal.

E. Section 31.23.23 - Fill: Filling and compaction.

1.03 PRICE AND PAYMENT PROCEDURES

A. Grading to building pad subgrade elevation indicated on the drawings: Unclassified. Includes: Excavating existing topsoil, stockpiling, scarifying substrate surface, placing where required, compacting, and dewatering.

B. Grading below building pad subgrade elevation indicated on the drawings: Classified. See Section 01.22.00 - Unit Prices, for general requirements relating to unit prices for this work.

1.04 SUBMITTALS

A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.05 QUALITY ASSURANCE – NOT USED

PART 2 - PRODUCTS

2.01 MATERIALS

A. Topsoil: See Section 31.23.23.

B. Other Fill Materials: See Section 31.23.23.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that survey bench mark and intended elevations for the Work are as indicated.

B. Verify the absence of standing or ponding water.

3.02 PREPARATION

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

B. Stake and flag locations of known utilities.

C. Locate, identify, and protect from damage above- and below-grade utilities to remain.

D. Notify utility company to remove and relocate utilities.

E. Provide temporary means and methods to remove all standing or ponding water from areas prior to grading.

F. Protect site features to remain, including but not limited to bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs, from damage by grading equipment and vehicular traffic.

G. Protect trees to remain by providing substantial fencing around entire tree at the outer tips of its branches; no grading is to be performed inside this line.

H. Protect plants, lawns, rock outcroppings, and other features to remain as a portion of final landscaping.

3.03 ROUGH GRADING

A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.

B. Do not remove topsoil when wet.

C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.

D. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.

E. When excavating through roots, perform work by hand and cut roots with sharp axe.

F. See Section 31.23.23 for filling procedures.

G. Benching Slopes: Horizontally bench existing slopes greater than 1:4 to key fill material to slope for firm bearing.

H. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

I. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack surface water control.

3.04 SOIL REMOVAL

A. Stockpile excavated topsoil on site.

B. Stockpile topsoil to be re-used on site; remove remainder from site.

C. Remove excavated topsoil from site.

D. Stockpile excavated subsoil on site.

E. Stockpile subsoil to be re-used on site; remove remainder from site.

F. Remove excavated subsoil from site.

G. Stockpiles: Pile depth not to exceed 8 feet; protect from erosion.

3.05 FINISH GRADING – NOT USED

3.06 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 0.10 foot (1-3/16 inches) from required elevation.

3.07 REPAIR AND RESTORATION

A. Existing Facilities, Utilities, and Site Features to Remain: If damaged due to this work, repair or replace to original condition.

B. Trees to Remain: If damaged due to this work, trim broken branches and repair bark wounds; if root damage has occurred, obtain instructions from Architect as to remedy.

C. Other Existing Vegetation to Remain: If damaged due to this work, replace with vegetation of equivalent species and size.

3.08 FIELD QUALITY CONTROL

A. See Section 31.23.23 for compaction density testing.

3.09 CLEANING

A. Remove unused stockpiled topsoil and subsoil. Grade stockpile area to prevent standing water.

END OF SECTION 31 22 00

SECTION 31 23 16 - EXCAVATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Excavating for building volume below grade, footings, pile caps, slabs-on-grade, paving, site structures, and utilities within the building.

B. Trenching for utilities and storm sewer pipes outside the building to utility main connections.

1.02 RELATED REQUIREMENTS

A. Document “Report of Subsurface Exploration, Proposed Engineering Services Building, University of Tennessee, Knoxville, Tennessee” dated January 16, 2017 by Professional Engineers, Inc. (PE Project No. 102561): Geotechnical report; bore hole locations and findings of subsurface materials.

B. Document “Addendum to Report of Subsurface Exploration, Proposed Engineering Services Building, University of Tennessee, Knoxville, Tennessee” dated March 21, 2018 by Professional Engineers, Inc. (PE Project No. 102561): Geotechnical report; bore hole locations and findings of subsurface materials.

C. Document “Limited Subsurface Investigation Report” dated June 30, 2017 by Quantum Environmental & Engineering Services, LLC (QE2): Environmental report; soil sample locations and findings related to soil contamination.

D. Document “Soil Management Plan, Early Release Package 1” dated April 25, 2018 by Quantum Environmental & Engineering Services, LLC (QE2): Environmental report; soil sample locations and requirements for management of contaminated soils.

E. Section 01.57.13 - Temporary Erosion and Sediment Control: Slope protection and erosion control.

F. Section 01.70.00 - Execution and Closeout Requirements: General requirements for dewatering of excavations and water control.

G. Section 02.41.00 - Demolition (including Selective Demolition): Shoring and underpinning.

H. Section 02.55.13 - Permanent and Temporary Excavation, Shoring, and Soil Nailing: Permanent and temporary excavation shoring and soil nailing.

I. Section 31.22.00 - Grading: Soil removal from surface of site.

J. Section 31.22.00 - Grading: Grading.

K. Section 31.23.16.13 - Trenching: Excavating for utility and storm sewer trenches outside the building to utility main connections.

L. Section 31.23.16.26 - Rock Removal: Removal of rock during excavating.

M. Section 31.23.23 - Fill: Fill materials, filling, and compacting.

1.03 SUBMITTALS

A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.

B. Field Quality Control Submittals: Document visual inspection of load-bearing excavated surfaces.

1.04 PRICE AND PAYMENT PROCEDURES

A. Excavation to building pad subgrade elevation indicated on the drawings: Unclassified. Includes: Excavating to required elevations, loading and placing materials in stockpile, dewatering, and removal of excess and unsuitable materials from the site.

B. Excavation below building pad subgrade elevation indicated on the drawings: Classified. See Section 01.22.00 - Unit Prices, for general requirements relating to unit prices for this work.

1.05 PROJECT CONDITIONS

A. Verify that survey bench mark and intended elevations for the Work are as indicated.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that survey bench mark and intended elevations for the work are as indicated.

3.02 PREPARATION

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

B. See Section 31.22.00 for additional requirements.

C. Locate, identify, and protect utilities that remain and protect from damage.

D. Notify utility company to remove and relocate utilities.

E. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

F. Protect plants, lawns, rock outcroppings, and other features to remain.

G. Implement the site-specific Soil Management Plan prior to excavation to ensure proper characterization and disposal of excavated soils.

H. Grade top perimeter of excavation to prevent surface water from draining into excavation. Provide temporary means and methods, as required, to maintain surface water diversion until no longer needed, or as directed by the Architect.

3.03 EXCAVATING

A. Underpin adjacent structures that could be damaged by excavating work.

B. Excavate to accommodate new structures and construction operations.

C. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

D. Preparation for Piling Work: Excavate to working elevations. Coordinate special requirements for piling.

E. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.

F. Do not interfere with 45 degree bearing splay of foundations.

G. Cut utility trenches wide enough to allow inspection of installed utilities.

H. Hand trim excavations. Remove loose matter.

I. Remove lumped subsoil, boulders, and rock up to 1/3 cubic yard measured by volume. See Section 31.23.16.26 for removal of larger material.

J. Correct areas that are over-excavated and load-bearing surfaces that are disturbed; see Section 31.23.23.

K. Provide temporary means and methods, as required, to remove all water from excavations until directed by the Architect. Remove and replace soils deemed suitable by classification and which are excessively moist due to lack of dewatering or surface water control.

L. Determine the prevailing groundwater level prior to excavation. If the proposed excavation extends less than 1 foot into the prevailing groundwater, control groundwater intrusion with perimeter drains routed to sump pumps, or as directed by the Architect. If the proposed excavation extends more than 1 foot

into the excavation, control groundwater intrusion with a comprehensive dewatering procedures, or as directed by the Geotechnical Engineer.

M. Remove excavated material that is unsuitable for re-use from site.

N. Remove excess excavated material from site.

3.04 FIELD QUALITY CONTROL

A. See Section 01.40.00 - Quality Requirements, for general requirements for field inspection and testing.

B. Provide for visual inspection of load-bearing excavated surfaces before placement of foundations.

3.05 PROTECTION

A. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.

B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

END OF SECTION 31 23 16

SECTION 31 23 23 - FILL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Filling, backfilling, and compacting for building volume below grade.

B. Backfilling and compacting for utilities and storm sewer pipes outside the building to utility main connections.

C. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

1.02 RELATED REQUIREMENTS

A. Document “Report of **Subsurface** Exploration, Proposed Engineering Services Building, University of Tennessee, Knoxville, Tennessee” dated January 16, 2017 by Professional Engineers, Inc. (PE Project No. 102561): Geotechnical report; bore hole locations and findings of subsurface materials.

B. Document “Addendum to Report of Subsurface Exploration, Proposed Engineering Services Building, University of Tennessee, Knoxville, Tennessee” dated March 21, 2018 by Professional Engineers, Inc. (PE Project No. 102561): Geotechnical report; bore hole locations and findings of subsurface materials.

C. Document “Limited Subsurface Investigation Report” dated June 30, 2017 by Quantum Environmental & Engineering Services, LLC (QE2): Environmental report; soil sample locations and findings related to soil contamination.

D. Document “Soil Management Plan, Early Release Package 1” dated April 25, 2018 by Quantum Environmental & Engineering Services, LLC (QE2): Environmental report; soil sample locations and requirements for management of contaminated soils.

E. Section 01.57.13 - Temporary Erosion and Sediment Control: Slope protection and erosion control.

F. Section 03.30.00 - Cast-in-Place Concrete.

G. Section 13.47.13 - Cathodic Protection.

H. Section 31.22.00 - Grading: Site grading.

I. Section 31.23.16 - Excavation: Removal and handling of soil.

J. Section 31.23.16.13 - Trenching: Excavating for utility trenches and storm sewer pipes outside the building to utility main connections.

K. Section 31.23.16.26 - Rock Removal: Removal of rock during excavating.

1.03 PRICE AND PAYMENT PROCEDURES

A. General fill to building pad subgrade elevation indicated on the drawings: Unclassified. Includes: Excavating existing soil, stockpiling, scarifying substrate surface, placing where required, compacting, and dewatering.

B. General fill below building pad subgrade elevation indicated on the drawings: Classified. See Section 01.22.00 - Unit Prices, for general requirements relating to unit prices for this work.

1.04 DEFINITIONS

A. Finish Grade Elevations: Indicated on drawings.

B. Subgrade Elevations: Indicated on drawings. Top of caisson elevation within the building pad.

1.05 REFERENCE STANDARDS

A. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses; 2017.

B. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18 in.) Drop; 2017.

C. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2014.

D. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012.

E. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2015.

F. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN m/m3)); 2012.

G. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2015.

H. ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; 2014.

I. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.

J. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2010.

K. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2015.

1.06 SUBMITTALS

A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.

B. Samples: 10 pounds sample of each type of fill; submit in air-tight containers to testing laboratory.

C. Materials Sources: Submit name of imported materials source.

D. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used, including manufactured fill.

E. Compaction Density Test Reports.

F. Testing Agency Qualification Statement.

1.07 QUALITY ASSURANCE

A. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

B. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.08 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

B. When fill materials need to be stored on site, locate stockpiles where indicated.
   1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
   2. Prevent contamination.
   3. Protect stockpiles from erosion and deterioration of materials.

1.09 WARRANTY

A. See Section 01.78.00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 - PRODUCTS

2.01 FILL MATERIALS

A. General Fill: Subsoil excavated on-site or imported from off-site.
   1. Graded.
   2. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris, unless otherwise specified or shown on the drawings.
   3. Plasticity Index (PI) no greater than 30.
   4. Fibrous organic content of no more than 5 percent by weight.
   5. Maximum dry density of no less than 90 pounds per cubic foot (pcf).

B. Trench Backfill: ASTM D2321 unless otherwise specified or shown on the drawings.

C. Concrete for Fill: As specified in Section 03.30.00; compressive strength of 2500 psi.

D. Topsoil: Topsoil excavated on-site.
   1. Select.
   2. Graded.
   3. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds and foreign matter.

2.02 ACCESSORIES

A. Geotextile Fabric: Non-biodegradable, non-woven.

B. Geogrid: Biaxial polypropylene.

2.03 SOURCE QUALITY CONTROL

A. See Section 01.40.00 - Quality Requirements, for general requirements for testing and analysis of soil material.

B. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.

C. Where fill materials are specified by reference to a specific standard, testing of samples for compliance will be provided before delivery to site.

D. If tests indicate materials do not meet specified requirements, change material and retest.

E. Provide materials of each type from same source throughout the Work.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that survey bench marks and intended elevations for the Work are as indicated.

B. Identify required lines, levels, contours, and datum locations.

C. See Section 31.22.00 for additional requirements.

D. Verify structural ability of unsupported walls to support imposed loads by the fill.

E. Verify areas to be filled are not compromised with surface or ground water.

3.02 PREPARATION

A. Scarify and proof roll subgrade surface to a depth of 6 inches to identify soft spots.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 FILLING

A. Fill to contours and elevations indicated using unfrozen materials.

B. Fill up to subgrade elevations unless otherwise indicated.

C. Employ a placement method that does not disturb or damage other work.

D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

E. Maintain soil moisture content within +2 to -3 percentage points of the optimum moisture standard Proctor moisture content of fill materials to attain required compaction density. Dry or wet soils as necessary prior to placement.

F. Trench Backfill: Place and compact materials in accordance with fill and compaction requirements in ASTM D2321 unless otherwise shown on the drawings.

G. General Fill: Place and compact material in equal continuous layers not exceeding 8 inches compacted depth.

H. Slope grade away from building minimum 2 inches in 10 feet, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

I. Correct areas that are over-excavated.
   1. Load-bearing foundation surfaces: Fill with concrete.
   2. Other areas: Use general fill, flush to required elevation, compacted to minimum 98 percent of the standard Proctor maximum dry density (ASTM D698).

J. Compaction Density Unless Otherwise Specified or Indicated:
   1. Upper 24 inches beneath grade slabs: 100 percent of the standard Proctor maximum dry density.
   2. Upper 24 inches beneath pavements: 100 percent of the standard Proctor maximum dry density.
   3. At other locations: 98 percent of the standard Proctor maximum dry density.

K. Reshape and re-compact fills subjected to vehicular traffic.

L. Maintain temporary means and methods, as required, to remove all water while fill is being placed as required, or until directed by the Architect. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

3.04 MANUFACTURED FILL INSTALLATION – GEOFOAM – NOT USED

3.05 FILL AT SPECIFIC LOCATIONS

A. Use general fill unless otherwise specified or indicated.

B. Over Buried Utility Piping, Conduits, and Storm Sewer Pipes in Trenches: See Section 31.23.16.13.

3.06 TOLERANCES

A. Top Surface of General Filling: Plus or minus 1 inch from required elevations.

B. Top Surface of Filling Under Paved Areas: Plus or minus 1 inch from required elevations.

3.07 FIELD QUALITY CONTROL

A. See Section 01.40.00 - Quality Requirements, for general requirements for field inspection and testing.

B. Perform compaction density testing on compacted fill in accordance with ASTM D1556/D1556M, ASTM D2167, or ASTM D6938.

C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D698 ("standard Proctor"), ASTM D1557 ("modified Proctor"), or AASHTO T 180.

D. If tests indicate work does not meet specified requirements, remove work, replace and retest.

E. Frequency of Tests: As determined by the Owner and the Geotechnical Engineer.

F. Proof roll compacted fill at surfaces that will be under slabs-on-grade and pavement.

3.08 CLEANING

A. See Section 01.74.19 - Construction Waste Management and Disposal, for additional requirements.

B. Leave unused materials in a neat, compact stockpile.

C. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

D. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION 31 23 23

SECTION 31 23 16 26 - ROCK REMOVAL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Removal of identified rock during excavation.

1.02 RELATED REQUIREMENTS

A. Document “Report of Subsurface Exploration, Proposed Engineering Services Building, University of Tennessee, Knoxville, Tennessee” dated January 16, 2017 by Professional Engineers, Inc. (PE Project No. 102561): Geotechnical report; bore hole locations and findings of subsurface materials.

B. Document “Addendum to Report of Subsurface Exploration, Proposed Engineering Services Building, University of Tennessee, Knoxville, Tennessee” dated March 21, 2018 by Professional Engineers, Inc. (PE Project No. 102561): Geotechnical report; bore hole locations and findings of subsurface materials.

C. Section 03.30.00 - Cast-in-Place Concrete.

D. Section 31.23.23 - Fill: Fill materials.

1.03 PRICE AND PAYMENT PROCEDURES

A. Mass rock removal to building pad subgrade elevation indicated on the drawings: Unclassified. Includes preparation of rock for removal, removal from position by mechanical means, loading and removing from site.

B. Mass rock removal below building pad subgrade elevation indicated on the drawings: Classified. See Section 01.22.00 - Unit Prices, for general requirements relating to unit prices for this work.

C. Trench rock removal: Classified. See Section 01.22.00 - Unit Prices, for general requirements relating to unit prices for this work.

1.04 DEFINITIONS

A. Rock: Solid mineral material of a size that cannot be removed with a 3/4 cubic yard capacity power shovel without drilling.

1.05 REFERENCE STANDARDS – NOT USED

1.06 SUBMITTALS – NOT USED

1.07 QUALITY ASSURANCE – NOT USED

PART 2 - PRODUCTS

2.01 MATERIALS

A. Mechanical Disintegration Compound: Grout mix of materials that expand on curing.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify site conditions and note subsurface irregularities affecting work of this section.

3.02 PREPARATION

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

3.03 ROCK REMOVAL

A. Excavate and remove rock by mechanical methods only; use of explosives is prohibited.

B. Mechanical Methods: Drill holes and utilize expansive tools to fracture rock.

C. Form level bearing at bottom of excavations.

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

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

F. Remove excavated materials from site.

G. Correct unauthorized rock removal in accordance with backfilling and compacting requirements of Section 31.23.23.

3.04 FIELD QUALITY CONTROL

A. Independent agency field inspection will be provided under provisions of Section 01.40.00 - Quality Requirements.

B. Provide for visual inspection of foundation bearing surfaces and cavities formed by removed rock.

END OF SECTION 31 23 16 26

SECTION 31 31 16 - TERMITE CONTROL

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Soil treatment with termiticide.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of termite control product.
   1. Include the EPA-Registered Label for termiticide products.

1.03 INFORMATIONAL SUBMITTALS

A. Product Certificates: For termite control products, from manufacturer.

B. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's records and include the following:
   1. Date and time of application.
   2. Moisture content of soil before application.
   3. Termiticide brand name and manufacturer.
   4. Quantity of undiluted termiticide used.
   5. Dilutions, methods, volumes used, and rates of application.
   6. Areas of application.
   7. Water source for application.

C. Warranties: Sample of special warranties.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located.

B. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA-Registered Label.

C. Source Limitations: Obtain termite control products from single source.

D. Preinstallation Conference: Conduct conference at Project site.

1.05 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.

B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.06 WARRANTY

A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 SOIL TREATMENT

A. Termiticide: Provide an EPA-Registered termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. BASF Corporation, Agricultural Products; Termidor.
      b. Bayer Environmental Science; Premise 75.
      c. FMC Corporation, Agricultural Products Group; Dragnet FT, Talstar or Prevail.
      d. Syngenta; Demon TC, Prelude or Probuild TC.
   2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label requirements, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.

B. Proceed with application only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
   1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.03 APPLICATION, GENERAL

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.04 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.
   1. Slabs-on-Grade and Basement Slabs: Underground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
   2. Foundations: Adjacent soil, including soil along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
   3. Masonry: Treat voids.
   4. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.

B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

D. Post warning signs in areas of application.

E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 31 31 16

SECTION 32 11 23 - AGGREGATE MATERIALS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Aggregate base course.

B. Paving aggregates.

1.02 RELATED REQUIREMENTS

A. Section 31.22.00 - Grading: Preparation of site for base course.

B. Section 31.23.16.13 - Trenching: Compacted fill over utility trenches under base course.

C. Section 31.23.23 - Fill: Compacted fill under base course.

D. Section 32.12.16 - Asphalt Paving: Finish and binder asphalt courses.

E. Section 33.05.13 - Manholes and Structures: Manholes including frames.

1.03 REFERENCE STANDARDS

A. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses; 2017.

B. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18 in.) Drop; 2017.

C. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2014.

D. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012.

E. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2015.

F. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN m/m3)); 2012.

G. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2015.

H. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.

I. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2010.

J. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2015.

K. Tennessee Department of Transportation (TDOT), Standard Specifications for Road and Bridge Construction; latest edition.

1.04 SUBMITTALS

A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.

B. Samples: 10 lb sample of each type of aggregate; submit in air-tight containers to testing laboratory.

C. Materials Sources: Submit name of imported materials source.

D. Aggregate Composition Test Reports: Results of laboratory tests on proposed and actual materials used.

E. Compaction Density Test Reports.

1.05 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

B. When aggregate materials need to be stored on site, locate where directed by Owner.

C. Aggregate Storage, General:
   1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
   2. Prevent contamination.
   3. Protect stockpiles from erosion and deterioration of materials.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Coarse Aggregate: Crushed aggregate base, conforming to TDOT Section 903.05, Type A, Class A, Grading D.

2.02 SOURCE QUALITY CONTROL

A. See Section 01.40.00 - Quality Requirements, for general requirements for testing and analysis of aggregate materials.

B. Where aggregate materials are specified using ASTM D2487 classification, test and analyze samples for compliance before delivery to site.

C. Where aggregate materials are specified using ASTM D2487 classification, testing of samples for compliance will be provided before delivery to site.

D. If tests indicate materials do not meet specified requirements, change material and retest.

E. Provide materials of each type from same source throughout the Work.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that survey bench marks and intended elevations for the work are as indicated.

B. Verify substrate has been inspected, gradients and elevations are correct, and is dry.

3.02 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.

B. Do not place aggregate on soft, muddy, or frozen surfaces.

3.03 INSTALLATION

A. Spread aggregate over prepared substrate to the total compacted thickness indicated on the drawings.

B. Compact to 100 percent of the standard proctor density at 2% less than optimum moisture content.

C. Place aggregate in maximum 6 inch layers and roller compact to specified density.

D. Level and contour surfaces to elevations and gradients indicated.

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

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

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

H. Apply herbicide to finished surface.

3.04 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.

B. Scheduled Compacted Thickness: Within 1/4 inch.

C. Variation From Design Elevation: Within 1/2 inch.

3.05 FIELD QUALITY CONTROL

A. See Section 01.40.00 - Quality Requirements, for general requirements for field inspection and testing.

B. Compaction density testing will be performed on compacted aggregate base course in accordance with ASTM D1556/D1556M, ASTM D2167, or ASTM D6938.

C. Results will be evaluated in relation to compaction curve determined by testing uncompacted material in accordance with AASHTO T 180, ASTM D698 ("standard Proctor"), or ASTM D1557 ("modified Proctor").

D. If tests indicate work does not meet specified requirements, remove work, replace and retest.

E. Proof roll compacted aggregate at surfaces that will be under slabs-on-grade.

3.06 CLEANING

A. Leave unused materials in a neat, compact stockpile.

B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

C. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION 32 11 23

SECTION 32 16 00-CURBS AND SIDEWALKS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Preparation and placement of combination Portland cement concrete curb and gutter.

B. Preparation and placement of Portland cement concrete curb.

C. Preparation and placement of Portland cement concrete sidewalk.

1.02 RELATED SECTIONS

A. Section 310000 – Earthwork

B. Section 321123 – Aggregate Material.

C. Cast-in-place Concrete (See Architectural/Building Specifications).

D. State Highway Department Standard Specifications.

E. Construction Drawings.

1.03 REFERENCE STANDARDS

A. American Concrete Institute (ACI) latest edition.

1. 304R Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.

2. 308 Standard Practice for Curing Concrete.

B. American Society for Testing and Materials (ASTM) latest edition.

1. A615 Deformed and Plan Billet-Steel for Concrete Reinforcement.

2. C33 Concrete Aggregates.

3. C94 Ready-Mixed Concrete.

4. C150 Portland Cement.

5. C260 Air-Entraining Admixtures for Concrete.

6. C309 Liquid Membrane-Forming Compounds for Curing Concrete.

7. C494 Chemical Admixtures for Concrete.
8. D1751 Performed Expansion Joint Fillers for Concrete Paving and Structural Construction. (Nonextruding and Resilient Bituminous Types)

C. FS TT-C-800 – Curing Compound, Concrete, for New and Existing Surfaces.

1.04 QUALITY ASSURANCE

A. Establish and maintain required lines and elevations.

B. Check surface areas at intervals necessary to eliminate ponding areas. Remove and replace unacceptable work as directed by Owner.

1.05 SUBMITTALS

A. Submit materials certificate to the independent testing laboratory which is signed by materials producer and Contractor, certifying that materials comply with, or exceed, requirements specified herein.

1.06 PROJECT CONDITIONS

A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to from radius bends as required. Forms shall be of depth equal to depth of curbing or sidewalk, and so designed as to permit secure fastening together at tops. Coat forms with nonstaining type of coating that will not discolor or deface surface of concrete.

B. Reinforcing Bars: Deformed steel bars, ASTM A 615, Grade 40.

C. Concrete Materials: Comply with requirements of Section 033000 for concrete materials, admixtures, bonding materials, curing materials, and others as required.

D. Joint Fillers: Resilient premolded bituminous impregnated fiberboard units complying with ASTM D 1751, FS HH-F-341, Type II, Class A.

E. Joint Sealers: Non-priming, pourable, self-leveling polyurethane. Acceptable sealants are Sonneborn “Sonolastic Paving Joint Sealant, Sonneborn “Sonomeric CT 1 Sealant”, Sonneborn “Sonomeric CT 2 Sealant, Mameco “Vulken 245”, or Woodmont Products “Chem-Caulk”.

2.02 MIX DESIGN AND TESTING

A. Concrete mix design and testing shall comply with requirements of Section 03300.

B. Design mix to produce normal weight concrete consisting of Portland cement, aggregate, water-reducing admixture, air-entraining admixture, and water to produce following:

1. Compressive Strength: 4,000 psi, minimum at 28 days, unless otherwise indicated on Construction Drawings.

2. Slump Range: 2 to 5 inches at time of placement.

3. Air Entrainment: 5 to 8 percent.

PART 3 – EXECUTION

3.01 PREPARATION

A. Proofroll prepared base material surface to check for unstable areas. Begin paving work only after unsuitable areas have been corrected and are ready to receive paving.

B. Remove loose material from compacted base material surface to produce firm, smooth surface immediately before placing concrete.

3.02 INSTALLATION

A. Form Construction:

1. Set forms to required grades and lines, rigidly braced and secured.

2. Install sufficient quantity of forms to allow continuance of work and so that forms remain in place a minimum of 24 hours after concrete placement.

3. Check completed formwork for grade and alignment to following tolerances:
    a. Top of forms not more than 1/8-inch in 10’-0”.

    b. Vertical face of longitudinal axis, not more than ¼-inch in 10’-0”.

4. Clean forms after each use and coat with from release agent as often as required to ensure separation from concrete without damage.

B. Concrete Placement:

1. Place concrete in accordance with requirements of Section 033000.

2. Do not place concrete until base material and forms have been checked for line and grade. Moisten base material if required to provide uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until set at required finish elevation and alignment.

3. Place Concrete using methods which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with Internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Consolidate with care to prevent dislocation of reinforcing, dowel, and joint devices.

4. Deposit and spread concrete in continuous operation between transverse joints, as far as possible, if interrupted for more than ½ hour, place construction joint. Automatic machine may be used for curb and gutter placement. Machine placement shall be at required cross section, line, grade, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified herein.

C. Joint Construction:

1. Contraction Joints: Construct concrete curb or combination concrete curb and gutter, where specified on Construction Drawings, in uniform sections of length specified on Construction Drawings. Form joints between sections either by steel templates, 1/8-inch in thickness, of length equal to width of curb and gutter, and with depth which will penetrate at least 2-inches below surface of curb and gutter; or

with ¾-inch thick performed expansion joint filler cut to exact cross section of curb and gutter; or by sawing to depth of at least 2-inches while concrete is between 4 and 24 hours old. If steel templates are used, they shall be left in place until concrete has set enough to hold its shape, but shall be removed while forms are still in place.

2. Longitudinal Construction Joints: Tie concrete curb or combination concrete curb and gutter, where specified on Construction Drawings, to concrete pavement with ½-inch round deformed reinforcement bars of length and spacing shown on Construction Drawings.

3. Transverse Expansion Joints: Concrete curb, combination concrete curb and gutter, or concrete sidewalk shall have filler cut to exact cross section of curb, gutter, or sidewalk. Joints shall be similar to type of expansion joint used in adjacent pavement.

D. Joint Filler: Extend joint fillers full-width and depth of joint, and not less than ½-inch or more than 1-inch below finished surface where joint sealer is indicated. Furnish joint fillers in 1-piece lengths for full width being placed, wherever possible. Where more than 1 length is required, lace or clip joint filler sections together.

E. Joints Sealants: Seal joints with approved exterior pavement joint sealants. Install in accordance with manufacturer's recommendations.

3.03 INSTALLATION PROCEDURES

A. The area to receive imprinted concrete shall have the sup-grade prepared as required as for any concrete slab on grade.

B. The formwork shall be installed in accordance with the drawings. The slab thickness shall be consistent with that of ordinary concrete slabs under the same conditions.

C. Provide reinforcement as specified.

D. Control joints and/or expansion joints shall be provided in accordance with the drawings and the guidelines established by the American Concrete Institute. As with any concrete slab, imprinted concrete usually contains construction joints, control joints and expansion joints. The contractor shall advise and work with the architect/engineer to determine the best location for these joints to minimize the visibility of the joints and to minimize unsightly cracking.

E. The concrete shall be placed and screeded to finished grade, and floated to a uniform surface using standard finishing techniques.

F. While the concrete is still in its plastic stage of set, the imprinting tools shall be applied to the surface.

G. Cure and Seal, or approved equal shall be applies in accordance with the manufacturer's recommendations immediately after the completing the imprinting process for

H. After the initial curing period the surface of the slab shall be sealed.

3.04 BACKFILL

A. After concrete has set sufficiently, spaces on either side of concrete curb, combination concrete curb and gutter, or concrete sidewalk shall be refilled to required elevation with suitable material compacted in accordance with geotechnical report.

3.05 CLEANING AND ADJUSTING

A. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.

B. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials.

END OF SECTION 32 16 00

SECTION 33 42 11 - STORMWATER GRAVITY PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Storm drainage piping, fittings, and accessories.

B. Connection of drainage system to existing sewers.

C. Catch basins and other inlet structures.

1.02 RELATED REQUIREMENTS

A. Section 03.30.00 - Cast-in-Place Concrete: Concrete for cleanout base pad construction.

B. Section 31.23.16 - Excavation: Excavating of trenches.

C. Section 31.23.16.13 - Trenching: Excavating, bedding, and backfilling.

D. Section 31.23.23 - Fill: Bedding and backfilling.

E. Section 33.05.13 - Manholes and Structures.

1.03 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.04 REFERENCE STANDARDS

A. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2003 (Reapproved 2012).

B. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe; 2016.

C. ASTM C76M - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric); 2016.

D. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets; 2012.

E. ASTM C443M - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric); 2011.

F. ASTM C 924 - Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.

G. ASTM C 969 - Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.

H. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2015.

I. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; 2014.

J. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2016.

K. ASTM D3350 – Standard Specification for Polyethylene Plastics Pipe and Fittings Materials; 2014.

L. Tennessee Department of Transportation (TDOT), Standard Specifications for Road and Bridge Construction; latest edition.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of stormwater pipe with size, location and installation of service utilities.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.06 SUBMITTALS

A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating pipe, pipe accessories, and structures.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.

E. Field Quality Control Submittals: Document results of field quality control testing.

F. Project Record Documents:
1. Record location of pipe runs, connections, catch basins, cleanouts, and invert elevations.
2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.07 REGULATORY REQUIREMENTS

A. Conform to applicable code for materials and installation of the Work of this section.

PART 2 - PRODUCTS

2.01 SEWER PIPE MATERIALS

A. Concrete Pipe: Reinforced, ASTM C76 (ASTM C76M), Minimum Class III; mesh reinforcement; inside nominal diameter as shown on the drawings, bell and spigot end joints.

B. Reinforced Concrete Pipe Joint Device: ASTM C443 (ASTM C443M) rubber compression gasket joint.

C. Plastic Pipe: ASTM D3034, Type PSM, Poly Vinyl Chloride (PVC) material, rated SDR 35; inside nominal diameter as shown on the drawings, bell and spigot style solvent sealed joint end. Pipe shall be continually marked with manufacturer’s name, pipe size, cell classification, SDR rating, and ASTM D3034 classification. Use only where specifically indicated on the drawings.

D. Plastic Pipe: ASTM D3350, High Density Polyethylene (HDPE) corrugated wall pipe with integrally formed smooth liner; inside nominal diameter as shown on the drawings, meeting the requirements of AASHTO M 252, Type S, for diameters between 3 inches and 10 inches and AASHTO M 294, Type S, for diameters between 12 inches and 60 inches, soil-tight, bell and spigot joints with rubber gaskets, with pipe and fittings manufactured from virgin PE compounds with cell classification 3254420C.P. Use only where specifically indicated on the drawings.

2.02 PIPE ACCESSORIES

A. Pipe Joints: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene ribbed gasket for positive seal.

B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

C. Filter Fabric: Non-biodegradable, woven.

D. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Storm Sewer Service" in large letters.

2.03 CATCH BASIN AND AREA DRAIN COMPONENTS

A. Lids and Drain Covers: Cast iron, hinged to cast iron frame.

B. Shaft Construction and Concentric Cone Top Section: Reinforced precast concrete pipe sections, lipped male/female dry joints, nominal shaft diameter as indicated on the drawings.

C. Base Pad: Cast-in-place concrete of type specified in Section 03.30.00, levelled top surface to receive concrete shaft sections.

2.04 BEDDING AND COVER MATERIALS

A. Bedding: As specified in Section 31.23.23.

B. Cover: As specified in Section 31.23.16.13.

PART 3 - EXECUTION

3.01 TRENCHING

A. See Section 31.23.16.13 - Trenching for additional requirements.

B. See Section 31.23.16 - Excavation and Section 31.23.23 - Fill for additional requirements.

C. Hand trim excavation for accurate placement of pipe to elevations indicated.

D. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.02 INSTALLATION - PIPE

A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

B. Commence installation at the lowest point for each segment of the route. Lay RCP with the groove or bell end upstream.

C. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
   1. Plastic Pipe: Also comply with ASTM D2321.

D. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

E. Do not place pipe in water or when trench conditions are unsuitable for such work.

F. Connect to existing storm sewer system.

G. Make connections through walls through sleeved openings, where provided.

H. Install continuous trace wire 6 inches above top of pipe; coordinate with Section 31.23.16.13.

3.03 INSTALLATION - CATCH BASINS AND MANHOLES

A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place cast-in-place concrete base pad.

C. Level top surface of base pad; sleeve concrete shaft sections to receive storm sewer pipe sections.

D. Establish elevations and pipe inverts for inlets and outlets as indicated.

E. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.04 FIELD QUALITY CONTROL

A. Perform field inspection in accordance with Section 01.40.00 - Quality Requirements.

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

C. Clean, inspect, and test storm sewer systems and culverts, upon completion or at such time as directed. The system or culvert shall have a true grade and line. Actual elevations shall be within 0.08 feet of the elevations given on the drawings.

D. Pressure Test: Test in accordance with ASTM C924.

E. Infiltration Test: Test in accordance with ASTM C969.

F. Deflection Test: After backfill has been placed and compacted to a depth not less than one foot above top of pipe, a visual inspection shall be made by flashing a light between manholes. Correct displacement or misalignment of invert.

3.05 PROTECTION

A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION 33 42 11

SECTION 33 46 00 - SUBDRAINAGE

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes subdrainage systems for the following:
   1. Foundations.

1.02 DEFINITIONS

A. PE: Polyethylene plastic.

B. PVC: Polyvinyl chloride plastic.

C. Subdrainage: Drainage system that collects and removes subsurface or seepage water.

1.03 SUBMITTALS

A. Product Data: For the following:
   1. Perforated-wall pipe and fittings.
   2. Solid-wall pipe and fittings.
   3. Geotextile filter fabrics.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.02 PIPING MATERIALS

A. Refer to the "Piping Applications" Article in Part 3 for applications of pipe, tube, fitting, and joining materials.

2.03 PERFORATED-WALL PIPES AND FITTINGS

A. Perforated PE Pipe and Fittings:
   1. NPS 6 and Smaller: ASTM F 405 or AASHTO M 252, Type CP; corrugated, for coupled joints.
   2. NPS 8 and Larger: ASTM F 667; AASHTO M 252, Type CP; or AASHTO M 294, Type CP; corrugated; for coupled joints.
   3. Couplings: Manufacturer's standard, band type.

2.04 SOLID-WALL PIPES AND FITTINGS

A. PVC Sewer Pipe and Fittings: ASTM D 3034, SDR 35, bell-and-spigot ends, for gasketed joints.
   1. Gaskets: ASTM F 477, elastomeric seal.

2.05 SPECIAL PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant metal tension band and tightening mechanism on each end.
   1. Sleeve Materials:
      a. For Concrete Pipes: ASTM C 443, rubber.
      b. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
      c. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
      d. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
   2. Unshielded Flexible Couplings: Elastomeric sleeve with corrosion-resistant metal tension band and tightening mechanism on each end.
   3. Shielded Flexible Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant metal tension band and tightening mechanism on each end.

2.06 CLEANOUTS

A. PVC Cleanouts: ASTM D 3034, PVC cleanout threaded plug and threaded pipe hub.

2.07 SOIL MATERIALS

A. Backfill, drainage course, impervious fill, and satisfactory soil materials are specified in Section 31 20 00 - Earthwork.

2.08 GEOTEXTILE FILTER FABRICS

A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. when tested according to ASTM D 4491.
   1. Structure Type: Nonwoven, needle-punched continuous filament.
   2. Style(s): Flat and sock.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 02300 - Earthwork.

3.03 PIPING APPLICATIONS

A. Underground Subdrainage Piping:
   1. Perforated PE pipe and fittings, couplings, and coupled joints.
   2. Perforated PVC sewer pipe and fittings for loose, bell-and-spigot joints.

B. Header Piping:
   1. PVC sewer pipe and fittings, couplings, and coupled joints.

3.04 CLEANOUT APPLICATIONS

A. In Underground Subdrainage Piping:
   1. At Grade in Earth: PVC cleanouts.
   2. At Grade in Paved Areas: Cast-iron cleanouts.

3.05 FOUNDATION DRAINAGE INSTALLATION

A. Place impervious fill material on subgrade adjacent to bottom of footing after concrete footing forms have been removed. Place and compact impervious fill to dimensions indicated, but not less than 6 inches deep and 12 inches wide.

B. Place impervious fill on subgrade adjacent to bottom of footing and compact to dimensions indicated, but not less than 6 inches deep and 12 inches wide after concrete footing forms have been removed.

C. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

D. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.

E. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with tape.

F. Install drainage piping as indicated in Part 3 "Piping Installation" Article for foundation subdrainage.

G. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.

H. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade.

I. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.

J. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.

3.06 RETAINING-WALL DRAINAGE INSTALLATION

A. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

B. Place supporting layer of drainage course over compacted subgrade to compacted depth of not less than 4 inches.

C. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with tape.

D. Install drainage piping as indicated in Part 3 "Piping Installation" Article for retaining-wall subdrainage.

E. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.

F. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade.

G. Place drainage course in layers not exceeding 3 inches in loose depth; compact each layer placed and wrap top of drainage course with flat-style geotextile filter fabric.

H. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.

I. Fill to Grade: Place satisfactory soil fill material over compacted drainage course . Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish grade.

3.07 PIPING INSTALLATION

A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.
   1. Foundation Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 30 inches unless otherwise indicated.
   2. Retaining-Wall Subdrainage: When water discharges at end of wall into stormwater piping system, install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 30 inches, unless otherwise indicated. However, when water discharges through wall weep holes, pipe may be installed with a minimum slope of zero percent.
   3. Lay perforated pipe with perforations down.
   4. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.

B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.

C. Install PE piping according to ASTM D 2321.

D. Install PVC piping according to ASTM D 2321.

E. Connect all subdrainage piping to drain to storm sewer system.

3.08 PIPE JOINT CONSTRUCTION

A. Join PE pipe, tubing, and fittings with couplings for soil-tight joints according to AASHTO's "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4, "Joint Properties."

B. Join perforated, PE pipe and fittings with couplings for soil-tight joints according to AASHTO's "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4, "Joint Properties"; or according to ASTM D 2321.

C. Join PVC pipe and fittings according to ASTM D 3034 with elastomeric seal gaskets according to ASTM D 2321.

D. Join perforated PVC pipe and fittings according to ASTM D 2729, with loose bell-and-spigot joints.

E. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

3.09 FIELD QUALITY CONTROL

A. Testing: After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

3.10 CLEANING

A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION 33 46 00