

SECTION 311000 - SITE CLEARING AND EROSION CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Protecting existing vegetation to remain.
 - 2. Removing existing vegetation.
 - 3. Clearing and grubbing.
 - 4. Stripping and removing 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.

1.3 DEFINITIONS

- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.
- B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 MATERIAL OWNERSHIP

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

1.5 SUBMITTALS

- A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.
- B. Record drawings, according to Division 01 Section "Project Record Documents," identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

- A. Pre-clearing Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
- B. Authorities Having Jurisdiction: Conform to requirements of all authorities having jurisdiction.
 - 1. Where conflicts exist between the requirements of the Contract Documents and those of authorities having jurisdiction, the higher quality or more restrictive requirement shall apply.

1.7 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 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 on Owner's premises where indicated.
- D. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing. Do not proceed with operations until existing utilities are located and clearly marked.
- E. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.
- F. Suspend clearing operations during wet conditions unless otherwise directed by Architect.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Satisfactory Soils: ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM, AASHTO M 145 Soil Classification Groups A-1, A-2-4, A-2-5, and A-3, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
 - 1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

2.2 EROSION CONTROL MATERIALS

- A. Silt Fence Geotextile: Woven geotextile fabric, manufactured for silt fence applications, made from polyolefins or polyesters; with elongation less than 20 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
1. Grab Tensile Strength: 100 lbf; ASTM D 4632.
 2. Permittivity: 0.05 per second, minimum; ASTM D 4491.
 3. UV Stability: 70 percent after 500 hours' exposure; ASTM D 4355.
- B. Silt Fence Post: Steel, either integrally manufactured with the silt fence as part of a complete system or separately provided. Where separately provided, the following shall apply:
1. Steel posts: T or U cross-sectional shape. Minimum weight 1.3 pounds per foot. Minimum length 5 feet. Shall have projections to aid in fastening wire of fabric. Shall have a metal plate welded near the bottom such that, when driven to proper depth, it will be below ground and will aid stability.
 2. Fasteners: Galvanized wire or other fasteners as required for a secure installation.
 3. Maximum Spacing: 6 feet on center.
- C. 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; SCDOT Standard Specs
 2. Grab Tensile Strength: 200 lbf; ASTM D 4632.
 3. Sewn Seam Strength: 180 lbf; ASTM D 4632.
 4. Puncture Strength: 80 lbf; ASTM D 4833.
 5. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
 6. Permittivity: 0.1 per second, minimum; ASTM D 4491.
 7. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.
- D. Woven Wire Fabric: ASTM A 116, Class 1, wire and opening sizes as indicated.
- E. Erosion Control Aggregate: Naturally or artificially graded mixture of crushed gravel or stone, in accordance with the gradation requirements indicated on the Drawings and the material requirements of the South Carolina Department of Transportation Standard Specifications for Highway Construction.
1. Material shall be free of shale, clay, friable material, debris, waste, frozen materials, vegetation, organic material, or other deleterious matter.
- F. Riprap: Broken, irregular size and shape, graded stone conforming to Section 804 of the South Carolina Department of Transportation Standard Specifications for Highway Construction
1. Gradation: Class B.

2.3 TREE PROTECTION MATERIALS

- A. Fence Material: As indicated. Orange polypropylene safety mesh, as indicated. Minimum weight 16 lbs per 4 foot x 100 foot roll.
- B. Wood Posts and Rails: As indicated. 2 inch x 4 inch framing lumber. Minimum post length 6 feet.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly flag trees and vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to a Stormwater Pollution Prevention Plan (SWPPP), specific to the site, that complies with EPA 832/R-92-005 or the requirements of authorities having jurisdiction, whichever is more stringent.
- B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- C. When directed by Architect, remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE PROTECTION

- A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.
 - 1. Do not store construction materials, debris, or excavated material within fenced area.
 - 2. Do not permit vehicles, equipment, or foot traffic within fenced area.
 - 3. Maintain fenced area free of weeds and trash.
- B. Do not excavate within tree protection zones, unless otherwise indicated.
- C. Where excavation for new construction is required within tree protection zones, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
 - 1. Cover exposed roots with burlap and water regularly.
 - 2. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
 - 3. Coat cut faces of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
 - 4. Backfill with soil as soon as possible.
- D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.

1. Employ an arborist, licensed in jurisdiction where Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.
2. Replace trees that cannot be repaired and restored to full-growth status, as determined by Architect.

3.4 UTILITIES

- A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
 1. Arrange with utility companies to shut off indicated utilities.
- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 1. Notify Owner, Architect and operating utility not less than two days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without the permission of all of the parties noted above.
- C. Excavate for and remove underground utilities indicated to be removed.
- D. Fill depressions caused by utility removal operations with satisfactory soil material unless further excavation or earthwork is indicated and is to be performed immediately. Do not leave depressions overnight.
 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.5 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, grass, 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. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
 3. Completely remove stumps and roots greater than 1" in diameter, obstructions, and debris extending to a depth of 24 inches below exposed subgrade.
 4. Use only hand methods for grubbing within tree protection zone.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated and is to be performed immediately. Do not leave depressions overnight.
 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.

3.6 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.

- B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
 - 1. Remove subsoil and nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.
- C. Dispose of topsoil as specified for surplus soil material in disposal article below.

3.7 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as 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 length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
 - 2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.8 DISPOSAL

- A. Disposal: 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.
 - 1. Do not burn or chip demolished or waste materials on Owner's property.
 - 2. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

END OF SECTION 311000

SECTION 311020 – ARBORIST SERVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Pruning, tree surgery, vine clearing, injection and other arborist measures needed to ensure health of existing trees.

1.3 ALLOWANCES

- A. Allowances for arborist's services are specified in Division 01 Section "Allowances."

1.4 SUBMITTALS

- A. Arborist's Report: Submit written recommendation by qualified arborist of measures needed to ensure health of existing trees.
- B. Qualification Data: For qualified arborist. Include list of similar projects completed by arborist demonstrating capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.
- C. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

- A. Arborist Qualifications: An arborist, licensed in the jurisdiction where Project is located, who specializes in tree surgery.
 - 1. Professional Membership: Arborist shall be a member in good standing of a recognized Arborist Society.
 - 2. Arborist's Field Supervision: Maintain an experienced full-time supervisor on Project site when work is in progress.
- B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
- C. Authorities Having Jurisdiction: Conform to requirements of all authorities having jurisdiction.
 - 1. Where conflicts exist between the requirements of the Contract Documents and those of authorities having jurisdiction, the higher quality or more restrictive requirement shall apply.

1.6 PROJECT CONDITIONS

- A. Coordinate work schedule with Owner, General Contractor and other trades and cooperate to insure optimum construction progress for overall project.
- B. During work, keep work area in a clean and orderly condition. Unless notified in writing, all material taken from the trees becomes the property of the Contractor.
- C. Proceed with and complete work as rapidly as portions of site become available, working within seasonal limitations for each kind of work required.

PART 2 - PRODUCTS

2.1 INJECTION MATERIALS

- A. Pesticides and Fertilizer: In accordance with accepted arboricultural practice in location of work. Conform to requirements of all authorities having jurisdiction over use of pesticides and other chemicals. Apply chemicals in accordance with label directions on chemical container.
- B. Injection System: Provide system by Mauget or equivalent.
- C. Transplant Enhancer: Mycorrhiza organic root enhancer.

PART 3 - EXECUTION

3.1 ARBORIST SERVICES

- A. Climbing: Spiked climbing shoes are prohibited. Use climbing method that ensures protection of trees and prevents scrapes, holes and wounds of any kind.
- B. Pruning:
 - 1. Conform to accepted horticultural practice for pruning. Make cuts vertically. Use pruning method which prevents splintering of bark.
 - 2. Perform pruning work within seasonal limitations of each tree species.
 - 3. Never remove more than 1/3 of any tree canopy.
 - 4. Remove all dead wood, weak branches, branches that must be removed for buildings or landscape development, and other limbs necessary to ensure health of tree.
- C. Vine Clearing: Remove all vines from existing trees to remain. Use removal method which prevents damage to tree.
- D. Root Pruning: Where roots are to be removed due to site development, make vertical, clean cuts, minimizing wound area. Do not remove more than 1/3 of any tree roots. If needed, prune branches to equalize the loss of roots and canopy.
- E. Injection and Other Measures:
 - 1. Provide injection of nutrients and pesticides, along with other measures included in arborist's written recommendations.

2. Perform all work in accordance with accepted arboricultural practice in location of site. Conform to requirements of authorities having jurisdiction. Perform injection in accordance with manufacturer's directions and recommendations.

3.2 DISPOSAL

- A. Disposal: Remove surplus plant materials and debris, and legally dispose of them off Owner's property.

END OF SECTION 015639

SECTION 312000 - EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. A geotechnical report has been prepared for the site by S&ME, Inc. and is available upon request.
 - 1. All Work shall be performed in accordance with the recommendations of the report and any subsequent recommendations by geotechnical engineer.
 - 2. Where material or installation requirements differ from those of this specification, those of the report or subsequent recommendations by the geotechnical engineer shall govern.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns and grasses, and exterior plants.
 - 2. Excavating and backfilling for buildings and structures.
 - 3. Base course for asphalt paving.
 - 4. Base course for grass paving system.
 - 5. Subsurface drainage backfill for walls and trenches.
 - 6. Excavating and backfilling trenches and pits for buried utilities.

1.3 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
- B. Base Course: Course placed between the subgrade and paving materials.
- C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
 - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
 - 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.
- F. Fill: Soil materials used to raise existing grades.

- G. Filter aggregate: Aggregate backfill material that acts as a filter medium in subdrainage systems.
- 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 28,090 lbf and stick-crowd force of not less than 18,650 lbf; measured according to SAE J-1179.
 - 2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210-hp flywheel power and developing a minimum of 48,510-lbf breakout force with a general-purpose bare bucket; measured according to SAE J-732.
- I. 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.
- J. Subgrade: Soil surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below base course, subbase, drainage fill, or topsoil materials, as applicable.
- K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 UNIT PRICES

- A. Unit prices for earth moving are included in Division 01 Section "Unit Prices."
- B. Dimensions of excavations shall be established and accepted by Architect prior to initiation of Work. Quantity for payment shall be based on calculation of volume using accepted dimensions. Volumes documented by truck counts are not acceptable.
- C. Volumes shall be based on in-situ measure. Swell factors for expansion of excavated material will not be accepted.
- D. Payment shall not be made without prior acceptance of proposed work by the Architect, or for quantities in excess of the quantity accepted by the Architect.
- E. Excavating Unsatisfactory Soils and Hauling Offsite
 - 1. Volume of naturally occurring in-situ unsatisfactory soil removed, measured in original position.
 - 2. Excavated unsatisfactory soil shall be removed from the site and legally disposed.
- F. Backfill of Excavations of Unsatisfactory Soils or Rock with Borrow Soil.
 - 1. Volume of borrow soil (imported from offsite).
 - 2. Replace excavated material as quickly as practical after excavation, but not before review and acceptance of excavation by Architect.
 - 3. Volume for payment shall be the same as established for Excavating Unsatisfactory Soils or Rock Removal as applicable.

1.5 SUBMITTALS

- A. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
 - 1. Classification according to ASTM D 2487 of each on-site and borrow soil material proposed for fill and backfill.
 - 2. Laboratory compaction curve according to ASTM D 1557 for each on-site and borrow soil material proposed for fill and backfill.

1.6 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.
- B. Authorities Having Jurisdiction: Conform to requirements of all authorities having jurisdiction.
 - 1. Where conflicts exist between the requirements of the Contract Documents and those of authorities having jurisdiction, the higher quality or more restrictive requirement shall apply.
 - a. For locations within areas of DOT jurisdiction, perform all work, testing, and inspections in accordance with applicable DOT standards and procedures.

1.7 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect 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.
 - 3. Contact utility-locator service for area where Project is located before excavating.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM, AASHTO M 145 Soil Classification Groups A-1, A-2-4, A-2-5, and A-3, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

1. For locations within areas of DOT jurisdiction, Satisfactory Soils shall be as defined by Standard Specifications for that DOT for the applicable work classification.
 - a. For drainage pipe culverts located within areas of SCDOT jurisdiction, backfill shall only be sand or gravel meeting the requirements of Soil Classification Groups A-1, in accordance with Supplementary Technical Specification SC-M-714 of the South Carolina Department of Transportation Standard Specifications for Highway Construction.
- C. Unsatisfactory Soils: ASTM D 2487 Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT, AASHTO M 145 Soil Classification Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 , or a combination of these groups.
 1. Unsatisfactory soils also include satisfactory soils not brought to within 2 percent of optimum moisture content at time of compaction. These soils are not eligible for compensation under any Unit Price provisions for removal of unsatisfactory soil.

2.2 AGGREGATE MATERIALS

- A. All sand and aggregate materials shall be free of shale, clay, friable material, debris, waste, frozen materials, vegetation, organic material, or other deleterious matter.
- B. Aggregate materials shall not be composed of marine limestone or slag unless specifically allowed in the individual paragraph(s) below.
- C. Graded Aggregate Base Course (GABC): Naturally or artificially graded crushed stone (macadam) or marine limestone in accordance with Section 305 of the South Carolina Department of Transportation Standard Specifications for Highway Construction.
- D. Bedding Course: Naturally or artificially graded mixture of crushed gravel or stone, in accordance with the gradation requirements for Coarse Aggregate #57 as defined by the South Carolina Department of Transportation Standard Specifications for Highway Construction.
 1. For locations within areas of SCDOT jurisdiction, bedding for drainage pipe culverts shall be in accordance with Supplementary Technical Specification SC-M-714 of the South Carolina Department of Transportation Standard Specifications for Highway Construction.
- E. Drainage Course: Naturally or artificially graded mixture of crushed gravel or stone, in accordance with the gradation requirements for Coarse Aggregate #57 as defined by the South Carolina Department of Transportation Standard Specifications for Highway Construction.
- F. Filter Aggregate: Naturally or artificially graded mixture of crushed gravel or stone, in accordance with the gradation requirements for Coarse Aggregate #57 as defined by the South Carolina Department of Transportation Standard Specifications for Highway Construction.
- G. Sand: Natural or manufactured sand in accordance with the gradation requirements for Fine Aggregate FA-10 (natural) or FA-10M (manufactured) as defined by the South Carolina Department of Transportation Standard Specifications for Highway Construction.

2.3 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 1, Type A, B, or C; SCDOT Standard Specs
 2. Grab Tensile Strength: 90 lbf; ASTM D 4632.
 3. Puncture Strength: 60 lbf; ASTM D 4833.
 4. Trapezoidal Tear: 40 lbf; ASTM D-4533
 5. Apparent Opening Size: No. 70 sieve, maximum; ASTM D 4751.
 6. Permittivity: 2.2 second-1, minimum; ASTM D 4491.
 7. UV Stability: 70 percent after 500 hours' exposure; ASTM D 4355.
 8. Water Flow Rate: 150 gal/min/ft²; ASTM D-4491
- B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 15 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
1. Survivability: Class 1, Type D; SCDOT Standard Specs
 2. Grab Tensile Strength: 200 lbf; ASTM D 4632.
 3. Mullen Burst: 400 psi; ASTM D-3786
 4. Puncture Strength: 90 lbf; ASTM D 4833.
 5. Trapezoidal Tear: 75 lbf; ASTM D-4533
 6. Apparent Opening Size: No. 50 sieve, maximum; ASTM D 4751.
 7. Permittivity: 0.05 second-1, minimum; ASTM D 4491.
 8. UV Stability: 70 percent after 500 hours' exposure; ASTM D 4355.
 9. Water Flow Rate: 5 gal/min/ft²; ASTM D-4491

2.4 FLOWABLE FILL

- A. Flowable Fill: Low-density, self-compacting, flowable concrete material (controlled low-strength material) in accordance with the requirements for Excavatable Flowable Fill as defined by Section 210 of the South Carolina Department of Transportation Standard Specifications for Highway Construction.

2.5 PIPE DETECTION MATERIALS

- 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.
- B. Locator Wire In addition to warning tape where required by operating utility.
1. Material, Gauge and Insulation: as required by operating utility.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Section titled "Site Clearing."
- C. Protect and maintain erosion and sedimentation controls, which are specified in Section titled "Site Clearing," during earthwork operations.

3.2 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. Where required, install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 EXPLOSIVES

- A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

- A. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Architect, based on the recommendations of the Geotechnical Testing Agency. The Contract Sum will be adjusted for rock excavation based on a mutually acceptable price. Changes in the Contract time may be authorized for rock excavation.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials or rock, replace with satisfactory soil materials. The Contract Sum will be adjusted for replacement of unsatisfactory soils based on a mutually acceptable price.
 - 2. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.
 - a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
 - 3. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:
 - 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.

3.5 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.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

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

3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
 - 1. Beyond building perimeter and where specific gradients, lines, depths, and elevations are not indicated, excavate trenches to allow installation of top of pipe below frost line or a minimum depth of 36" below finished grade, whichever is greater.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
 - 1. Clearance: 12 inches each side of pipe or conduit or as indicated.
- C. Trench bottoms where bedding course is indicated: Excavate trenches 4 inches deeper than bottom of pipe elevation to allow for bedding course, unless otherwise indicated.
 - 1. See "Utility Trench Backfill" paragraph below for bedding course requirements.
- D. Trench bottoms where no bedding course is indicated: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for

bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
3. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.8 SUBGRADE INSPECTION

- A. Notify Architect when excavations have reached required subgrade.
- B. If Architect, based on the recommendations of the Geotechnical Testing Agency, determines that unsatisfactory soil is present: a) continue excavation and replace with compacted backfill or fill material or; b) prepare cement modified subgrade as directed.
 1. Authorized additional excavation and replacement material or cement modified subgrade will be paid for based on a mutually acceptable price.
- C. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades. Unless otherwise directed by Architect, based on the recommendations of the Geotechnical Testing Agency (typically, in order to avoid over-compaction of porous pavement subgrades) perform proof-rolls as follows:
 1. Completely proof-roll subgrade in one direction and, where dimensions permit, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
 2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, based on the recommendations of the Geotechnical Testing Agency, 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, based on the recommendations of the Geotechnical Testing Agency, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations, wall footings, utility pipe, or other construction as directed by Architect, based on the recommendations of the Geotechnical Testing Agency.

3.10 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.

3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following, as applicable:
 - 1. Making arrangements for required testing and evaluation of subdrainage requirements by Geotechnical Testing Agency.
 - 2. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 - 3. Surveying locations of underground utilities for Record Documents.
 - 4. Testing and inspecting underground utilities.
 - 5. Removing concrete formwork.
 - 6. Removing trash and debris.
 - 7. Removing temporary shoring and bracing, and sheeting.
 - 8. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.
- C. Comply with the requirements indicated in the paragraph below titled “Compaction of Soil Backfills and Fills”.

3.12 UTILITY TRENCH BACKFILL

- A. For locations within areas of SCDOT jurisdiction, bedding and backfill for drainage pipe culverts shall be in accordance with Supplementary Technical Specification SC-M-714 of the South Carolina Department of Transportation Standard Specifications for Highway Construction.
- B. Bedding Course: Where indicated or required by agency having jurisdiction, place and compact bedding course on trench bottoms. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
 - 1. Unless otherwise indicated or required by agency having jurisdiction, bedding course shall be required for the following pipe materials:
 - a. Corrugated High Density Polyethylene Pipe (AASHTO M 252M)
 - b. Corrugated Steel Pipe (ASTM A 760)
 - c. Gravity Flow Polyvinyl Chloride Pipe (ASTM D 3034)
 - d. Gravity Flow Ductile Iron Pipe (ASTM A 746)
 - e. Elliptical Concrete Pipe (ASTM C 507)
 - f. Concrete Box Culvert (ASTM C 1433)
- C. Backfill trenches excavated under footings and within 18 inches of bottom of footings as directed by Architect, based on the recommendations of the Geotechnical Testing Agency.
- D. Flowable Fill: Where indicated or required by agency having jurisdiction, place backfill of flowable fill over the utility pipe or conduit for the full depth of the trench to final subgrade elevation.
- E. Initial Backfill—Bedding Material: Where indicated or required by agency having jurisdiction, place and compact initial backfill of bedding course to a height of 2 inches over the utility pipe or conduit.
 - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

- F. Initial Backfill—Satisfactory Soil: Where no other initial backfill is indicated, place and compact initial backfill of satisfactory soil to a height of 6 inches over the utility pipe or conduit.
 - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit.
 - 2. Coordinate backfilling with utilities testing.
- G. Backfill voids with satisfactory soil while installing and removing shoring and bracing.
- H. Place and compact final backfill of satisfactory soil, in accordance with requirements for Backfill as indicated above, to final subgrade elevation.
- I. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.
- J. Place backfill on subgrades free of mud, frost, snow, or ice.
- K. Comply with the requirements indicated in the paragraph below titled “Compaction of Soil Backfills and Fills”.

3.13 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. Make arrangements for required testing by Geotechnical Testing Agency as required. Do not place subsequent layers until required testing is complete and acceptable results have been obtained and documented.
 - 2. Under grass and planted areas, use satisfactory soil material.
 - 3. Under walks and pavements, use satisfactory soil material.
 - 4. Under steps and ramps, use satisfactory soil material.
 - 5. Under building slabs, use satisfactory soil material.
 - 6. Under footings and foundations, use satisfactory soil material.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.
- D. Do not place soil fill on yielding or unapproved subgrade.

3.14 SOIL MOISTURE CONTROL

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

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
 - 1. Make arrangements for required testing by Geotechnical Testing Agency as required. Do not place subsequent layers until required testing is complete and acceptable results have been obtained and documented.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry density according to ASTM D 1557:
 - 1. Under structures, building slabs, steps, and pavements, compact each layer of backfill or fill soil material at 95 percent.
 - 2. Under walkways, compact each layer of backfill or fill soil material at 92 percent.
 - 3. Under lawn or unpaved areas, compact each layer of backfill or fill soil material at 85 percent.
 - 4. For utility trenches under lawns or unpaved areas, compact each layer of initial and final backfill soil material at 85 percent. For all other areas compact to the level required for that area.

3.16 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 Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Lawn or Unpaved Areas: Plus or minus 1 inch.
 - 2. Walks and 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.

3.17 SUBSURFACE DRAINAGE

- A. Subsurface Drainage (if applicable): Specified in Section titled "Subdrainage."
- B. Make arrangements for evaluation of subsurface drainage requirements by Geotechnical Testing Agency as required.
- C. If Architect, based on the recommendations of the Geotechnical Testing Agency, determines that subsurface drainage requirements differ from those indicated in the Contract Documents, install revised subsurface drainage as directed.

- D. Authorized adjustments of Subsurface Drainage will be paid for according to Contract provisions for unit prices. If Contract does not provide unit prices for Subsurface Drainage, adjustment will be based on mutually acceptable pricing established prior to the initiation of the Work.

3.18 GRADED AGGREGATE BASE COURSE (GABC)

- A. Place GABC on subgrades free of mud, frost, snow, or ice.
- B. Immediately prior to placing GABC, proof-roll subgrade as directed in the "Subgrade Inspection" paragraph above. Do not proceed with placement of GABC until subgrade is approved.
- C. On prepared and approved subgrade, place GABC under pavements as follows:
 - 1. Make arrangements for required testing by Geotechnical Testing Agency.
 - 2. Where indicated, install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 - 3. Place GABC material over subgrade under pavements as indicated.
 - 4. Shape GABC to required crown elevations and cross-slope grades.
 - 5. Place GABC 8 inches or less in compacted thickness in a single layer.
 - 6. Place GABC that exceeds 8 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 8 inches thick or less than 4 inches thick.
 - a. Do not place subsequent layers until required testing is complete and acceptable results have been obtained and documented.
 - 7. Compact GABC at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 100 percent of maximum dry density according to ASTM D 1557.
- D. Shoulders: Where installation is not bordered by concrete curb, walks or alternate confinement system, place shoulders along edges of GABC to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each base layer to not less than 92 percent of maximum dry density according to ASTM D 1557.

3.19 DRAINAGE COURSE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. Immediately prior to placing drainage course, proof-roll subgrade as directed in the "Subgrade Inspection" paragraph above. Do not proceed with placement of GABC until subgrade is approved.
- C. On prepared and approved subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
 - 1. Make arrangements for observation of consolidation efforts by Geotechnical Testing Agency.
 - 2. Where indicated, install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 - 3. Place drainage course 6 inches or less in consolidated thickness in a single layer.
 - 4. Place drainage course that exceeds 6 inches in consolidated thickness in layers of equal thickness, with no consolidated layer more than 6 inches thick or less than 3 inches thick.
 - 5. Consolidate each layer of drainage course with vibratory roller or plate compactor until aggregate appears to be completely consolidated and no additional settlement or consolidation is apparent during a final pass.

6. Protect drainage course from displacement by traffic until subsequent layer or pavement course is installed. Where drainage course is displaced, re-consolidate before placement of subsequent layers or slab-on-grade.
- D. Shoulders: Where installation is not bordered by concrete foundation walls or alternate confinement system, place shoulders along edges of drainage course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each drainage course layer to not less than 92 percent of maximum dry density according to ASTM D 1557.

3.20 FIELD QUALITY CONTROL

- A. Geotechnical Testing Agency: Contractual responsibilities for testing are identified in Division 1 Section "Quality Requirements". Responsible party will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare test reports in accordance with requirements of International Building Code Chapter 1704.7.
 1. Soils: Verify site preparation complies with approved soils report.
 2. Placement and Compaction: Verify placement and compaction of fill materials comply with approved soils report.
 3. Dry-Density: Verify dry-density of compacted fill complies with approved soils report.
- C. Allow Geotechnical Testing Agency to inspect and test subgrades, each fill or backfill layer, and each base course layer as applicable. Proceed with subsequent earthwork 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, based on the recommendations of the Geotechnical Testing Agency.
- E. Geotechnical Testing Agency will test compaction of soils and base course in place according to ASTM D 1556 or ASTM D 2922 as applicable, except for locations within areas of SCDOT jurisdiction which shall be tested according to applicable SCDOT procedures and rates.
 1. Unless otherwise indicated or required by SCDOT or other authorities having jurisdiction, tests will be performed at the following locations and frequencies:
 - a. Paved and Building Slab Areas: At subgrade, each compacted fill and backfill layer, and each base course layer, at least 1 test for every 5000 sq. ft or less of paved area or building slab, but in no case fewer than 3 tests.
 - b. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.
 - c. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 300 feet or less of trench length, but no fewer than 2 tests.
- F. When Geotechnical Testing Agency reports that subgrades, fills, backfills, or base course have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace to depth required; recompact and retest until specified compaction is obtained.

3.21 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.

3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: All surplus satisfactory soil is to remain the property of Coastal Carolina University. Contractor to coordinate with Owner on proper area to stockpile on owner's property. Unless directed to stockpile onsite, remove surplus unsatisfactory soil and legally dispose of it off Owner's property. Remove waste material, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 312000

SECTION 312319 - DEWATERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes construction dewatering.

1.3 PERFORMANCE REQUIREMENTS

- A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
 - 1. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
 - 2. Prevent surface water from entering excavations by grading, dikes, or other means.
 - 3. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
 - 4. Remove dewatering system when no longer required for construction.

1.4 SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Other Informational Submittals:
- C. Photographs or Videotape: Show existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by dewatering operations.
- D. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer that has specialized in design of dewatering systems and dewatering work.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to dewatering including, but not limited to, the following:

- a. Inspection and discussion of condition of site to be dewatered including coordination with temporary erosion control measures and temporary controls and protections.
 - b. Geotechnical report.
 - c. Proposed site clearing and excavations.
 - d. Existing utilities and subsurface conditions.
 - e. Coordination for interruption, shutoff, capping, and continuation of utility services.
 - f. Construction schedule. Verify availability of Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - g. Testing and monitoring of dewatering system.
 - h. <Insert agenda items>.
- D. Authorities Having Jurisdiction: Conform to requirements of all authorities having jurisdiction.
- 1. Where conflicts exist between the requirements of the Contract Documents and those of authorities having jurisdiction, the higher quality or more restrictive requirement shall apply.

1.6 PROJECT CONDITIONS

- A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
- 1. Notify Architect and Owner no fewer than two days in advance of proposed interruption of utility.
 - 2. Do not proceed with interruption of utility without Owner's written permission.
- B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.
- 1. Make additional test borings and conduct other exploratory operations necessary for dewatering.
 - 2. The geotechnical report is referenced elsewhere in the Project Manual.
- C. Survey Work: Where the dewatering is in the vicinity of existing structures, engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.
- 1. During dewatering, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
- 1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.
 - 2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

- B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Provide temporary grading to facilitate dewatering and control of surface water.
- D. Monitor dewatering systems continuously.
- E. Promptly repair damages to adjacent facilities caused by dewatering.
- F. Protect and maintain erosion and sedimentation controls, which are specified in Section titled "Site Clearing," during earthwork operations.

3.2 INSTALLATION

- A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
 - 1. Space well points or wells at intervals required to provide sufficient dewatering.
 - 2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.
- B. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.
- C. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
 - 1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
- D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
 - 1. Maintain piezometric water level a minimum of 24 inches below surface of excavation.
- E. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others and complies with the requirements of authorities having jurisdiction. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.
- F. Provide standby equipment on site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.
 - 1. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.
- G. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

END OF SECTION 312319

SECTION 313116 - TERMITE CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following for termite control:
 - 1. Soil treatment.

1.3 SUBMITTALS

- A. Product Data: Treatments and application instructions, including EPA-Registered Label.
- B. Product Certificates: Signed by manufacturers of termite control products certifying that treatments furnished comply with requirements.
- C. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- D. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following as applicable:
 - 1. Date and time of application.
 - 2. Moisture content of soil before application.
 - 3. Brand name and manufacturer of termiticide.
 - 4. Quantity of undiluted termiticide used.
 - 5. Dilutions, methods, volumes, and rates of application used.
 - 6. Areas of application.
 - 7. Water source for application.
- E. Test Results: Furnish written test results, performed by South Carolina Department of Pesticide Regulation, showing that treatment meets requirements of specifications.
- F. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: A PCO who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment in jurisdiction where Project is located and who is experienced and has completed termite control treatment similar to that indicated for this Project and whose work has a record of successful in-service performance.

- B. Regulatory Requirements: Formulate and apply termiticides, and label with a Federal registration number, to comply with EPA regulations and authorities having jurisdiction.
- C. Standards for Application: Current edition of South Carolina Division of Regulatory and Public Service Programs Standard 27-1085.

1.5 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 EPA-Registered Label requirements and requirements of authorities having jurisdiction.

1.6 COORDINATION

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

1.7 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Warranty: Written warranty, 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.
- C. Warranty Period: Five years from date of Substantial Completion.
- D. Monitoring and Continued Service: Monitoring and continued service with applicator shall be responsibility of the Owner after the first year.

1.8 MAINTENANCE SERVICE

- A. Continuing Service: Provide a proposal for continuing service, including monitoring, inspection and retreatment for occurrences of termite activity, from applicator to Owner, in the form of a standard yearly continuing service agreement, starting on the date of Substantial Completion. State services, obligations, conditions and terms for agreement period and for future renewal options.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

- A. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in a soluble or emulsible, concentrated formulation that dilutes with water or foaming agent, and formulated to prevent termite infestation. Use only soil treatment solutions that are not harmful to

plants. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA-Registered Label.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aventis Environmental Science USA LP; Termidor.
2. Bayer Corporation; Premise 75.
3. Dow AgroSciences LLC; Dursban TC or Equity.
4. FMC Corporation, Agricultural Products Group; Prevail FT.
5. Syngenta; Demon TC.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of the soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparing substrate. 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 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 by termiticide manufacturer.
- C. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

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

3.4 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 the treatment evenly.

1. Slabs-on-Grade: Under ground-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 entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers, piers, and chimney bases; and along 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 313116

SECTION 316317 – AUGERED PRESSURE GROUTED PILES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This section includes augered pressure grouted displacement piles and all associated hardware
- B. Related Sections
 - 1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
 - 2. Division 1 Section "Unit Prices" for list of Unit Prices

1.3 DEFINITIONS

- A. Augered Pressure Grouted Displacement Piles: Piles formed by rotating and advancing a displacement tool into the ground to the required depth using high torque and high crowd force such that no spoils are generated, with subsequent injection of grout through the hollow shaft as the displacement tool is being withdrawn in such a way to as to exert pressure on the grout column and soil surrounding the hole, and subsequent placement of the required reinforcing steel.

1.4 UNIT PRICES

- A. The Contract Sum:
 - 1. Base the Contract Sum on number, size and length of piles indicated from tip to head, plus not less than 12 inches of overlength.
- B. Work of this Section is affected as follows:
 - 1. Additional payment for pile lengths in excess of that indicated, and credit for pile lengths less than that indicated, will be calculated at unit prices stated in the Contract, based on net addition or deduction to total pile length as determined by Engineer measured to nearest 12 inches.
 - 2. Additional payment for number of piles in excess of that indicated, and credit for number of piles less than that indicated, will be calculated at per pile unit price stated in contract plus adjustment for addition or reduction in length per unit prices stated in the contract.
 - 3. Unit prices include labor, materials, tools, equipment, and incidentals for installing piles
 - 4. No payment will be made for rejected piles, including piles installed out of tolerance, defective piles, or piles that fail inspection and cannot be substantiated for use as production piles.

1.5 SUBMITTALS

- A. Contractor's Statement of Responsibility Per Division 01 Section "Quality Requirements"
- B. Product Data:
 - 1. Couplers (as used)

2. Centralizers/Spacers
 3. Pile head casings (as used)
- C. Design Mixtures: For each grout mixture.
1. Indicate amounts of mixing water to be withheld for later addition at Project site.
 2. Mix design submittals shall include test results and/or trial batch data that meet or exceed the required average compressive strength as required by ACI 301.
 3. Trial batches shall consist of identical cementitious materials, fine and course aggregates, and admixtures to be used for mix design.
 4. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 5. Mix designs for grout shall include test results for trial batches indicating compliance with specified shrinkage limits.
- D. Steel Reinforcement Shop Drawings:
1. Drawings that detail fabrication, bending, and placement.
 2. Include bar sizes, lengths, material, grade, bar schedules, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing,
 3. Include centralizer/spacer arrangement verified to comply with centralizer/spacer manufacturer requirements, but not less than the following:
 - a. Each spacer tier shall have spacers equally spaced around perimeter of reinforcing cage with not less than four spacers per tier.
 - b. Provide spacer tiers not more than 2 feet from bottom of cage
 - c. Provide spacer tiers not more than 2 feet from finished grade at top of pile construction
 - d. Provide spacer tiers along the length of cage at spacing not exceeding 8 feet on center.
- E. Mill Test Reports:
1. Submit mill test reports for ASTM A615 reinforcing steel indicating compliance with the ASTM and additional restrictions
 2. Submit mill test reports for ASTM A706 reinforcing steel indicating compliance with the ASTM.
- F. Material Test Reports: For the following, from a qualified testing agency, not more than 90 days old and indicating compliance with the requirements:
1. Cementitious Materials
 2. Aggregates
- G. Research/Evaluation Reports:
1. Submit ICC reports for the following:
 - a. Mechanical Couplers (as required/used)
 - b. Mechanical End Anchors (as required/used)
- H. Installation sequence narrative: A written narrative description of equipment, installation procedures, and installation sequences to be used. The narrative shall include any necessary measures for placement of reinforcing cages, and prevention of near surface soil collapse or pile necking. Include a layout plan and numbering system to identify each pile.

I. Quality Control Plan: Provide a written quality control plan outlining how production piles will be monitored and logged by the contractor's personnel. As a minimum Quality Control monitoring and associated reports shall include the following and will be verified by the special inspector:

1. Pile number and location
2. Ground Surface Elevation
3. Pile toe depth and elevation
4. Pile butt elevation
5. Pile Length
6. Auger Diameter
7. Reinforcing steel details
8. Theoretical volume of pile
9. Depth of Reinforcing Steel Placement
10. Date and time of beginning of drilling
11. Date and time that each truck of concrete/grout was batched
12. Date and time that each truck of concrete/grout arrived at site
13. Date and time of beginning of grouting
14. Date and time of completion of grouting
15. Date and time of placement of reinforcing steel
16. Identification of all grout/concrete samples taken from pile
17. Any unusual conditions encountered
18. Any obstructions encountered, including the depth of the obstruction and the effect of the obstruction.
19. Any deviations from the methods outlined in the approved shop drawing submittal
20. Readings from automated measuring equipment to include
 - a. Auger rotation verses depth for every 2 ft increment (or less) of pile advancement during the drilling process and during the grouting process
 - b. Volume of grout or concrete placed versus depth of outlet orifice for ever 2 ft increment (or less) of pile placed.
 - c. Average maximum and minimum pump stroke pressures at ground level for every 2ft increment (or less) of pile placed.
 - d. Average maximum and minimum pump stroke pressures at or near auger head level for every 2ft increment (or less) of pile placed.
 - e. Torque and crowd force measurements for every 2ft increment (or less) of pile advancement during the drilling process.

J. Qualification Data:

1. Installer:
 - a. A list of at least three projects completed within the previous three years wherein the installer installed piles of types similar to those required for this project, using equipment similar to that required for this project, and under similar conditions required for this project

K. Installation Equipment Data:

1. Indicate type, make, and rating of equipment to be used for pile installation.
 - a. Drilling/Displacement Equipment
 - b. Grout Pump
 - c. Displacement tool
 - d. Monitoring equipment capabilities and description

L. Quality Control Reports for each pile including all data required by the Quality Control Plan
AUGERED PRESSURE GROUTED PILES
Brooks Stadium Additions – Phase 2
State Project No. H17-9610-MJ-B

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ADC Engineering
9/20/2017

- M. As built pile survey
- N. Minutes of pre-installation conference

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

- 1. The installer shall have completed at least three projects within the previous three years wherein the installer installed piles of types similar to those required for this project, using similar equipment required for this project, and under similar conditions required for this project.

B. Ready Mix Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

- 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

- 1. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

E. Grout Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design grout mixtures.

F. Unless modified herein comply with the provision in the following

- 1. TM-ACIP-4, "Augered Cast-In-Place Piles Manual", Latest Edition.
- 2. Geotechnical Engineering Circular (GEC) No. 9, April 2007

G. Pre-installation Conference: Conduct conference at Project site.

- 1. Review production pile sequencing and separation requirements
- 2. Review production pile installation requirements
- 3. Review production pile installation tolerances
- 4. Review production pile inspection requirements
- 5. Review grout sampling and testing requirements

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver store and handle steel reinforcement to prevent bending or damage.
- B. Store reinforcement on dunnage elevated off of the ground.
- C. Store all pile accessories in manufacturer's packaging until such time they are installed.

1.8 PROJECT CONDITIONS

- A. Protect structures, underground utilities, and other construction from damage caused by pile installation.
- B. Site Information: A geotechnical report has been prepared for this Project and is included elsewhere in the Project Manual for information only.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Reinforcing Bars:
 - 1. ASTM A706, Grade 60, deformed
 - 2. ASTM A 615/A 615M, Grade 60, deformed.
 - a. With mill tested yield strength not exceeding specified yield by more than 18,000 psi.
 - b. With mill tested ultimate strength to mill tested yield strength not less than 1.25

2.2 CASINGS

- A. Pile Head Casing: Steel or other approved casing material of sufficient strength and rigidity to maintain the upper portion of the excavation and prevent soil collapse while the auger is removed and/or the reinforcing steel cage is placed.

2.3 ACCESORIES

- A. Centralizers/Spacers: Rigid and durable mechanical device which attaches to the reinforcing cage and maintains the cage central to the drill hole.
 - 1. Device must be capable of firmly attaching to the reinforcing cage and be sufficiently robust to withstand the reinforcing cage process.
- B. Mechanical Couplers
 - 1. Coupler devices shall have an ICC ESR report.
 - 2. Coupler devices shall have been evaluated in accordance with ICC ES-AC133
 - 3. Coupler devices shall comply with all requirements for "Type 2" mechanical splices per chapter 21 of ACI 318.
 - 4. Positional couplers shall be used as required to properly orient reinforcing bars with hooks or bends
- C. Mechanical End Anchors
 - 1. End Anchor devices shall have an ICC ESR report.
 - 2. End Anchors shall comply with requirements of "Type 2" mechanical splices per chapter 21 of ACI 318
 - 3. End anchors may be shop or field applied to associated reinforcing steel. Special arrangements shall be made to field apply one or both ends where clearance requirements are of concern.
 - 4. End anchors shall be fully fabricated and prepared for installation by a single manufacturer. End anchors consisting of multiple parts assembled by multiple manufacturers will not be permitted.

2.4 GROUT MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type I, Type I/II or Type III
 - 2. Fly Ash: ASTM C 618, Class F.
- B. Fine Aggregates: ASTM C 33.
 - 1. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
 - 2. Free of materials with deleterious reactivity to alkali in cement.
- C. Water: Potable, and complying with ASTM C94
- D. Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.
 - 5. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 6. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 7. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
 - 8. Shrinkage Reducing Admixture: ASTM C494, Type S
 - 9. Grout Fluidifier: ASTM C937

2.5 GROUT MIXES

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Maximum allowable unit shrinkage: .15% in the vertical direction, as tested in accordance with ASTM C1090 and housed in a 100% humidity room at a temperature of 68 to 74 degrees Fahrenheit. Compliance with shrinkage limit shall be validated with preproduction testing.
- C. The grout shall be tested for fluid consistency (using a flow cone) in accordance with the modifications made to either ASTM C 939 or the U.S. Army Corps of Engineers specification CRD 611-94 (USACE, 1994). Either of these specifications is herein required to have the flow cone outlet modified from a ½ in. (12 mm) diameter outlet to a ¾ in. (19 mm) diameter outlet. A range of acceptable fluid consistency (expressed as efflux time per standard volume as described in the cited specifications) shall be established, and must meet the approval of the Engineer.
- D. Approved admixtures may be used in grout if they were included in the mix design.
- E. Compressive Strength: 5000psi.
- F. The grout mix shall be capable of maintaining the solids in suspension without excessive bleed water, shall be pumped without difficulty, and shall be capable of penetrating and filling voids in the adjacent soils.

- G. Limit water-soluble chloride ion content in hardened concrete to 0.15 percent by weight of cement.

2.6 INSTALLATION EQUIPMENT

A. General:

1. All equipment shall be capable of installing the specified pile types of diameter, reinforcing and embedment indicated with the understanding of the anticipated soil profiles and soil properties. Contractor shall carefully review all geotechnical reports and information regarding previously installed test piles and ensure that proposed equipment is capable of installing piles of specified type in the anticipated soil conditions.
2. All equipment shall be capable of accessing the site given the existing limits of accessibility and any other limits that may exist as construction progresses.
3. All equipment shall be capable of installing the piles within the existing space limits, including headroom and any other space limitation that may exist as construction progresses.
4. The installation contractor shall be responsible for visiting the site to confirm the proposed equipment can access the site and work within the space limits.

B. Augering Equipment: A continuous flight hollow-shaft auger and appropriate rotational and crowd pressure force mechanism capable of rotating the auger into the anticipated soil conditions with continuous advancement at a rate resulting in minimal soil removal, while improving the sides of the resulting hole through displacement pressure.

1. The auger flighting shall be continuous from auger tip to head without gaps or breaks.
2. The pitch of the auger shall not exceed 9 inches.
3. The auger tip shall be fitted with a hole below the cutting teeth which allows for placement of grout.
4. Equipment leads shall be anchored from rotation with a stabilizing arm, and shall be marked at 1 ft intervals to facilitate auger penetration.
5. Auger hoisting equipment shall be capable of withdrawing the auger at a smooth constant rate while maintaining auger rotation to maintain positive grout pressure.

C. Displacement Equipment: A displacement tool attached to a hollow shaft with appropriate rotational and crowd pressure force mechanism capable of rotating the displacement tool into the anticipated soil conditions with continuous advancement at a rate resulting in minimal soil removal, while improving the sides of the resulting hole through displacement pressure.

1. The displacement tool shall be of configuration required to produce a pile of the specified dimensions.
2. The displacement tool shall be equipped with cutting teeth as required to install the pile to the specified depth with an understanding of the anticipated geotechnical conditions.
3. The displacement tool shall be fitted with a hole below the cutting teeth which allows for placement of grout.
4. Equipment leads shall be anchored from rotation with a stabilizing arm, and shall be marked at 1 ft intervals to facilitate auger penetration.
5. Displacement tool hoisting equipment shall be capable of withdrawing the displacement tool at a smooth constant rate while maintaining rotation to maintain positive grout pressure.

D. Grout Pump: A positive displacement piston type pump free of oil, rust or other deleterious materials.

1. Minimum pressure capability of 350 psi or as required to install the submitted piles.
2. An integral and automated monitor capable of measuring and recording grout pressure and volume
3. An integral and automated digital or mechanical stroke or revolution counter capable of counting total number of strokes or revolutions per pile.

4. Discharge capacity shall be calibrated in cubic feet per stroke or revolution.
- E. Automated Measuring and Recording Equipment: The installation rig shall have an on board computer monitoring system capable of measuring and recording the information required to be included in the Quality Control Reports per the Quality Control Plan requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Site Conditions:
 1. Do not start pile installation operations until earthwork fills have been completed or excavations have reached an elevation of 6 to 12 inches above bottom of footing or pile cap.
 2. Located and protect existing structures, underground utilities, and other construction from damage caused by pile installation.

3.2 SCHEDULING

- A. Contractor shall acknowledge and make provisions in the schedule associated with the need to install piles and pile caps to allow for relocation of existing light poles, and the demolition of existing light pole foundations prior to the installation of the balance of production piles.
- B. Production pile installation shall be planned and scheduled to account for the specified limitations on piles being installed adjacent to uncured piles.
- C. Pile installation shall be schedule such that all existing utilities on site have been identified and appropriate actions taken to relocate utilities prior to commencing pile installation.
- D. Allow schedule time for demonstration piles as required

3.3 DEMONSTRATION PILES

- A. Contractor may elect to install demonstration piles in order to determine the anticipated method of pile construction prior to installing production piles. The use of demonstration piles shall be solely at the discretion of the contractor and shall be at no additional cost to the owner.
- B. If adjustments to site specific procedures from those used for previously executed test piles are requested, the cost of the installation and testing of test piles, including cost of owner's inspector will be the responsibility of the contractor.
- C. Demonstration Piles shall not be used as production piles.

3.4 STATIC PILE TESTS

- A. General: If pile installation methods procedures used for previously executed test piles are employed then test piles are not required. If adjustments to site specific procedures from those used for previously executed test piles are requested, the cost of the installation and testing of test piles, including cost of owner's inspector will be the responsibility of the contractor.
- B. If alternate site specific procedures are used Contract document pile lengths and diameters will be verified by load testing.

1. Axial Compressive Static Load Test: ASTM D 1143. Quick Load Test is Acceptable.
- C. Installing Test Piles: Installation methods, procedures, equipment, and overall length shall be identical to the proposed production piles to the extent practical.
- D. Testing Process:
 1. Owner's inspector shall recommend and facilitate the installation of any internal pile instrumentation for collecting load test data.
 2. Owner's inspector shall observe and log the installation of test piles.
 3. Notify Architect and owner's inspector at least 96 hours in advance of installing test piles, and performing tests.
 4. Conduct testing with owner's inspector present to audit and record results of testing program and report to the architect.
 5. On completion of testing, remove testing structure, equipment, and instrumentation.
 6. Test piles, anchor piles and reaction piles shall be sacrificial, and shall not be used as production piles.
- E. Number of Test Piles:
 1. One test pile shall be installed for each alternate pile size, length, or installation method from those used in previously executed test pile program.
- F. Compression Test Approval Criteria: Pile shall be tested to 2.5 times the design load and shall be deemed approved if they meet all of the following:
 1. The net settlement after rebound does not exceed 0.5 inches.
 2. There is not a sharp break in the load displacement curve at any time during the loading sequence.

3.5 INSTALLING PILES

- A. General: Installation technique shall be consistent with the geotechnical, logistical, environmental and load carrying conditions of the project.
 1. Where test piles where employed production piles shall be installed with the same techniques of that used for test piles.
 2. Where test piles are employed materials for production piles shall not be procured, and production piles shall not be installed until test piles results have been reviewed and approved.
- B. Preparation:
 1. Stage the necessary reinforcement, couplers and other accessories for the pile prior to commencing pile installation.
 2. Stage materials on dunnage out of contact with soil.
 3. Place centralizers/spacers on reinforcing cage per shop drawings
 4. Clean all bars, couplers and other devices to ensure they are free of dirt.
- C. Sequencing: The sequencing of pile installation shall be such that adjacent piles show no evidence of disturbance.
 1. The load applied to the soil by drilling or other equipment shall be held far enough away from piles being excavated to avoid compression or shearing of the soil column around the excavation.

2. Excavation for piles within 10 feet of previously placed piles shall not commence until the grout in the previously placed pile has set for not less than 72 hours since completion of grouting.

D. Augering:

1. Unclassified Augering: Augering is unclassified and includes excavation to bearing elevations regardless of obstructions encountered.
2. Obstructions: Removal of significant unforeseen obstructions which cannot be removed with conventional excavation equipment, or cannot be penetrated with augering equipment with soil or rock cutting teeth, augering buckets, or under reaming tools attached to augering equipment of size, power, torque and crowd force necessary for the scope of work, will be paid according to the contract provision for change of work.
3. All augering procedures shall be consistent with methods documented during the installation of test piles.
4. Prevent surface water from entering excavated shafts. Conduct water to site drainage facilities.
5. Where soil conditions necessitate install steel casings by rotating and/or weighting to the required depth. All casing installation is subject to approval and shall not be detrimental to the geotechnical performance of the pile.
6. When a permanent drilling casing is not used a pile head casing shall installed prior to commencing drilling. The head casing shall extend from the ground surface to at least 1 foot below design pile head elevation, but not less than 10 feet below ground surface at time of drilling.
7. Each pile shall be augered to the required depth as confirmed by the test pile program.
8. The displacement tool shall be advanced at a continuous rate that prevents removal of excess soil.

E. Grouting and reinforcing:

1. Commence the reinforcing and grouting process immediately upon advancing the displacement tool to the required depth.
2. All grouting and reinforcing procedures shall be consistent with methods documented during the installation of test piles.
3. When a sole continuous center reinforcing rod is specified it shall be placed through the hollow stem auger prior to grouting.
4. Each truck of grout shall be sampled and tested for fluid consistency prior to discharging into the pump hopper.
5. At the start of pumping grout raise the displacement tool 6 to 12 inches to allow for flow of grout.
6. After the initial grout pressure is allow to build up sufficiently reposition the displacement tool to the previously established tip elevation.
7. The rate of grout injection and displacement tool withdrawal shall be coordinated to maintain the minimum grout head and/or positive pressure consistent with test pile installation.
8. The rate of grout injection shall produce sufficient head to prevent suction from developing as the displacement tool is withdrawn.
9. Once grout flows freely from the pile at the ground surface the rate of grout injection and displacement tool withdrawal shall be coordinated such that there is a constant rate of grout flow at the ground surface. Pump sufficient excess grout to displace all laitance from the pile.
10. Maintain rotation of displacement tool in a manner to positive pressure on the grout column throughout the grouting process.
11. The displacement tool shall be withdrawn at a smooth continuous rate.
12. The displacement tool extraction rate shall not exceed 10 feet per minute.
13. The minimum total volume of grout placed in the pile shall be 115 percent of the nominal volume of the pile.
14. If at any time the displacement tool jumps upward during removal, the grouting process is interrupted, or there is a decrease or loss of grouting pressure the displacement tool shall be reinserted to the tip elevation the grouting process started over.
15. When a full reinforcing cage is specified it shall be installed immediately after the grouting process

is complete, the displacement tool is removed from the pile and the pile head casing is installed (if a full length casing is not required). The reinforcing cage shall be placed in one smooth and continuous effort using the required equipment.

16. If at any time the reinforcing cage meets refusal or significant resistance requiring it to be worked in or out or requiring the application of significant downward force, the cage shall be removed, and the auger inserted back into the hole and the grouting procedure started over.
17. All reinforcing shall be installed before initial set of grout, but not more than 10 minutes after auger withdrawal.
18. Upon completion of grouting and reinforcing the pile shall be finished to the correct head elevation or sound grout, whichever is lower by removing fresh grout within the drilling casing and/or pile head casing. As an alternate, contractor may elect to allow excess grout to harden within the drill casing and/or pile head casing at the full grouted elevation and carefully trim down to the specified head elevation with hand operated chipping guns.

F. Cleanup:

1. Unless approved otherwise all evacuated grout, trimmings, other debris from pile installation operations and excess materials shall be removed from the site and legally disposed of.
2. All excess soils as a result of augering shall be removed and disposed of.

G. Installation Tolerances: Install piles without exceeding the following tolerances, measured at pile heads:

1. Location: 2 inches from specified location,
2. Inclination Angle: Maintain alignment within 2 degrees from vertical.
3. Cutoff elevation: Shall not be higher than, and not more than 2 inches below the specified design elevation

H. If a pile quality control criteria is not met for any reason, proposed remedy is subject to the approval of the architect prior to implementing the remedy. It shall be the burden of the contractor to substantiate the remedy to the architect.

I. Abandoned damaged or defective piles and piles that exceed tolerances and install new piles within tolerances as directed by the Architect.

J. As-Built Survey: Contractor shall provide an as-built survey to the engineer of record. The survey shall show all piles with deviations from theoretical pile location, pile alignment and pile butt elevation. All pile locations, alignments and cutoff elevations that are not within tolerance shall be specifically noted.

1. Foundation work should not commence until the as-built survey has been reviewed and/or approved and/or associated foundation revisions have been made to account for any out of tolerance piles.

K. Additional pile and/or foundation work as the resultant of defective or out of tolerance piles shall be completed at no additional cost or time penalty to the owner.

L. The cost of additional analysis and design of piles and/or foundations as the resultant of defective or out of tolerance pile shall be the responsibility of the contractor and reimbursed to the owner as a change order to the contract.

3.6 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports in accordance with the schedule of special inspections.

- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION 316313